THE Ember Alliance

2024

COAL CREEK CANYON FIRE PROTECTION DISTRICT

Jefferson, Boulder, and Gilpin Counties, Colorado

Community Wildfire Protection Plan

Coal Creek Canyon Fire Protection District Community Wildfire Protection Plan 2024 Update

PREPARED FOR COAL CREEK CANYON FIRE PROTECTION DISTRICT

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PREPARED BY THE EMBER ALLIANCE

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APPROVAL AND SIGNATURES

This Community Wildfire Protection Plan (CWPP) was developed in response to the Healthy Forest Restoration Act of 2003 and complies with CWPP standards set forth by the Colorado State Forest Service in 2022. The CWPP is a collaborative effort to guide our wildfire protection. Where possible, we intend to apply the recommended practices to improve our community and increase public safety.

The following individuals and organizations were engaged in developing the Coal Creek Canyon CWPP and approve the 2024 update:

Garret Ball, Chief,
Coal Creek Canyon Fire Protection District

Signature: _____

Date: 02/05/24

Ben Pfohl, Supervisory Forester
Colorado State Forest Service

Signature: Ben Pfhol
Ben Pfhol (May 2, 2024 10:04 MDT)

Date: 02/05/24

Meg Halford, Wildfire Team Forest and Grasslands Project Coordinator
Boulder County

Signature: Meg Halford
Meg Halford (May 2, 2024 09:56 MDT)

Date: 02/05/24

Tom Hoby, Director of Parks and Conservation
Jefferson County

Signature: Tom Hoby
Tom Hoby (May 2, 2024 15:09 MDT)

Date: 02/05/24

ADDITIONAL SIGNATURES

The following individuals and organizations were engaged in developing the Coal Creek Canyon CWPP and approve the 2024 update:

Name: Jody Dickson

Title: Various

Organization: CCCFPD Board / Saws &

Signature: Jody Dickson
Jody Dickson (Apr 30, 2024 22:45 MDT)

Date: 30/04/24

Name: Maya MacHamer

Title: Director

Organization: Boulder Watershed Collec

Signature: Maya MacHamer
Maya MacHamer (Apr 30, 2024 09:26 MDT)

Date: 30/04/24

Name: Cork Rech

Title: Executive Director

Organization: Blue Mountain Forest Stev

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Cork Rech (May 1, 2024 11:50 MDT)

Date: 01/05/24

Name: Jennifer Cook

Title: Gilpin County CSU Extension Dir

Organization: CSU Extension

Signature: Jennifer Cook
Jennifer Cook (Apr 30, 2024 10:03 MDT)

Date: 30/04/24

Name: Patrick Chavez

Title: Statewide Emergency Manager

Organization: CDOT

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Patrick Chavez (May 2, 2024 11:57 MDT)

Date: 02/05/24

Name:

Title:

Organization:

Signature:

Date:

Table of Contents

How to use this CWPP Document

This document is designed for everyone that lives, works, and manages land within and around CCCFPD. Different sections will be most helpful to different people; please use this guide to direct you to the resources most relevant to you.

I want to learn the basics about wildfire, my community, and CWPPs.	• Section 1.a to learn about CWPPs. • Section 2.f to learn about wildfire threats in your local fire protection district. • Appendix A for an introduction to fire behavior.
I want to learn about protecting my home and family.	• Section 3.a to learn about the actions you can take, including detailed recommendations and research-backed guidance for protecting your home and family. • Section 3.b to find detailed hazard ratings and recommendations for your neighborhood.
I want to learn about community-led action.	• Sections 3.a, 3.b, and 3.d to learn about the actions communities can take together to better protect everyone, including funding opportunities. • Section 5.b to find all specific recommended actions for the community.
I want to learn about landscape-scale wildfire mitigation.	• Section 2.e, 2.f and 2.g to learn about fire history and treatment history in the area. • Section 4.c to learn about the priority fuel treatment projects for this community. • Sections 4.a, 4.b, and 4.d for general recommendations for stand-level and roadside fuel treatments.
I want to learn about the science behind these recommendations.	• Appendix B to learn about modeling methodology for fire behavior and evacuation modelin, on-the-ground hazard assessments, and treatment prioritization. • Appendix C for survey methology and results. • Section 7 to see all referenced research and information.

Acronyms and Abbreviations

BMFSI	Blue Mountain Forest Stewardship Initiative
BCPOS	Boulder County Parks and Open Space
BCSO	Boulder County Sherrif's Office
BoCo	Boulder County
BVLCD	Boulder Valley-Longmont Conservation Districts
BWC	Boulder Watershed Collective
CCC	Coal Creek Canyon
CCCFPD	Coal Creek Canyon Fire Protection District
CPCFPA	Crescent Park Community Fire Protection Association
CO	Colorado
CR	County Road
CSFS	Colorado State Forest Service
CWDG	Community Wildfire Defense Grant
CWPP	Community Wildfire Protection Plan
DFPC	Division of Fire Prevention and Control
FAC	Fire Adapted Community
FEMA	Federal Emergency Management Agency
HFRA	Healthy Forests Restoration Act of 2003
HIZ	Home Ignition Zone
HOA	Homeowner's Association
IIBHS	Insurance Institute for Business & Home Safety
IRPG	Incident Response Pocket Guide
ISO	Insurance Services Office
JCOS	Jefferson County Open Space
JCSO	Jefferson County Sheriff's Office
JeffCo	Jefferson County
NFPA	National Fire Protection Association
NWCG	National Wildfire Coordinating Group
PBC	Pile Burn Cooperatives
PODs	Potential Operational Delineations
RAWS	Remote Automatic Weather Stations
TEA	The Ember Alliance
USFS	United States Forest Service
VPD	Vapor Pressure Deficit
WUI	Wildland-Urban Interface

Refer to the **Glossary** for definitions of the words and phrases used throughout this document.

1. Introduction

1.a. Purpose and Need for a CWPP

Community Wildfire Protection Plans (CWPPs) help communities assess local hazards and identify strategic investments to mitigate risk and promote preparedness (**Figure 1.a.1**). Assessments and discussions during the planning process assist fire protection districts with fire operations in the event of a wildfire and help residents and communities prioritize mitigation actions. These plans also assist with funding gaps for fuel mitigation projects since many grants require an approved CWPP.

> *"Community Wildfire Protection Plans (CWPPs) represent the best opportunity we have to address the challenges of the wildland-urban interface (WUI) in a way that brings about comprehensive and locally supported solutions." – Colorado State Forest Service*

The Coal Creek Canyon Fire Protection District (CCCFPD) oversees 52 square miles in Jefferson, Boulder, and Gilpin Counties. The district is in the foothills of Colorado's Front Range along Coal Creek and Highway 72, approximately 6 miles southwest of Boulder, CO (**Figure 1.a.2**). This area is the ancestral land of the Núu-agha-tuvu-pu (Ute) and Tséstho'e (Cheyenne) Nations.

***Figure 1.a.1**. Elements of a holistic and actionable CWPP.*

The 2024 CWPP update for CCCFPD takes advantage of recent advances in fire science and addresses changes to fire risk, home construction, and other characteristics of the community. The CWPP includes a wildfire risk analysis, prioritization of mitigation activities, and implementation recommendations. This document is a tool for CCCFPD, land managers, residents, communities, and community groups to prioritize projects that will make CCCFPD a safer and more resilient community to wildfire. The objectives of this project are to:

- Produce an actionable CWPP based on robust analyses of fuel hazards, burn probability, evacuation routes, post-fire erosion, and community values across the fire district.
- Provide recommendations, including prioritization, for projects that reduce fire hazards, hardening homes, and increasing evacuation safety.
- Engage community members during the CWPP process to ensure local needs and concerns are addressed.
- Set the stage for planning and implementation by residents, CCCFPD, local organizations, HOAs, and agency partners to mitigate hazards and promote community preparedness, and to prepare for grant and funding applications to support the necessary mitigation work.
- Create strategic and tactical maps and evacuation pre-plans to increase community preparedness and safety of firefighters and residents.

Complex interactions among wildland fuels, weather, and topography determine how wildfires behave and spread. Many aspects of wildfires are predictable based on known scientific research on the physical processes driving fire. Much of the work in this CWPP is based on scientific research and computer models of wildfire behavior. A basic understanding of fire behavior aids in interpreting the findings and recommendations reported herein. See **Appendix A. Introduction to Wildfire Behavior and Terminology** and the **Glossary** for key terms.

Looking south into Coal Creek Canyon from the Walker Ranch area. Photo credit: The Ember Alliance.

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, owns property, protects, or manages land in and around this community. Conditions in Coal Creek Canyon 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, how to mitigate your home ignition zone to give your house a chance to stand strong during wildfires and protect firefighters engaged in protecting your community.

Even if you do not have a permanent home on your property, you can take steps to protect your assets, including the value of your property; areas that are heavily burned have less aesthetic and monetary value. More importantly, work you do to reduce fire risk on your property can amplify the work that your neighbors do on theirs, resulting in greater risk reduction 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 Coal Creek Canyon a beautiful and safe community. CCCFPD and partners 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.

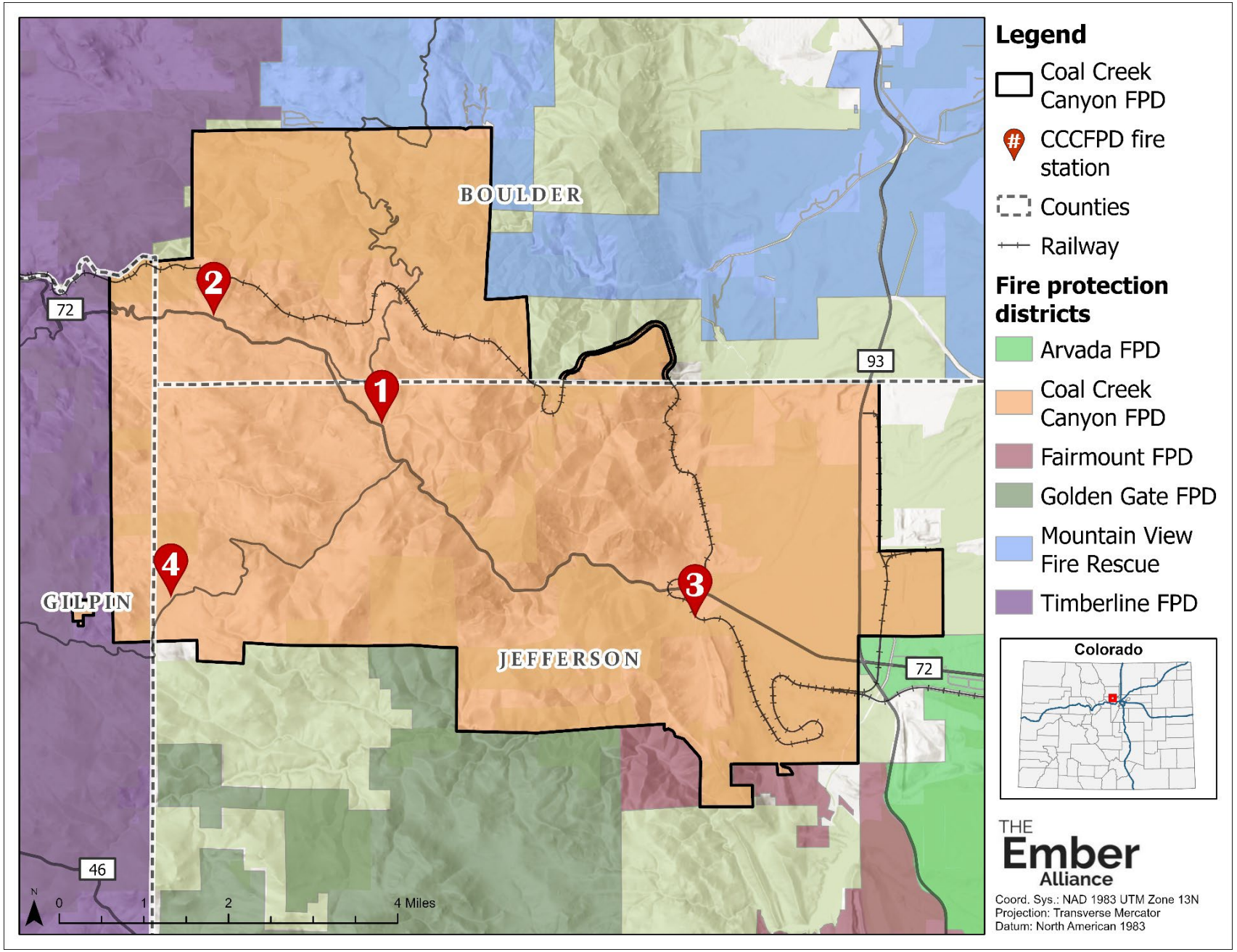


Figure 1.a.2. *Boundary of CCCFPD in Jefferson, Boulder, and Gilpin Counties, Colorado. Source: Colorado Department of Local Affairs and OpenStreetMap.*

1.b. Community and Partner Engagement

Collaboration is an essential part of CWPPs. Community engagement, partner commitment, and follow-through are what make a CWPP successful and effective. The Ember Alliance (TEA)—a Colorado nonprofit dedicated to fire management and community engagement—worked with CCCFPD to write the CWPP. TEA and representatives from CCCFPD engaged partners from across the landscape and neighboring districts to develop the recommendations set forth in this CWPP. They incorporated lessons learned from the recent challenging wildfire seasons in Colorado and considered valuable insights shared by community members and other partners.

CCCFPD and TEA would like to thank the following partners for their time and effort in developing, providing data, providing feedback, and planning implementation projects for this CWPP:

- Arapaho-Roosevelt National Forest
- Arvada Water
- Blue Mountain Forest Stewardship Initiative
- Boulder County Community Planning and Permitting: Wildfire Team
- Boulder County Office of Disaster Management
- Boulder County Open Space
- Boulder County Road and Bridge
- Boulder Valley-Longmont Conservation District
- Boulder Watershed Collective
- Coal Creek Canyon Collaborative (C4)
- Colorado Department of Transportation
- Colorado Parks and Wildlife
- Colorado State Forest Service
- Colorado State University Extension Offices
- Crecent Park Community Fire Protection Association
- Denver Mountain Parks
- Denver Water
- Gilpin County Office of Emergency Management
- Jefferson County Office of Emergency Management
- Jefferson County Open Space
- Jefferson County Road and Bridge
- Mountain View Fire Protection District
- Saws and Slaws
- Timberline Fire Protection District
- United Power

The CWPP Community Outreach Committee conducted extensive community and partner engagement to gain a better understanding of the community's current knowledge of wildfires, assess their concerns and needs, and learn about ongoing mitigation work.

The committee was initially made up of representatives from Saws and Slaws, Blue Mountain Forest Stewardship Initiative, Boulder Watershed Collective, a locally owned tree service, and CSU Extension in Jefferson County. The team, which works under the supervision of the CCCFPD, has since grown to include more resident representatives.

The committee started in early 2023, engaging the local community organizations, businesses and churches; building a website (CoalCreekCWPP.org); maintaining an email list of CCC residents; publishing a monthly CWPP article in the local monthly magazine in addition to emails and blog posts; getting the word out on social media; and recruiting a Community Ambassador from each of the 15 CWPP plan units to help keep their communities informed and engaged. See **Figure 1.b.1** for a map of plan units.

In early 2023, the committee developed and distributed a survey to help determine the needs and concerns of residents. The survey was completed by 246 residents who provided vital information on the concerns of living in a wildfire prone environment. This information was used to guide the prioritization of mitigation projects in the district.

A Community CWPP Kickoff meeting was held at the CCCIA Hall in April 2023. Over 125 CCC residents attended. The presentation was followed by breakout discussions to identify resident's concerns and suggestions for inclusion in the CWPP.

Next, the committee planned and held four focus group meetings. Residents were given access to an interactive map to determine in which of the plan units their street address is located. The CCCFPD operates 4 fire stations, and the plan units nearest each station were grouped together. Residents were invited to attend a focus group meeting at their local fire station to learn about the CWPP process, get an overview of how wildfire would impact their ability to safely evacuate, and have a chance to voice their biggest concerns about wildfire in CCC.

The committee worked with TEA to provide maps showing risk analysis for the plan unit clusters covered at each of the meetings. A presentation was given showing how the latest fire science is being utilized to map and model the different fire scenarios in our communities. Evacuation routes were mapped, and un-survivable roads were identified. After the presentation of this content, attendees were grouped by plan unit and were asked to answer some prepared questions. This allowed for indexing of specific wildfire concerns of residents from each neighborhood.

The meetings, held on Thursday evenings in June 2023, were well attended.

- Station #1, 39 attendees
    - Plan Units: Chute Road, Crescent Park, Hilltop, Pika and Vonnie Claire.
- Station #2, 46 attendees
    - Plan Units: Camp Eden, Coal Creek Heights, Copperdale, Miramonte, Wondervu
- Station #3, 20 attendees
    - Plan Units: Blue Mountain, Central Canyon, Plainview
- Station #4, 30 attendees
    - Plan Units: Burke, Upper Twin Spruce (Lyttle Dowdle, Nadm, Stanton)

Attendee input was recorded and was used in the creation and prioritization of mitigation projects.

The Community Outreach Committee will continue to provide education and resources as residents of the individual plan units form community fire mitigation groups to implement the recommendations outlined in the updated CWPP.

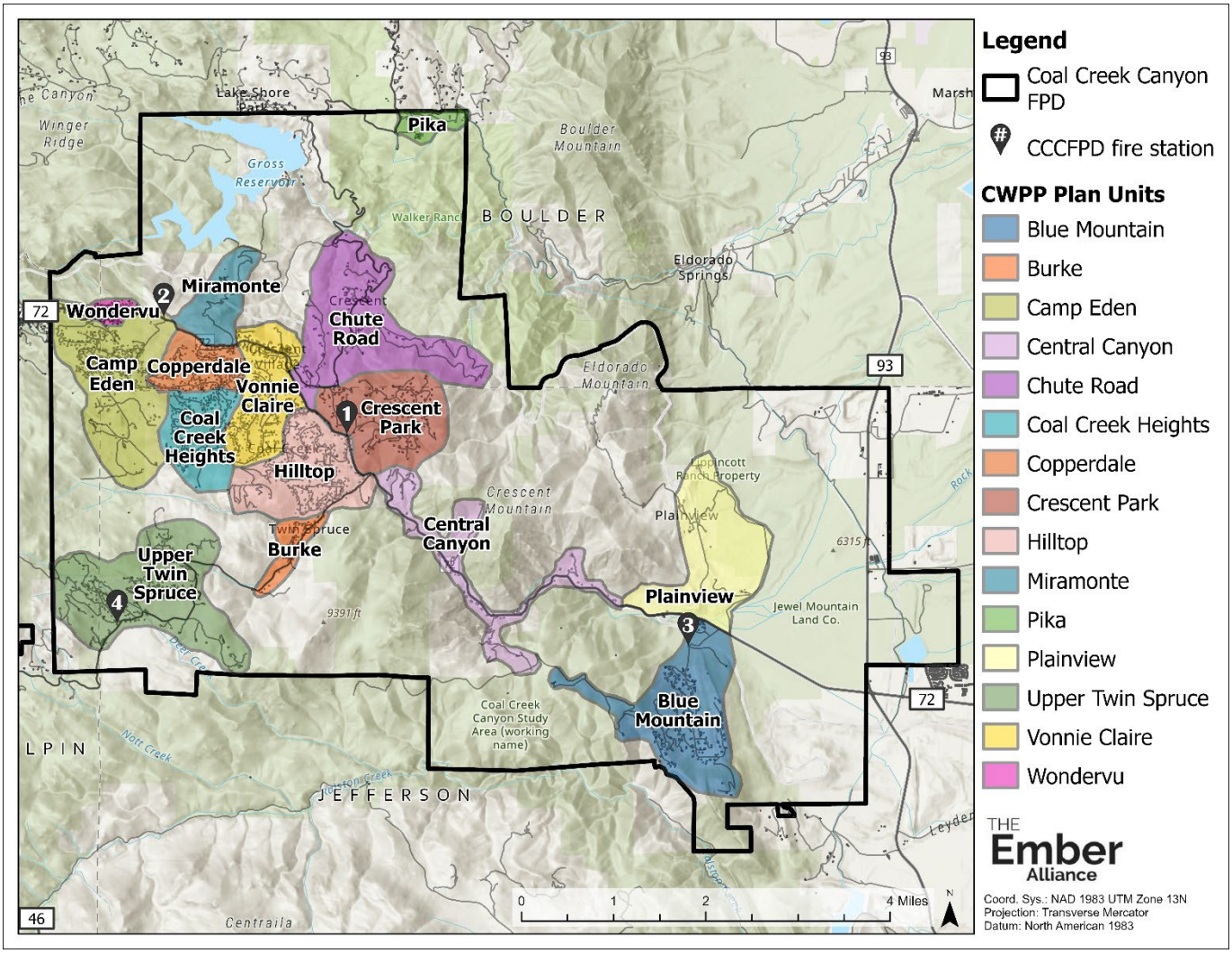


Figure 1.b.1. *Plan units in Coal Creek Canyon.*

Community engagement was a fundamental aspect of this CWPP. Thank you for helping us create a locally relevant and actional CWPP to meet your needs! The top photo is from a project prioritization meeting with the Core Team and many partners; the left photo is from the second community focus group meeting on June 15, 2023; the bottom photo is from the first community focus group meeting on June 8, 2023 (sources: The Ember Alliance (top), CCCFPD (left and bottom)).

1.c. Accomplishments Since the Previous CWPP

Since 2008, CCCFPD and its partner organizations within Coal Creek Canyon have made great strides to reduce the risk of wildfire in the community.

Coal Creek Canyon Fire Protection District

- All firefighters for the district receive, at minimum, S-130/190 Basic Firefighter training through the National Wildfire Coordinating Group (NWCG).
- Each firefighter, at minimum, is required to attend the RT-130 Annual Fireline Safety Refresher through the NWCG.
- The district holds monthly wildland fire training and additional training in the summer. Personnel are encouraged to take more advanced NWCG courses through the Boulder County Cooperators, and the Colorado Wildfire and Incident Management Academy.
- The district held wildfire incident preparedness workshops for staff and volunteers.
- CCCFPD maintains map books for all engines, regularly updates their water resources maps, and has located all their potential dip sites and safety zones.

Government Agencies

- Jefferson County Open Space has completed almost two miles of roadside mitigation along Brumm Trail.
- Boulder County improved their WUI and building code requirements regarding home hardening and defensible space.
- Boulder County developed the Wildfire Partners Program to assist residents in home hardening and defensible space.
- Boulder County developed a Community Chipping Program to assist five or more landowners in chipping and hauling slash.
- Jefferson County now requires a defensible space assessment and compliance with resulting fire mitigation recommendations prior to issuing a building permit.
- USFS has completed hundreds of acres of fuels reduction through pile burning and broadcast burning for the Forsythe II projects to the north of Wondervu.

Nonprofit Community Organizations

- The Boulder Watershed Collective (BWC) partners with many organizations and communities to complete projects related to forest health, watershed health, and wildfire adaptation.
    - Helped develop the Coal Creek Canyon Collaborative (C4) to increase agency and community coordination related to wildfire planning.
    - Held three visioning workshops with Copperdale and Camp Eden.
    - Helped coordinate the Team Rubicon project: 11 homes received defensible space (8.1 acres).
    - Supported the Copperdale mitigation project (zone 3 and linked defensible space; 16 acres across 9 parcels).
        - Grants included FRWRM, Justin Brooks Fisher Foundation, and an anonymous donor.
- Crescent Park residents created the Crescent Park Community Fire Protection Association in 2021.
    - Held two educational events for 105 property owners in 2022 and 2023.
    - Trained two certified home ignition zone auditors and performed 15+ HIZ audits for properties in the Crescent Park Community.

    - Residents have completed significant defensible space work and home hardening upgrades in their neighborhood.
    - Sponsored a Community Slash Collection Event in 2021. 17 residents participated, 85 cubic yards of slash were chipped and disposed.
    - Held a Community Slash Event in 2023, sponsored by United Power, 35 residents participated in this five-day slash event, which resulted in 422 cubic yards. Approximately 20 truckloads of slash were chipped and disposed.
    - Achieved Firewise USA Site certification in 2022.
    - Supported a Team Rubicon fire mitigation event in 2023 that provided property evaluations and established defensible space for two properties in the Crescent Park Community.
- Blue Mountain Forest Stewardship Initiative was formed in 2013.
    - Received three grants and won one national award for mitigation work.
    - Residents have completed significant defensible space work in their neighborhood and meaningful home hardening upgrades.
    - Gained Firewise USA site designation and hosted 26 outreach events.
    - Conifer regeneration is regularly removed along roads and in the shaded fuelbreaks.
    - Completed 22 acres of stand thinning and 18 acres of shaded fuelbreak along Eastridge Road and along Blue Mountain Drive in the "south bowl" of the neighborhood.
    - Completed 80 HIZ assessments.
    - Completed defensible space and structure hardening on the Blue Mountain Water District water treatment plant and service infrastructure.
- Saws & Slaws was formed in 2011.
    - Hosted community education events regarding forest ecology, fire ecology, wildfire risk and mitigation, and related topics.
    - Offers annual chainsaw safety and skills class to local residents.
    - Worked with landowners to complete mitigation work on 300 properties throughout the Coal Creek Canyon area through over 160 events and 8,000 volunteer hours.
    - Sponsored and completed three ten-acre treatments through grant-funding and forester partnership.
    - Supports local landowners in small project tree and slash removal as well as firewood distribution.

Other Organizations

- United Power has completed thinning and mitigation along powerline rights-of-way.
- Miramonte completed 50+ acres of fuels reduction projects in collaboration with Denver Water, Jefferson Conservation District and CSFS along their primary egress route and near structures.
- Camp Eden residents have completed meaningful defensible space work in their plan unit.
- Hilltop residents have completed meaningful defensible space work in their plan unit.
- Copperdale residents have completed meaningful defensible space work in their plan unit.
- Jefferson Conservation District completed a 52-acre forest thinning project on Janelle Circle.

Restored ponderosa pine woodlands following restoration and fuels mitigation work by Jefferson County Open Space in the Coal Creek Canyon Study Area. Photo credit: The Ember Alliance.

2. Coal Creek Canyon Fire Protection District: Background

2.a. General Description

CCCFPD oversees 52 square miles in Jefferson, Boulder, and Gilpin Counties. The district is in the foothills of Colorado's Front Range along Coal Creek and Highway 72, approximately 6 miles southwest of Boulder, CO.

CCCFPD is home to 4,000 residents. Some of the residents live on large tracts of land, but the bulk of the population resides in subdivisions with forested lots consisting of one acre or less. The eastern portion of CCCFPD is a mixture of light and heavy industries, ranch and grazing lands, and some undeveloped portions of the City of Arvada. Approximately 20% of residents are over the age of 65, and 9% have some kind of disability. (U.S. Census Bureau, 2021).

CCCFPD is bordered by Timberline Fire Protection District to the west, Golden Gate and Fairmount Fire Protection Districts to the south, Arvada Fire Protection District to the east, and Mountain View Fire Protection District to the north. CCCFPD often coordinates with these districts to provide mutual aid and respond to calls near the borders of the district.

There are numerous non-residential highly valued resources within CCCFPD, including four fire stations, six communication towers, Coal Creek Canyon K-8 School, Crescent Post Office, Gross Reservoir, two Jefferson County Road & Bridge buildings, two places of worship, and the community center for the Coal Creek Canyon Improvement Association (**Figure 2.a.1**). There are dozens of recreation areas, including campgrounds, trailheads, and picnic areas in and around CCCFPD. The Central Corridor Rail Line was constructed in the 1880s and contains 25 tunnels within CCCFPD. As many as 28 trains per day use the rail line, including trains owned by the California Zephyr, Burlington Northern, and Union Pacific.

Approximately 21 square miles of land (44%) of CCCFPD is publicly managed land. Public land includes the Roosevelt National Forest, a small portion of Rocky Flats National Wildlife Refuge, Eldorado Canyon State Park, a small portion of Golden Gate Canyon State Park, Gross Reservoir managed by the Denver Water Board, Walker Ranch managed by Boulder County Parks & Open Space, and several properties managed by Jefferson County Open Space (**Figure 2.a.2**).

Elevations in CCCFPD range from 5,900 to 9,930 feet above sea level, with elevations steadily increasing from east to west. Topography is highly varied, with numerous ravines, saddles, and steep slopes—factors that can exacerbate wildfire behavior. Watersheds in the northern and southern parts of CCCFPD have extremely high importance to the provisioning of surface drinking water, and Upper Coal Creek Watershed in the center of the district has moderate importance according to the U.S. Forest Service Forest to Faucets 2.0 analysis.

Vegetation changes across CCCFPD with increasing elevation (**Figure 2.a.3**). The eastern fifth of CCCFPD is relatively flat grassland. Ponderosa pine and dry-mixed conifer forests cover almost 50% of the district, with higher tree densities on north- and northwest-facing slopes where soil moisture is higher. Lodgepole pine forests cover 13% of CCCFPD, primarily in the southwest where elevations are higher. Black bear, elk, mountain lion, moose, and mule deer are some of the large wildlife found in CCCFPD.

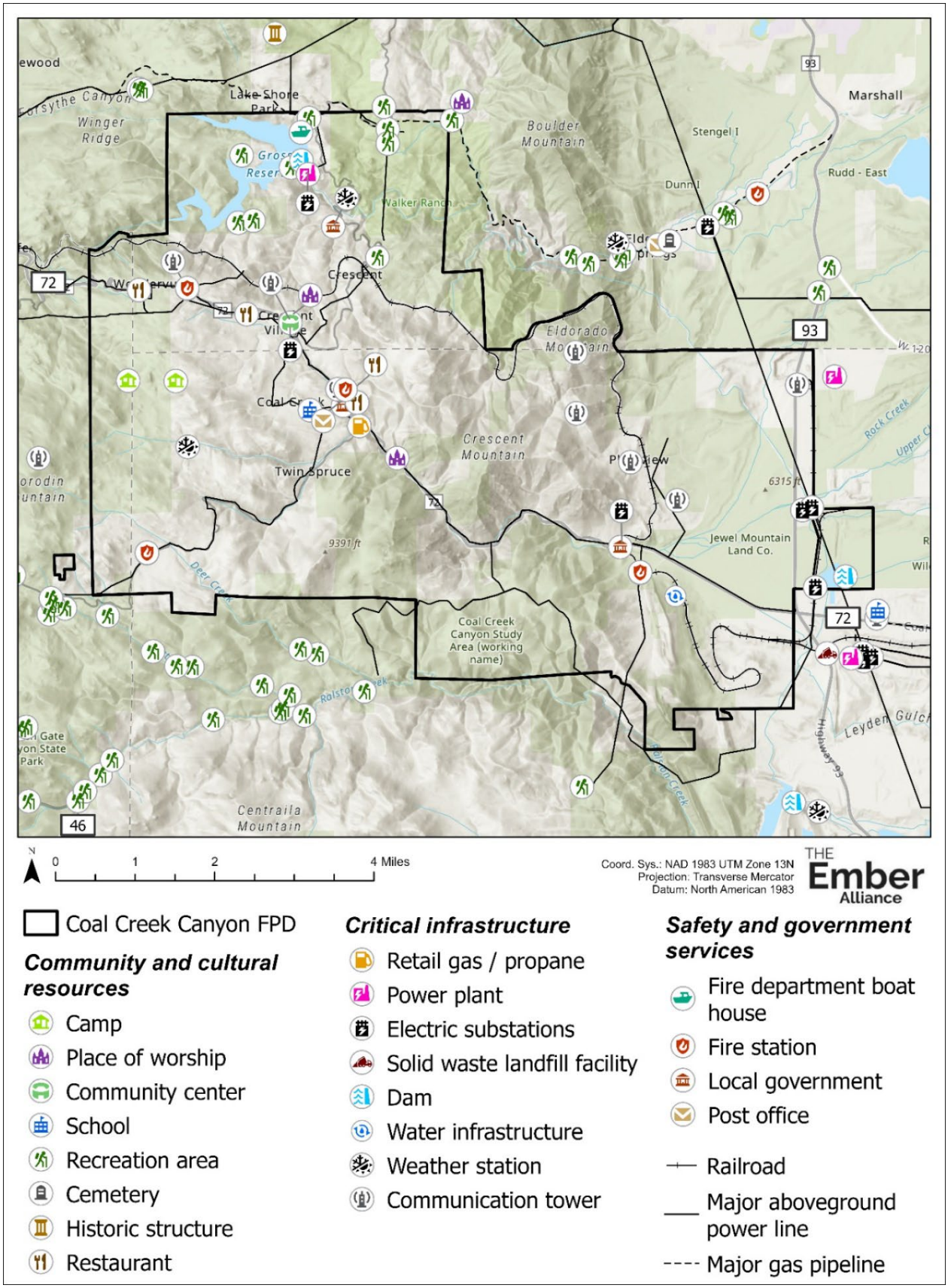


Figure 2.a.1. *Non-residential values within and around CCCFPD. Sources: Blue Mountain Water District, Boulder County, CCCFPD, City of Boulder, CO Division of Oil and Public Safety, CO Parks & Wildlife, Homeland Infrastructure Foundation, National Park Service, U.S. Environmental Protection Agency, U.S. Department of Transportation, U.S. Forest Service, U.S. Geological Survey, United Power, and Western Regional Climate Center.*

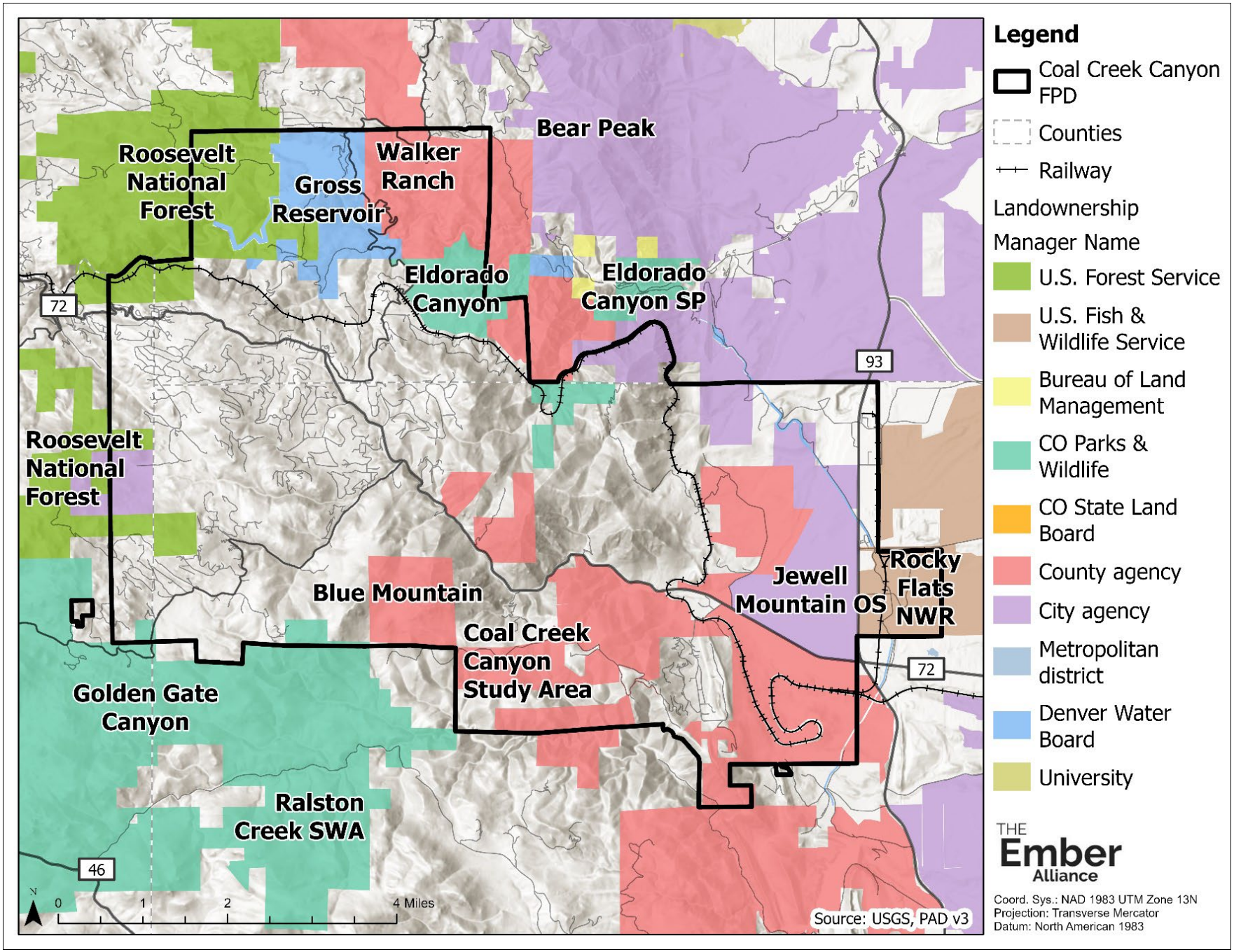


Figure 2.a.2. *Publicly owned land across CCCFPD. Source: U.S. Geological Survey, Protected Areas Database of the United States.*

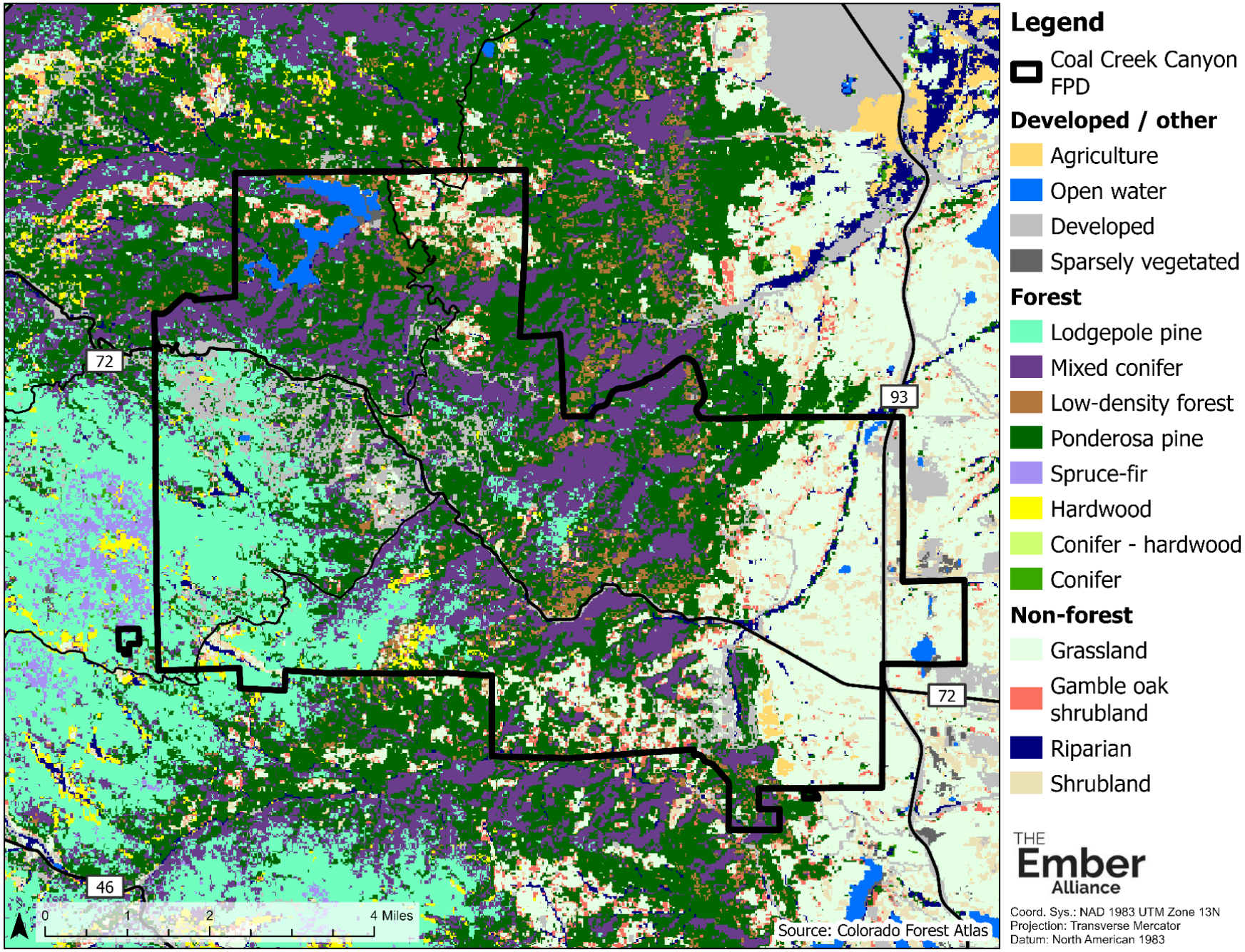


Figure 2.a.3. *Map of vegetation across CCCFPD. Source: Colorado State Forest Service, Colorado Forest Atlas*

2.*b.* District Capacity

CCCFPD hosts a paid Chief, a half-time paid administrative professional, and approximately 60 volunteer responders.

CCCFPD has four Type 1 structure engines, one Type 2 tactical tender, one Type 4 wildland engine, four Type 6 wildland engines, one ambulance, one command vehicle, a UTV with foam package, a zodiac boat with Mark III pump, a light rescue truck, and access to a snowcat. These trucks are spread out among four stations, all of which are staffed as needed by volunteers.

The Insurance Services Office (ISO) rating is 5/5X for CCCFPD. ISO ratings range from 1 (highest) and 10 (lowest) and are provided to fire departments and insurance companies to reflect how prepared a community is for fires in terms of local fire department capacity, water supply, and other factors.

CCCCFPD Light Rescue Truck. Photo credit: CCCFPD.

Coal Creek Canyon Fire Protection District Station 2. Photo credit: The Ember Alliance.

2.c. Wildland-Urban Interface

Every year, wildfires result in billions of dollars in fire suppression costs and destroy thousands of homes across the United States (Bayham et al., 2022; Higuera et al., 2023). Some of the most destructive, deadly, and expensive wildfires occurred in the past several years, partly due to construction of additional homes in the wildland-urban interface (WUI). Wildfire risk in the WUI is further exacerbated by severe fire weather perpetuated by climate change (Caton et al., 2016). Some nearby examples include the 2010 Fourmile Canyon Fire, which destroyed 162 homes, the 2020 East Troublesome Fire, which destroyed at least 366 structures; the 2020 Calwood Fire, which destroyed 26 homes; the 2020 Cameron Peak Fire, which destroyed 469 homes and structure; and the 2021 Marshall Fire, which destroyed over 1,000 structures. See **Appendix A** for a discussion about how wildfires can threaten and destroy homes.

The 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). The built environment includes homes, businesses, infrastructure, services such as utilities, roadways, and geographic features that aid in wildfire suppression, such as roads or ridgetops (*Healthy Forest Restoration Act*, 2003). People that live and work in the WUI must be aware of the effect that wildland fires have on their lives.

WUI exists along a continuum of wildland to urban densities (**Figure 2.c.1**). The WUI is often subdivided into intermix, interface, and occluded types. Wildland-urban intermix refers to places where the built environment intermingles with wildland vegetation; wildland-urban interface refers to places where the built environment abuts large area of wildland vegetation; and occluded refers to places where wildland vegetation is surrounded by the built environment (Johnston, 2018).

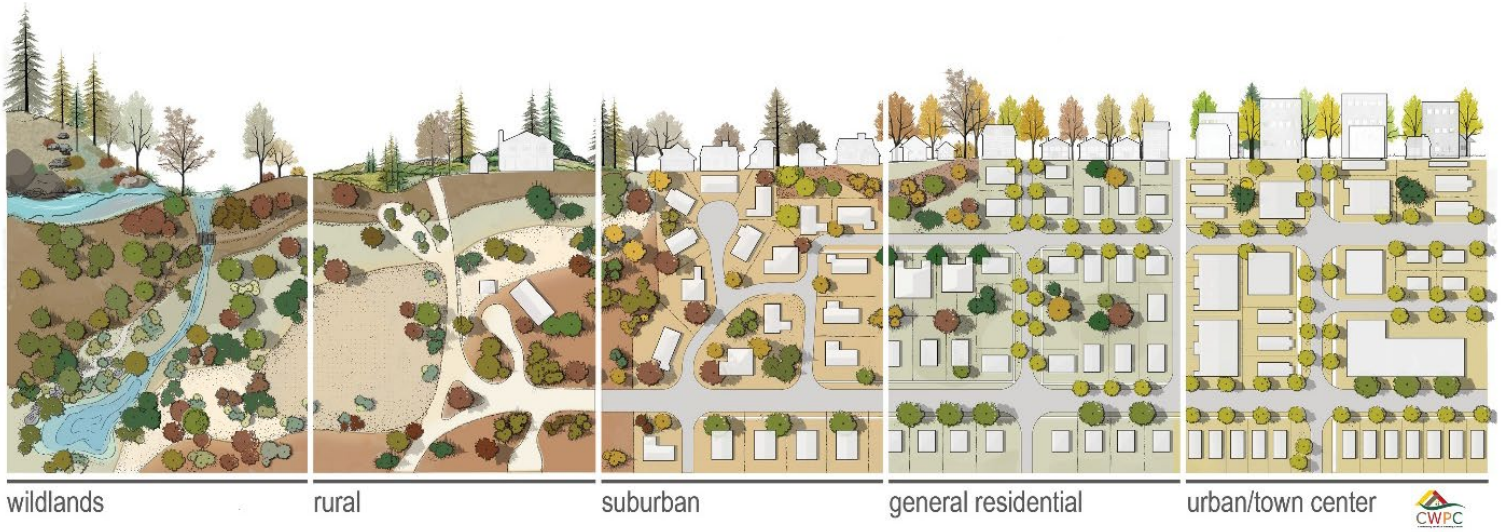


Figure 2.c.1*. The wildland-urban interface exists along a continuum of wildland to urban densities. Source: Community Wildfire Planning Center.*

All residents of CCCFPD live in the WUI (**Figure 2.c.2**). The WUI boundary for this CWPP includes all developed areas in CCCFPD and the surrounding landscape that could transmit wildland fire into those populated and developed areas, and the area along important evacuation routes (**Figure 2.c.2**; see methodology in **Appendix B**). As demonstrated by the Plainview Fire of 2006 and the Marshall Fire of 2021, wildfire is not only native to forested areas, but also to the grasslands in Colorado, and so the WUI does not end at the foothills but extends into the grasslands. This area may be referred to as the grassland-urban interface, or GUI. Vegetation fires that ignite buildings are still considered wildfires but, as in the case of the 2021 Marshall Fire, fires that begin to primarily spread from structures to structures are usually classified as urban conflagrations. The distinction is

important because different firefighting tactics are used for each of these different fire types. Some fires can have wildland elements and urban conflagration elements.

According to the 2020 Wildfire Risk to Communities analysis by the U.S. Forest Service, homes in CCCFPD and the surrounding areas have a higher risk of fire than 93% of the communities in the state of Colorado (USFS, 2021a). Over the past 50 years, the Colorado Front Range has seen significant population growth within this historically forested landscape. This population change increased not only the density and size of the WUI, but also increased the risk of structure loss from wildfire and the likelihood of fire ignitions.

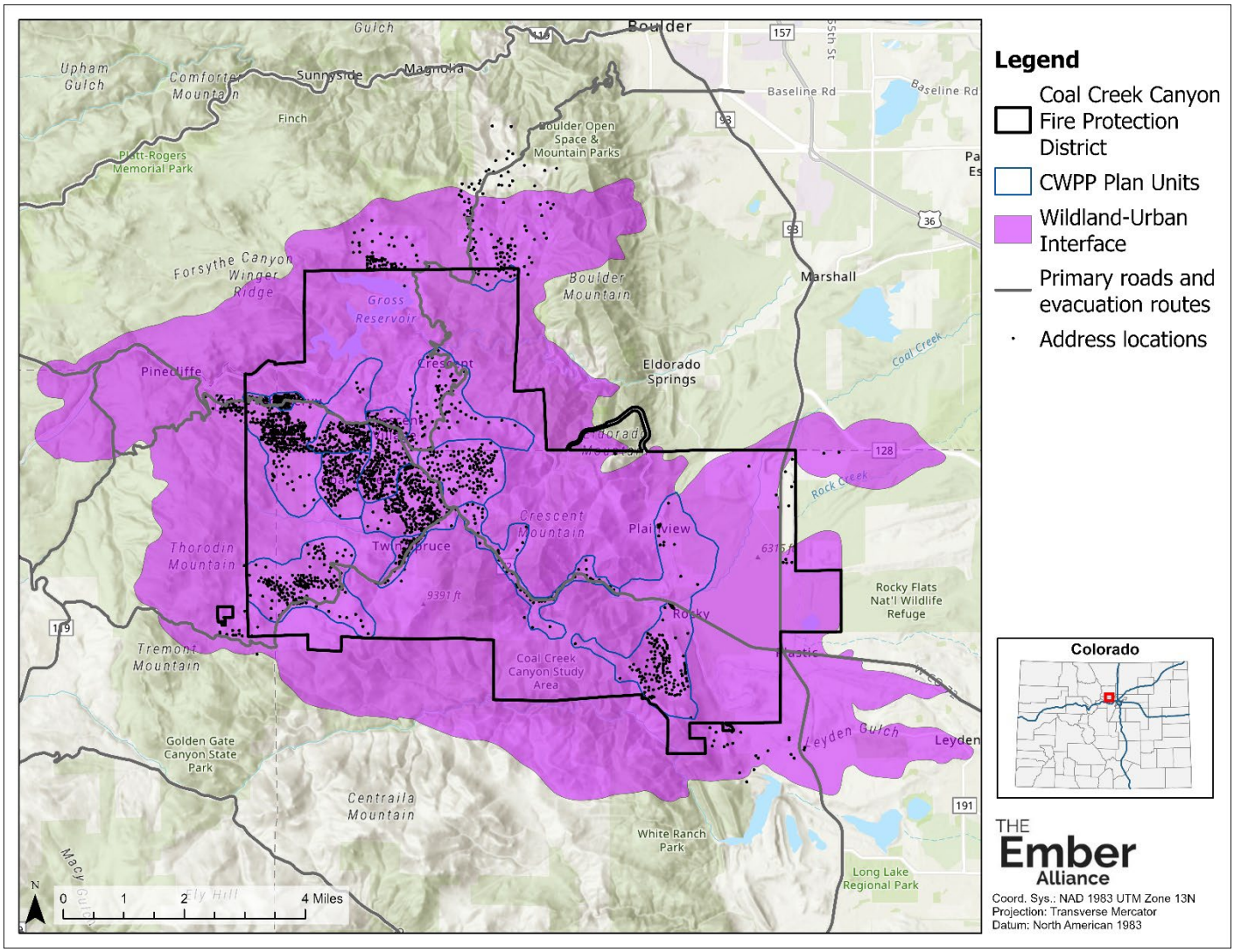


Figure 2.c.2. *All residents of CCCFPD live in the wildland-urban interface and/or intermix and are exposed to elevated wildfire risk. The WUI boundary for this CWPP includes all residential structures and evacuation routes in CCCFPD and the surrounding landscape that could transmit wildland fire into CCCFPD (see methodology in* ***Appendix B****). You can find links to an interactive version of this map at CoalCreekCWPP.org.*

2.d. Firefighting in the WUI

One of the standard firefighter orders is to "fight fires aggressively, having provided for safety first" (NWCG, 2018a). Firefighters are committed to protecting lives and property, but firefighting is particularly perilous in the WUI. The firefighting community is committed to wildland firefighter safety, which can require them to cease structure protection when conditions are exceedingly dangerous, particularly around homes with inadequate defensible space, safety zones, and egress routes.

High-intensity, fast-moving wildfires in the WUI can quickly overwhelm firefighting resources when homes begin igniting each other (Caton and others 2016). Firefighters are often forced to perform structure triage to effectively allocate limited resources during an incident, and more importantly, to protect the lives of firefighters. The Incident Response Pocket Guide (IRPG), which is carried by all firefighters certified under the National Wildfire Coordinating Group, explicitly states, "**Do not** commit to stay and protect a structure unless a safety zone for firefighters and equipment has been identified at the structure during size-up and triage" (NWCG, 2018a). The IRPG outlines four categories of structure triage:

1. Defensible – prep and hold.
2. Defensible – stand alone.
3. Non-defensible – prep and leave.
4. Non-defensible – rescue drive-by.

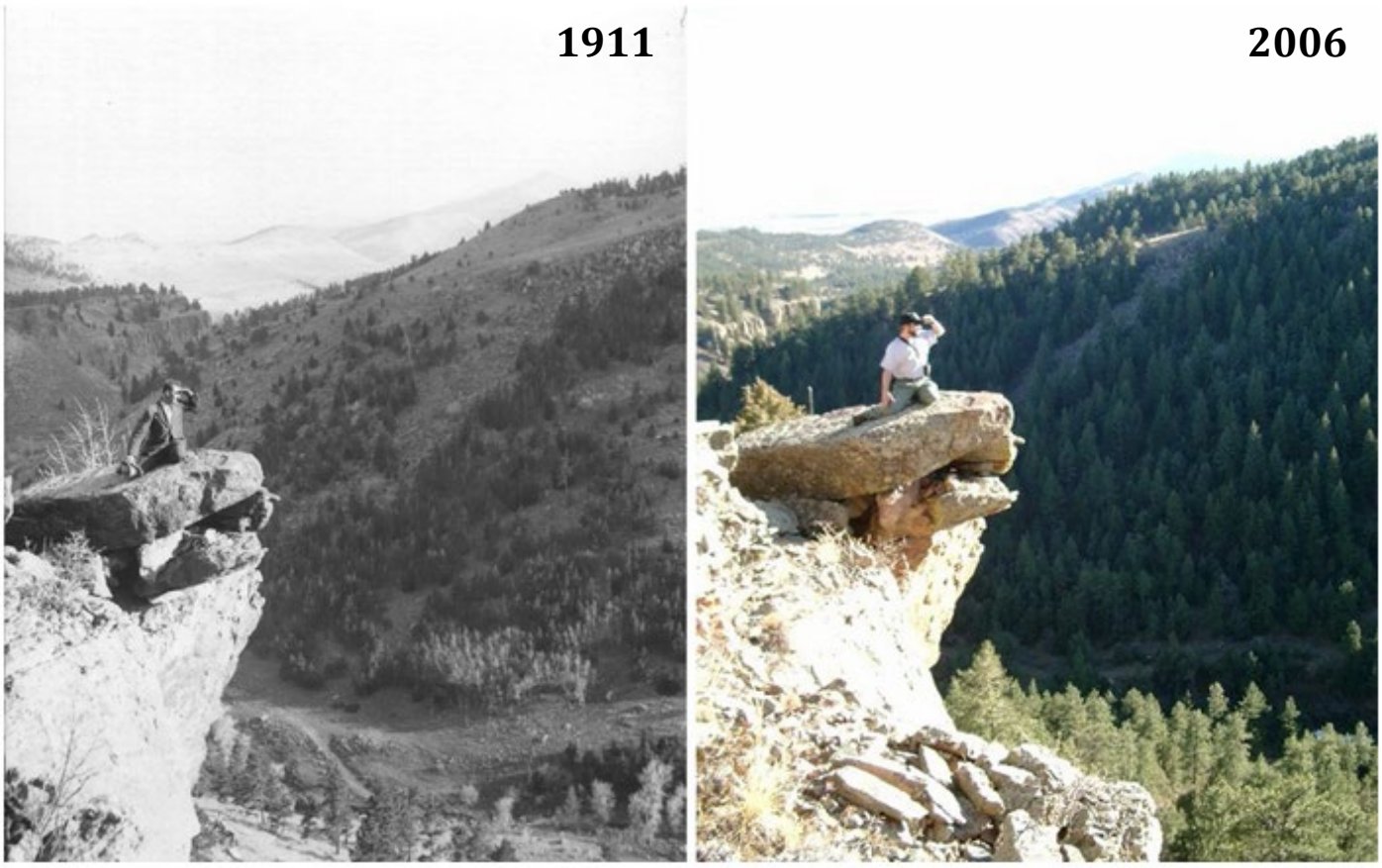
Do not count on firefighters staying to defend your home—your home should be able to stand strong on its own during a wildfire. There are never enough firefighters to stay and defend every single home during large incidents. Section Mitigate the home ignition zone of this CWPP provides recommendations for how residents can increase the chance of their homes standing strong during wildfires and enhance the safety of wildland firefighters.

Defensible space allowed firefighters to protect this home during the 2016 Cold Springs Fire near Nederland, CO. Photo credit: Wildfire Partners.

2.e. Fire History Along the Colorado Front Range

Wildfires and cultural burning heavily influenced Colorado's Front Range before the era of fire suppression. Many Indigenous peoples utilized fire to steward the land, including the Núu-agha-tuvu-pu (Ute) and Tséstho'e (Cheyenne) Nations who hold much of the Colorado Front Range as their ancestral land (Wright, 2016). Frequent, low-severity fires were common in grasslands, shrublands, and ponderosa pine and dry mixed-conifer forests before European settlement in the 1850's, and other forest types, particularly lodgepole and subalpine forests at higher elevations, experienced infrequent but high-severity wildfires (**Figure 2.e.1**). Some plant species evolved adaptations to wildfire, for example, the heat from wildfires opening the cones of lodgepole pine or mortality from wildfire triggering resprouting in Gambel oak and aspen. Some wildlife benefit from recently burned ecosystems with lower tree densities and a greater abundance of understory plants (Kalies et al., 2012; Pilliod et al., 2006).

Wildfire behavior is vastly different today than it was over a century ago in many ecosystems along the Colorado Front Range. As the initial ranching and logging activities of Euro-American settlers subsided in the region and government-mandated fire suppression began in the late 1800's, forests filled in with trees (Addington et al., 2018). Tree densities in lower-elevation forests along the Colorado Front Range average 4.5 times higher today than they were in the mid-1800s, and tree densities in mid-elevation forests average 2.3 times higher today (Battaglia et al., 2018). Although many residents consider dense forest as "natural," these conditions are vastly different from the fire-resilient ecosystems that existed before.



Tree densities in many ponderosa pine and mixed-conifer forests are higher today than they were historically in part due to fire suppression, as demonstrated by these paired photographs in Geer Canyon, which is about 20 miles north of CCCFPD. Photo credits: Carnegie Library for Local History / Museum of Boulder Collection and Boulder County Parys & Open Space.

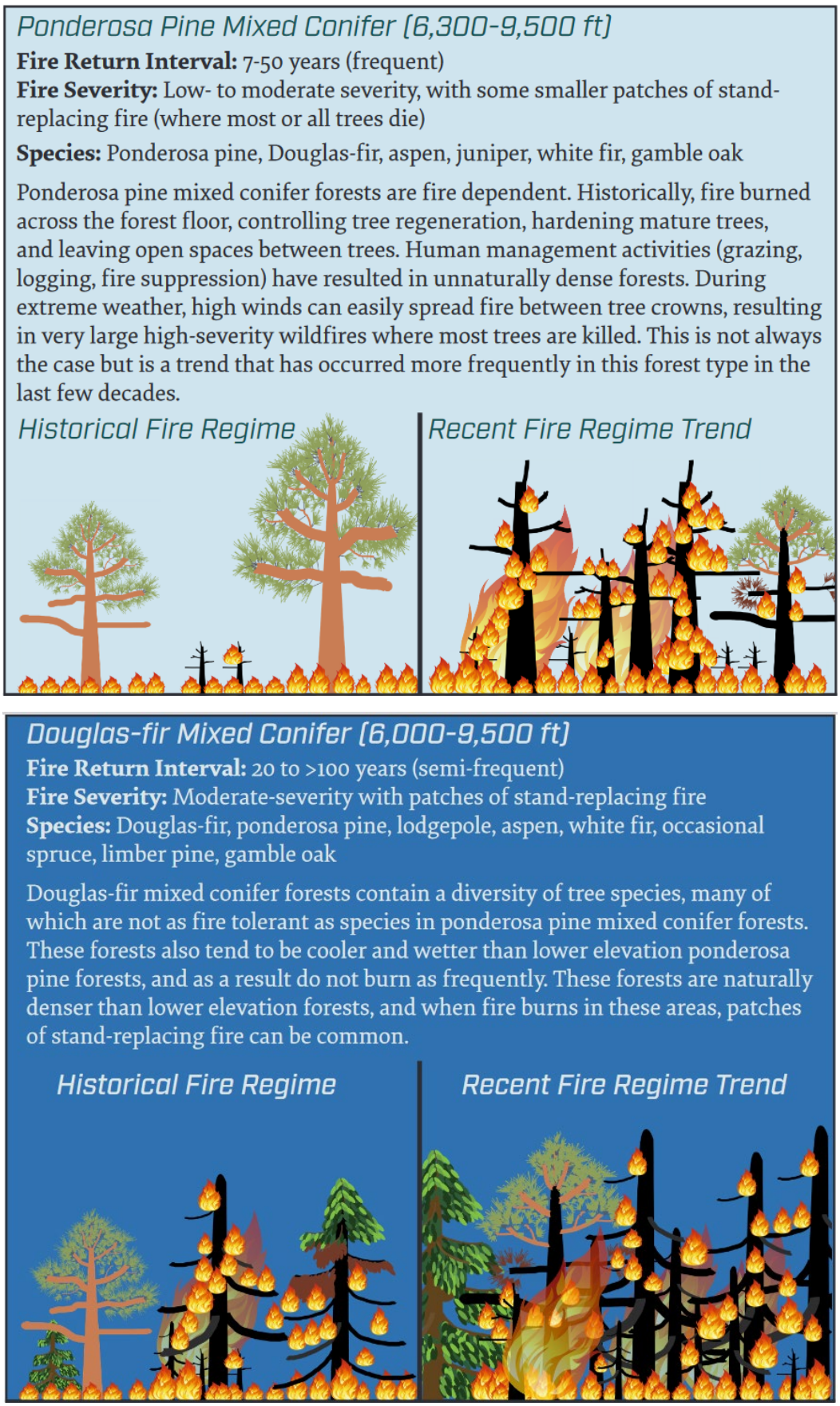


Figure 2.e.1. *Fire behavior has changed for many ecosystems along the Front Range of Colorado, partially due to the suppression of wildfires for over a century. Source: Colorado Forest Restoration Institute.*

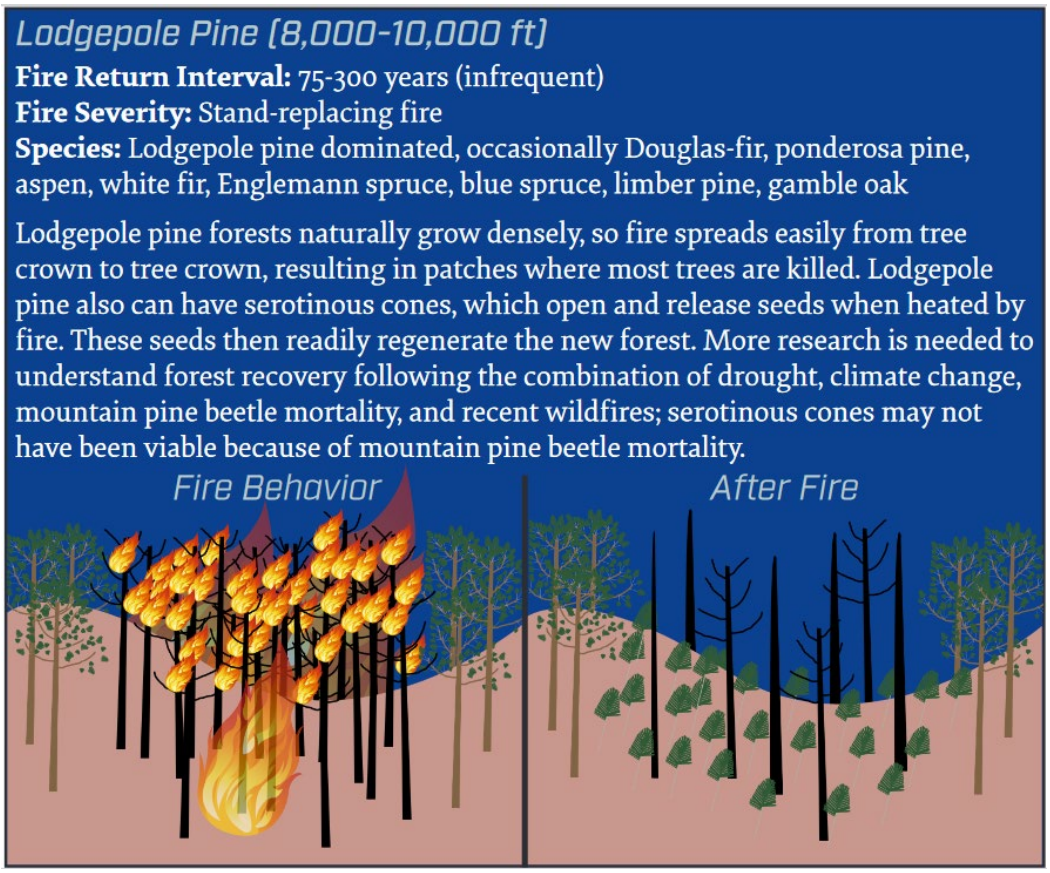


***Figure 2.e.1**. (Continued). Other forests experienced more infrequent but high-severity wildfires in the past, and this fire behavior persists today. Source: Colorado Forest Restoration Institute.*

A combination of dense wildland vegetation, extreme heat and high winds, unplanned ignitions, and housing developments in the wildland urban interface (WUI) can create catastrophic wildfire scenarios (Haas et al., 2015). Climate change is making high-severity wildfires more frequent, intense, and larger in extent (Parks et al., 2016). Many catastrophic wildfires in Colorado's history have occurred on dry and windy days, resulting in rapidly spreading fires that outpace the ability of firefighters to respond. On the Front Range, wind can gust over 60 miles/hour, which makes wildfire suppression nearly impossible (Haas et al., 2015).

CCCFPD and adjacent districts have significant wildland fire potential due to high hazard conditions such as dense forests, steep terrain, and limited road access. The 2006 Plainview Fire spread across 2,700 acres in CCCFPD, fueled by over 70 mph winds. The Plainview Fire forced about 100 families to evacuate from the Plainview and Blue Mountain Estates communities. The 2000 El Dorado Fire burned 1,000 acres in the northern portion of CCCFPD and triggered voluntary evacuations for 250 homes. Other fires that burned near but not within CCCFPD include the 2010 Fourmile Canyon Fire (6,175 acres), 2016 Cold Springs Fire (525 acres), 2021 Marshall Fire (6,080 acres), (**Figure 2.e.2**).

Fires as large as the Fourmile Canyon Fire, which burned in forested fuel, would cover 20% of the CCCFPD. Fortunately, wildland firefighters suppress a vast majority of ignitions in CCCFPD before they exceed 0.25 acres in size, but fires can escape the initial capacity of firefighters under high, dry, and windy conditions. Human-caused ignitions predominate in CCCFPD, with the most human-caused ignitions occurring in May and July and the most lightning-caused ignitions in July and August (**Figure 2.e.3**).

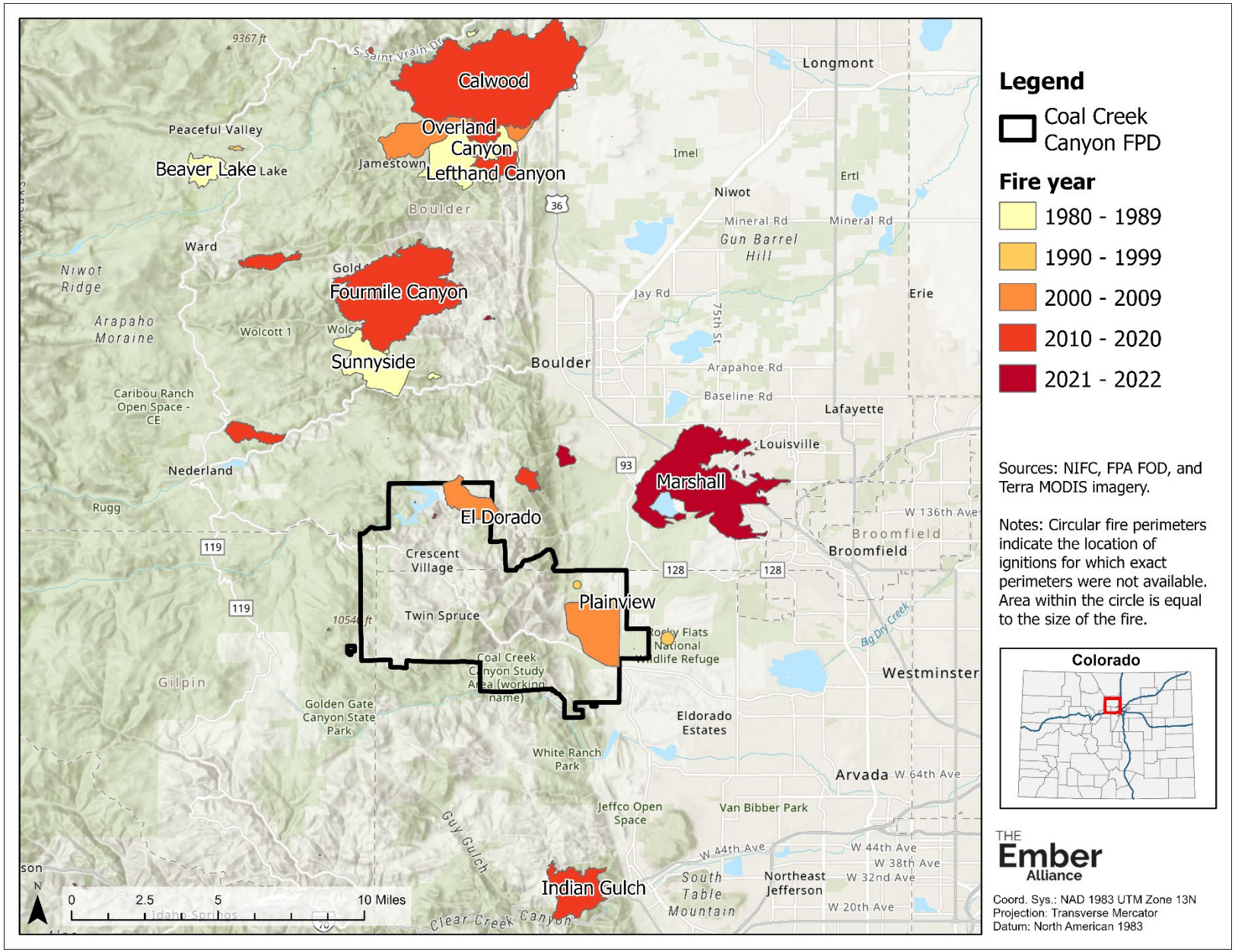


Figure 2.e.2. *The 2006 Plainview Fire spread across 2,700 acres in CCCFPD, fueled by over 70 mph winds. The 2000 El Dorado Fire was ignited by lightning and burned 1,000 acres in the northern portion of CCCFPD. Source: National Interagency Fire Center, Fire Program Analysis Fire-Occurrence Database, and Zoom Earth/NASA/GSFC/EOSDIS/Terra MODIS imagery. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

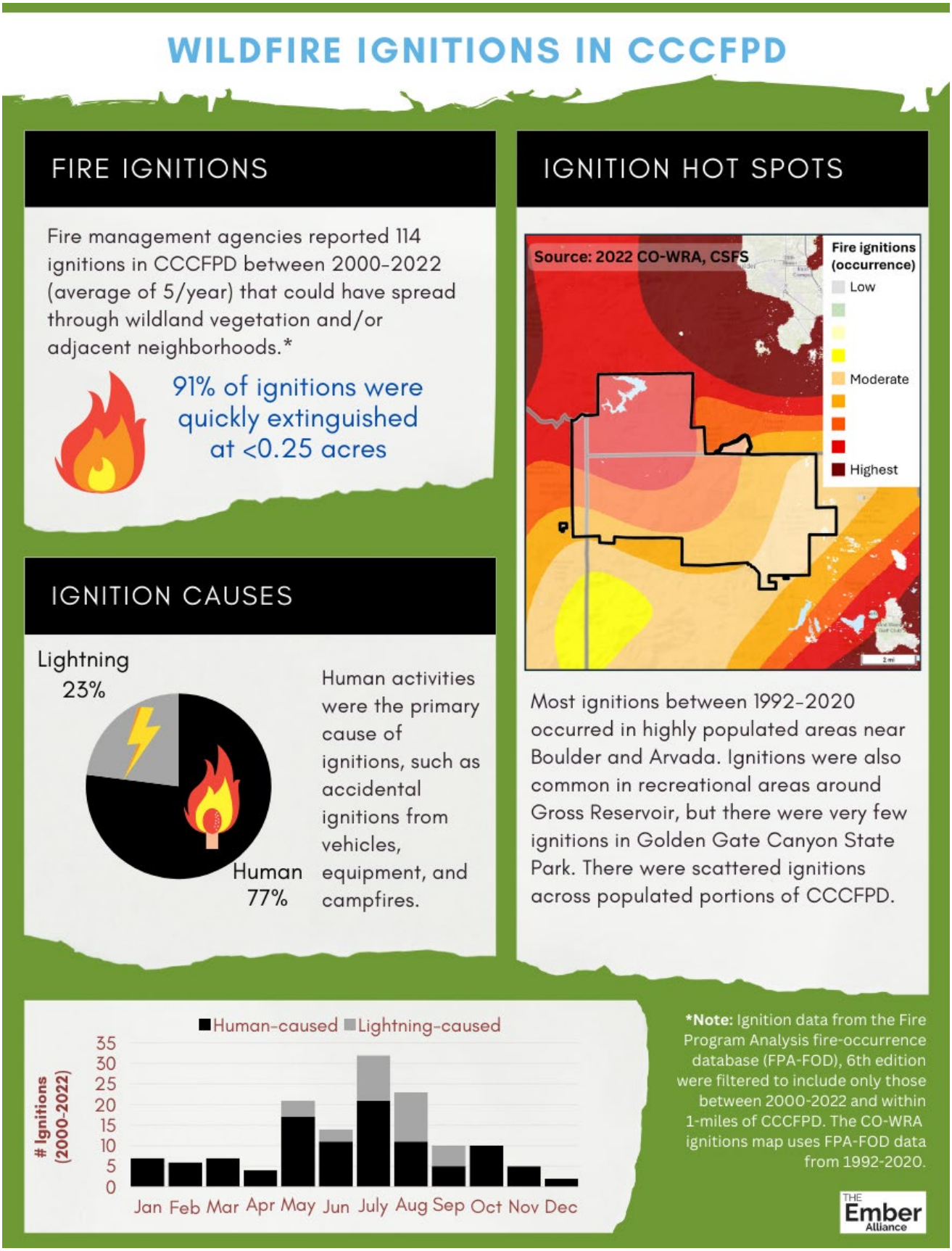


Figure 2.e.3. *Historic wildfire ignitions in CCCFPD. Understanding when, why, and where ignitions occur can inform fire prevention campaigns and planning for firefighter staffing and equipment needs. Sources: (CSFS & Technosylva, 2023a; Short, 2022). Infographic by The Ember Alliance.*

2.f. Potential for Extreme Fire Behavior and Exposure in CCCFPD

Many neighborhoods in CCCFPD could experience extreme fire behavior that could put the lives of residents, visitors, and firefighters at risk. Steep slopes, dense forests, limited road access in and out of neighborhoods, and flammable building material contribute to this dangerous situation. **There is an immediate need for this community to undertake proactive measures to mitigate wildfire risk to protect lives and property.**

Residents in CCCFPD are highly concerned about wildfire risk. Top concerns to residents were firefighter safety, loss of life, loss of insurance coverage, and receiving timely and accurate information about a wildfire (**Figure 2.f.1**). Fortunately, life safety concerns can be addressed through concerted effort across the community to mitigate wildfire risk and increase emergency preparedness. Implementing recommendations in this CWPP will go a long way towards helping CCCFPD become a fire-adapted community.

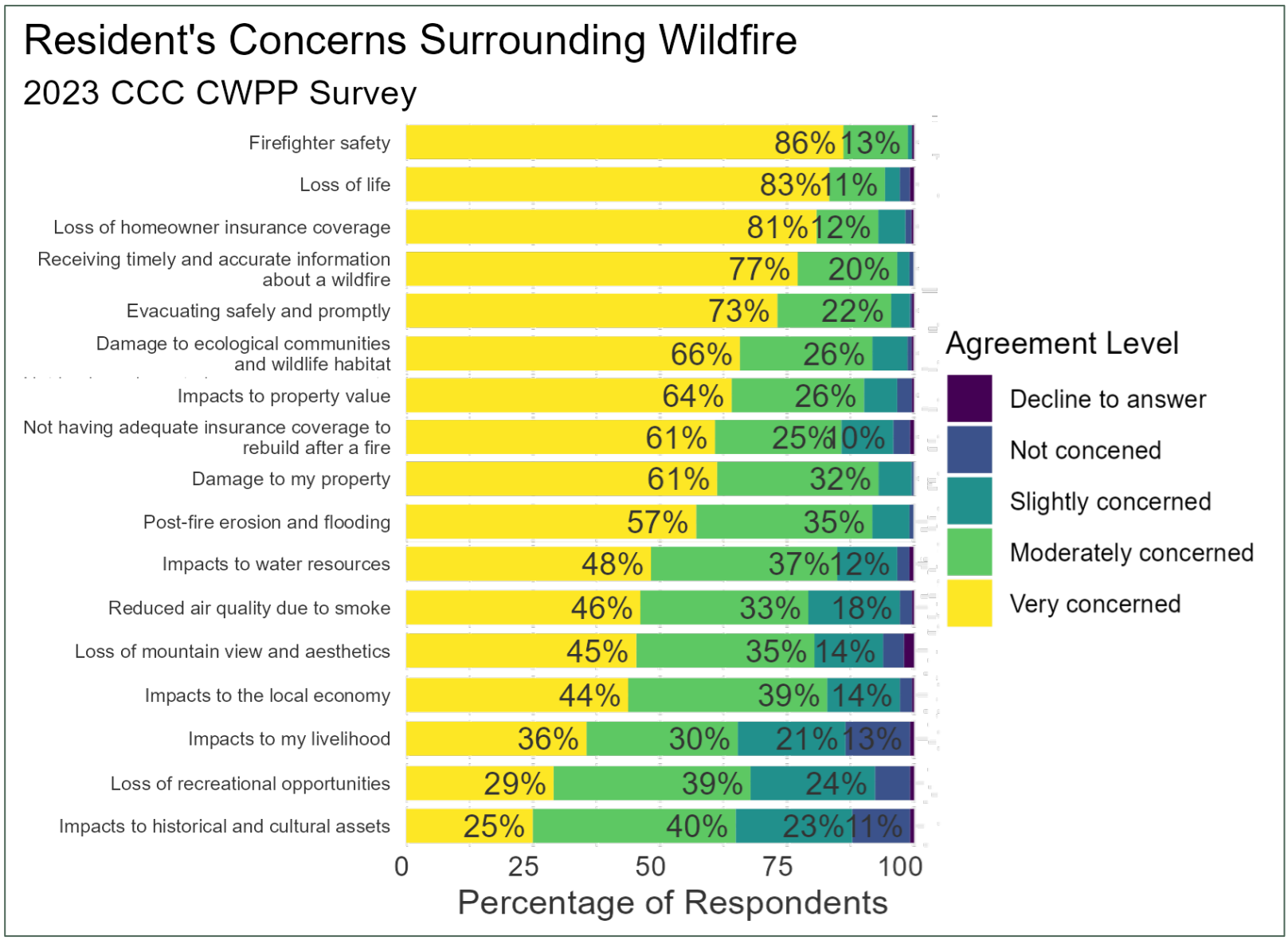


Figure 2.f.1. *Level of concern about wildfire impacts expressed by CCCFPD residents who responded to the CWPP survey. Top concerns were firefighter safety, loss of life, loss of insurance coverage, and receiving timely and accurate information about a wildfire. See* ***Appendix C*** *for a full summary of survey findings.*

Potential Fire Behavior

Topography and fuel conditions are highly variable across CCCFPD (**Figure 2.f.2**), and this variation, plus alignment between wind patterns and topography, help explain the patterns of potential fire behavior across the landscape. If wind is pushing wildfire up a steep slope, it can result in more extreme fire behavior than if a fire is backing down the leeward side of a slope. Northwest facing slopes are likely to have dense forest conditions and a greater quantity of fuel available to burn if conditions are dry enough. However, south facing slopes are usually drier than north-facing slopes, and grasses present in moderately dense forests and shrublands can dry out very quickly on hot days and support rapidly moving fires with high flame lengths.

Under moderate fire weather conditions—conditions typical of a summer day in CCCFPD—about 50% percent of CCCFPD could experience high to extreme fire behavior. This percentage increases to 75% under less common but more extreme, hot, dry, and windy conditions (**Figure 2.f.3**).

High to extreme fire behavior includes ember production that ignites additional fires away from the main fire and the movement of high-intensity fire from treetop to treetop, also known as an active crown fire. Such fires are extremely challenging if not impossible to control until winds die down and fuel moistures increase. Homes serve as an additional source of fuel that could produce high-intensity flames, emit embers, and initiate home-to-home ignitions. Fire growth could be extensive across CCCFPD if wildland firefighters cannot engage due to dangerous conditions from extreme fire behavior and if wildland fire moves rapidly (**Figure 2.f.4**).

Important Considerations about Fire Behavior Predictions

Fire behavior models can provide reasonable estimates of relative wildfire behavior across a landscape. However, wildfire behavior is complex, and models are a simplification of reality. Models also struggle to capture impacts of structures on wildfire spread and home-to-home ignitions. It is recommended to use the fire behavior analyses within this document to understand relative risk at a landscape scale, and not as an indication of a single property's risk.

Exceptionally hot, dry, and windy conditions are increasingly common due to climate change and could result in even more extreme fire behavior across CCCFPD than predicted by this analysis.

See **Appendix B** for details on fire behavior modeling conducted for this CWPP.

Many ponderosa pine and dry-mixed conifer forests in CCCFPD have grasses, shrubs, and small trees in the understory that serve as ladder fuels and help transition wildfires from the ground into treetops. Fire can transition into treetops even under moderate fire weather conditions, especially on steep slopes. When trees are closely spaced in dense forests, fire can begin spreading as an active crown fire.

Moderate fire behavior is possible in grasslands in the eastern part of CCCFPD and lodgepole pine forests in the southwest under moderate fire weather conditions. Lodgepole pine forests tend to have very few grasses, shrubs, and small trees in the shade below dense tree canopies, which reduces the potential for fire to transition into treetops under moderate fire weather. However, when fuels are very dry and winds are strong, it is possible for wildfire to transition into treetops in lodgepole pine forests and become an active crown fire, particularly on steep slopes. Grasslands can experience high fire behavior with rapid rates of spread and high flame lengths under extremely hot, dry, and windy conditions and quickly outgrow the ability of firefighters to suppress the fire.

Figure 2.f.2. *Fuel loads are variable across CCCFPD, ranging from dense forests with abundant ladder fuels (top), to open forests with moderately spaced trees and few ladder fuels (foreground of middle), to grasslands and agricultural lands with scattered trees (bottom). Fuel type and fuel loads greatly influence fire behavior, intensity, and rate of spread. Photo credit: The Ember Alliance.*

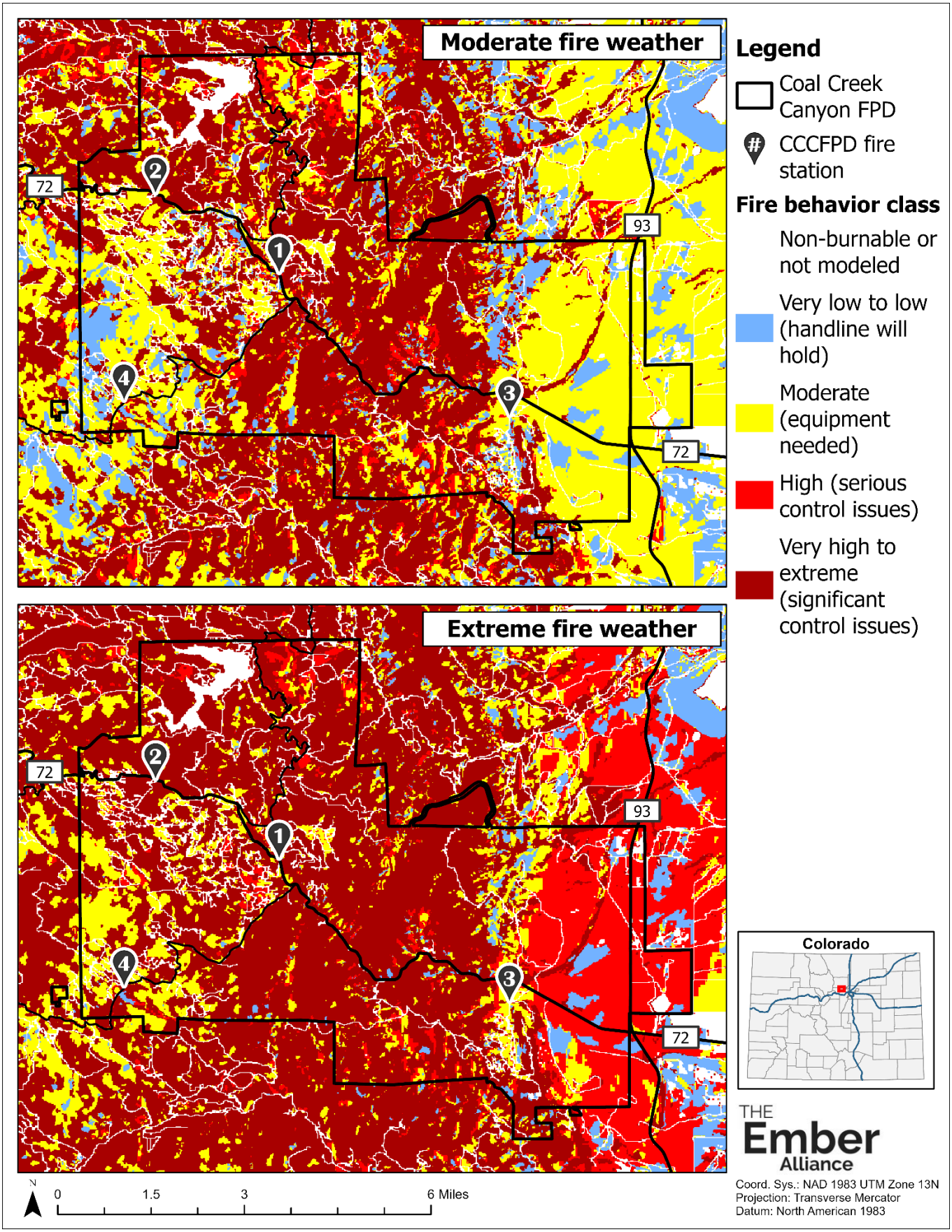


Figure 2.f.3. *Under moderate fire weather conditions—conditions typical of a summer day in CCCFPD—50% percent of CCCFPD could experience high to extreme fire behavior, and this percentage increases to 75% under less common but more extreme, hot, dry, and windy conditions. See* ***Appendix B*** *for a description of fire behavior modeling for this CWPP. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

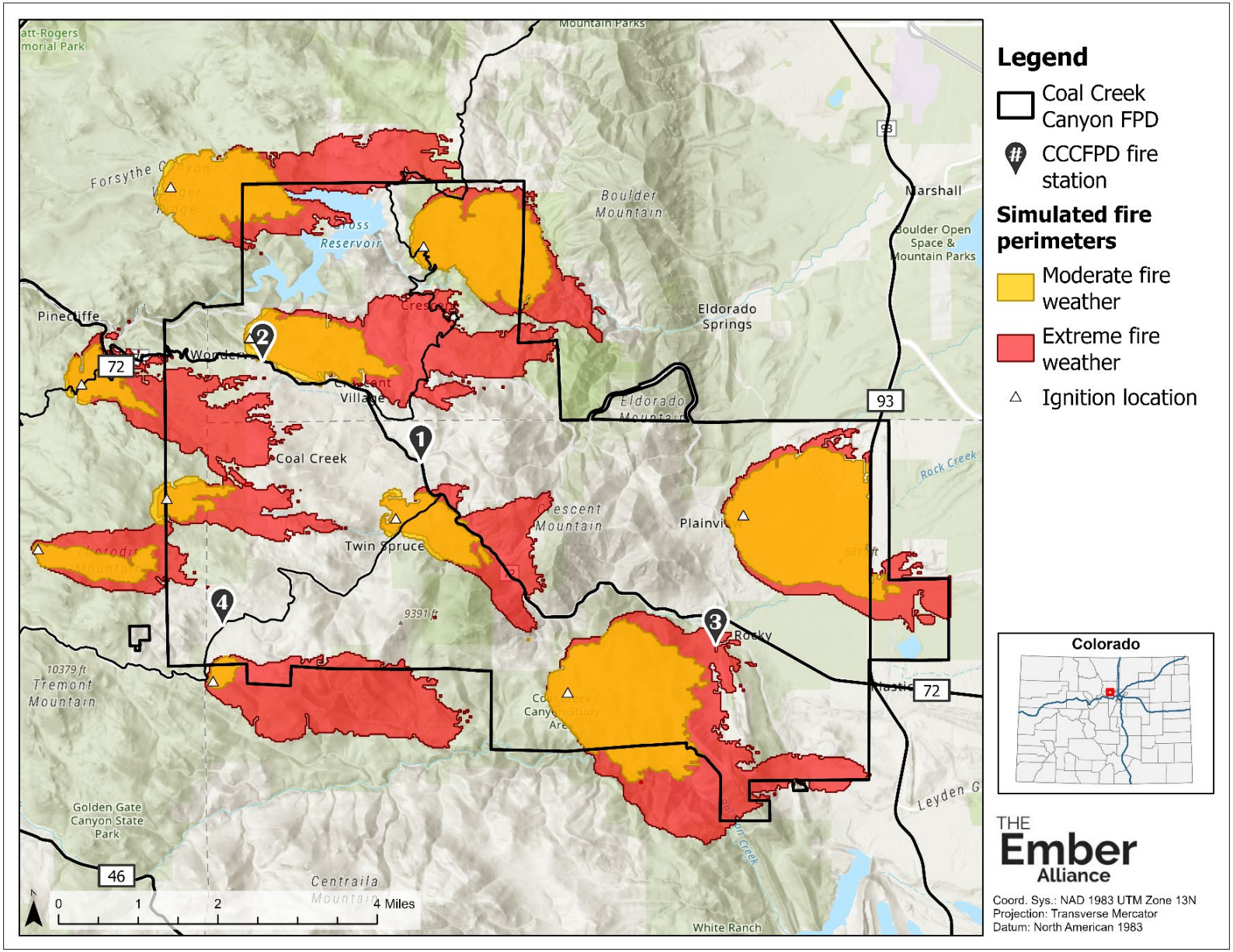


Figure 2.f.4. *Fire growth could be extensive across CCCFPD under extreme fire weather conditions if wildland firefighters cannot engage due to dangerous conditions from extreme fire behavior. Simulated fire perimeters were based on fire behavior predictions after 4-hours of fire growth without suppression activities from hypothetical ignition locations. Multiple fire perimeters are shown to demonstrate the variety of fire sizes, shapes, and travel paths that could happen in and around CCCFPD under different fire weather conditions and wind directions.*

Likelihood of Wildfire

Wildfire risk is composed of hazard (potential intensity of wildfire and likelihood of wildfire) and vulnerability (exposure of highly valued resources and their susceptibility to damage). Burn probability is the annual probability of any location burning due to a wildfire. According to the 2022 Colorado Wildfire Risk Assessment from the Colorado State Forest Service, CCCFPD has some of the highest relative burn probabilities in Jefferson, Gilpin, and Boulder Counties. Some of the highest burn probabilities relative to the entire state of Colorado occur around Crescent Mountain and Scar Top Mountain in the center of CCCFPD (**Figure 2.f.5**).

High burn probabilities occur in much of CCCFPD due to the potential for rapid rates of fire spread across steep, complex terrain covered in grasslands, shrublands, and forests with low to moderate tree densities and abundant understory vegetation. Rocky Flats National Wildlife Refuge also has elevated relative burn probabilities because large grasslands in the area could experience rapid rates of spread.

Another metric of the likelihood of wildfires is the frequency of days with weather conducive to large-scale fire growth. CCCFPD frequently experiences days with weather conducive to large-scale fire growth. A Red Flag Warning is issued by the National Weather Service when there is high confidence that Red Flag criteria will be met within the next 24 to 48 hours or when those criteria are already being met or exceeded. Days with Red Flag Warnings indicate severe fire weather and require extra vigilance by fire departments and residents. Hot, dry, and windy conditions on Red Flag days can lead to exceptionally fast fire growth and high fire intensity that exceeds the ability of firefighters to quickly suppress the blaze. The occurrence of Red Flag Warnings is variable from year to year due to regional weather patterns and weather anomalies such as El Niño and La Niña. CCCFPD experiences on average 17 days with weather conditions that qualify as Red Flag Warnings, ranging from 1 to 43 per year between 2006 and 2023. Climate change will further increase the number of days with very high fire weather danger, potentially by 10-14 days/year (**Figure 2.f.6**).

The Cold Springs Fire burned 525 acres northwest of CCCFPD under hot, dry, and windy conditions in July 2016. Photo credit: Colorado National Guard, Staff. Sgt. Joseph K. VonNida.

Take Away Message

Parts of CCCFPD are at high 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. **Proactive work by CCCFPD, residents, and partners is imperative to protect lives and property.**

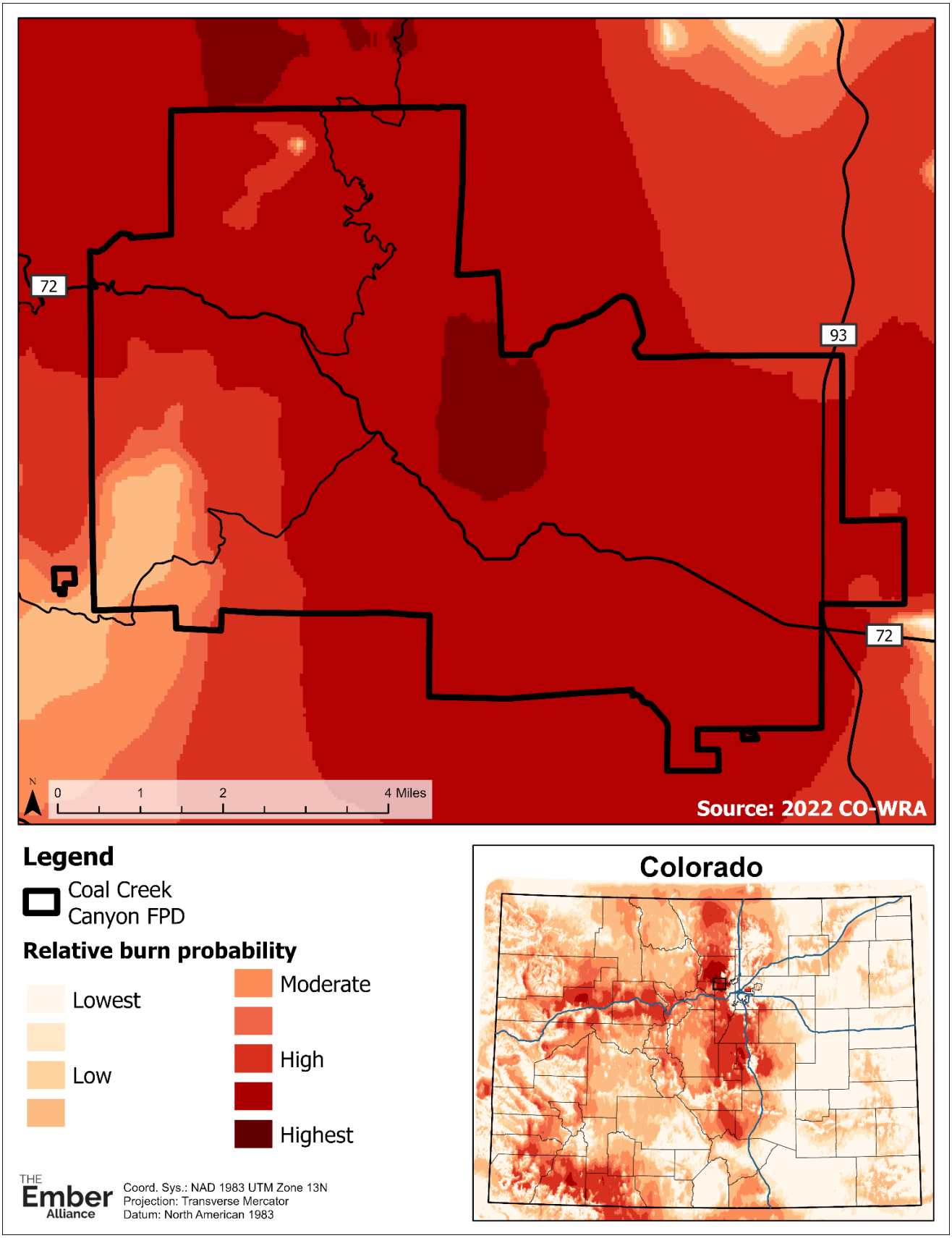


Figure 2.f.5. *Most of CCCFPD falls into the high to highest burn probability categories relative to the state of Colorado. Predictions used high to extreme weather conditions. See (CSFS and Technosylva, 2023a) for detailed methodology. Source: 2022 CO-WRA. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

FIRE WEATHER DANGER IN CCCFPD

During red flag warnings, all residents need to follow fire restrictions and be prepared to evacuate in the case of a wildfire.

RED FLAG CRITERIA

Red flag days are warnings issued by the National Weather Service to indicate that warm temperatures, very low humidity, and stronger winds are expected to result in elevated fire danger in the next 24-48 hours.

CCCFPD falls within the Denver/Boulder Forecast Office, which has two options for red flag criteria:

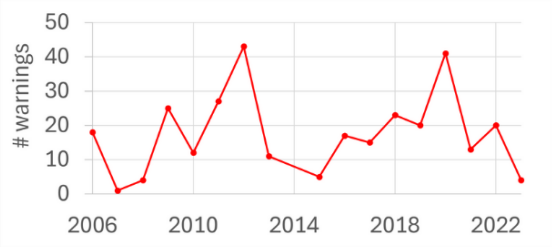
Option 1	Option 2
Relative humidity <= 15% Wind gusts >= 25 mph Dry fuels	Widely scattered dry thunderstorms Dry fuels

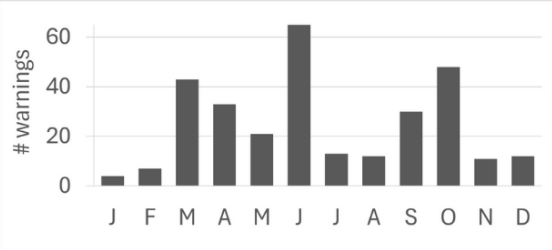
Many large wildfires around CCCFPD occurred during red flag warnings:

2006 Plainview
2010 Fourmile Canyon
2011 Indian Gulch
2012 Flagstaff
2016 Cold Springs

WARNINGS FROM 2006-2023

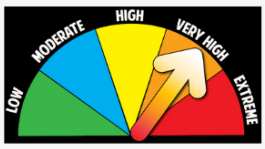
The National Weather Service issued on average 17 red flag warnings/year for the fire weather zones that intersect CCCFPD, with as many as 43 in 2012. Red flag conditions most often occurred in March, June, and October.





CLIMATE CHANGE MEANS MORE FIRE DANGER AHEAD

Hotter and dryer conditions due to climate change could result in **10-14 more days/year** with very high fire weather danger in CCCFPD by 2050.



National Fire Danger Ratings are separate from red flag warnings but use similar indicators of severe fire weather.

BE INFORMED ABOUT COUNTY FIRE RESTRICTIONS

Permissible activities are limited during fire restrictions to protect the community.
Jefferson County: https://www.jeffco.us/511/Fire-Restrictions-Bans
Boulder County: https://bouldercounty.gov/safety/fire/fire-restrictions/
Gilpin County: https://www.gilpincountysheriff.com/firerestrictions

THE Ember Alliance

Sources: Historic red flag warnings for from Iowa Environmental Mesonet at Iowa State University. Future fire danger from https://climatetoolbox.org.

Figure 2.f.6. *CCCFPD experiences on average 17 days with weather conditions that qualify as Red Flag Warnings, and climate change will further increase the number of days with high fire weather danger. Source: Iowa Environmental Mesonet and the Climate Toolbox's Future Climate Scatter. Infographic by The Ember Alliance.*

Potential Consequences to the Community

High to extreme fire behavior can also cause potentially non-survivable conditions along roadways due to extreme radiant heat. When flame lengths next to roads are greater than 8 feet, they can emit more radiant heat than an adult human body can survive. If there is congestion along the roadways where evacuees are stuck in a location with flame lengths over 8 feet, this is considered potentially non-survivable. This is of particular concern in CCCFPD where some neighborhoods have few points of egress for an evacuation. Under moderate fire weather conditions, 10% of the roads in CCCFPD could experience non-survivable conditions, and this percentage rises to 44% under extreme fire weather conditions (**Figure 2.f.7**). Evacuation preparedness is of the utmost importance for residents in neighborhoods with hazardous conditions along roadways (see **Evacuation Preparedness**).

On days with extreme fire weather conditions, virtually all homes within CCCFPD (99% of homes) could be exposed to embers from burning vegetation, regardless of vegetation in the immediate vicinity of the home (**Figure 2.f.8**). Homes serve as an additional source of fuel that could produce high-intensity flames, emit embers, and initiate home-to-home ignitions. This CWPP outlines home hardening practices that residents and business owners can complete to reduce the risk of embers penetrating their homes.

Several non-residential highly valued resources could also be exposed to damaging wildfire, including CCCFPD Stations 1 and 2, Coal Creek Canyon K-8 School, communication towers, water infrastructure, and recreation areas (**Appendix B, Figure B.11**). Fuel treatments and other recommendations in this CWPP seek to reduce this exposure and protect critical resources in CCCFPD.

Impacts of wildfires do not end once the flames are extinguished. Intense rainfall events can result in flash floods, erosion, sediment delivery and debris flows the first few years following a wildfire (Neary et al., 2005). It is very possible that a large storm in the years following a high-intensity wildfire in CCCFPD could result in high to extreme sedimentation along Coal Creek and South Beaver Creek and around Gross Reservoir (**Figure 2.f.9**).

Erosion and sedimentation are natural processes that shape streams, transport soil and nutrients across a landscape and create diversity in streams and riparian habitats (Prettyman, 2018). However, extreme post-fire sediment delivery and debris flows can damage and destroy homes, community assets, infrastructure, fisheries, and riparian vegetation. For example, changes to soils and vegetation brought about by the 2010 Fourmile Canyon Fire exacerbated the degree of flooding experienced in Fourmile Canyon in mid-September 2013, flooding that resulted in the destruction of roads, bridges, and homes. The potential for post-fire sediment delivery and damage to values at risk can be mitigated through activities to improve stream health and resilience, strategic fuel treatments to reduce fire hazards and pre-planning for emergency response.

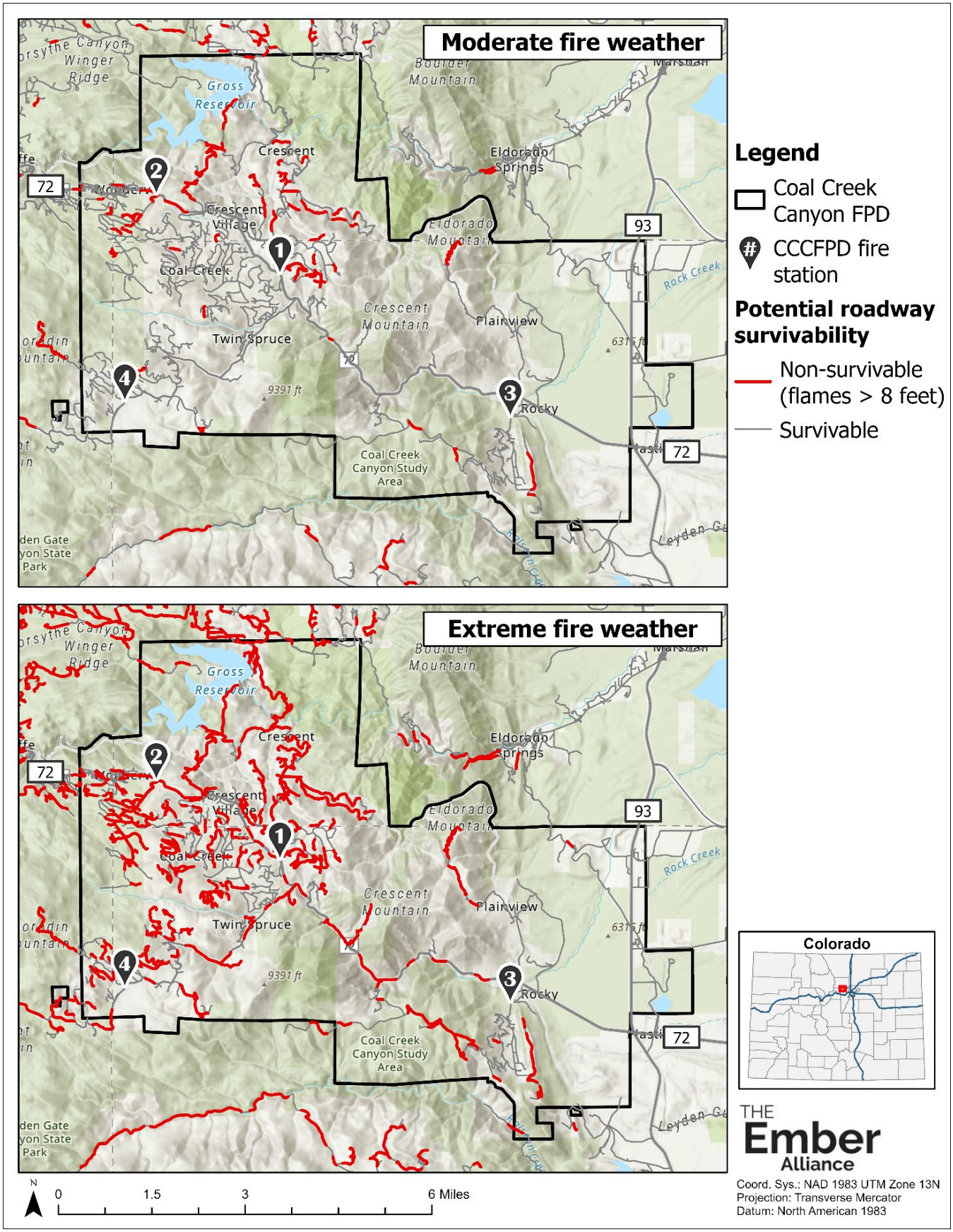


Figure 2.f.7. *Under moderate fire weather conditions, 10% of roads in CCCFPD could experience potentially non-survivable conditions while a fire is actively burning over them (flame lengths along the roadway are over 8 feet). This percentage rises to 44% under extreme fire weather conditions.*

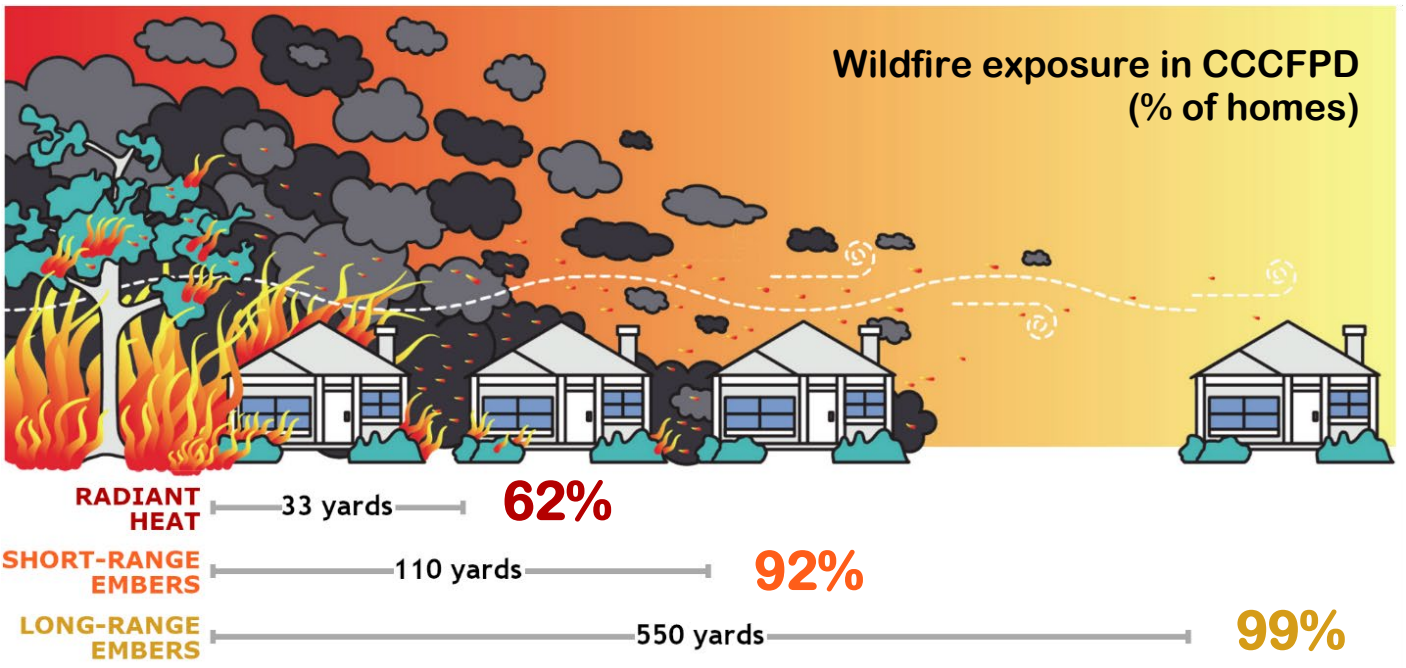


Figure 2.f.8. *Percentage of homes in CCCFPD with different types of exposure to wildfire under extreme fire weather conditions. Radiant heat from burning vegetation can ignite nearby homes, and embers emitted from burning vegetation or other homes can travel long distances and ignite vegetation and homes away from the main fire. Analysis based on research by Beverly et al., (2010) (see* ***Appendix B*** *for details). Image modified from Reducing Brushfires Risks by the Victorian Auditor-General's Office.*

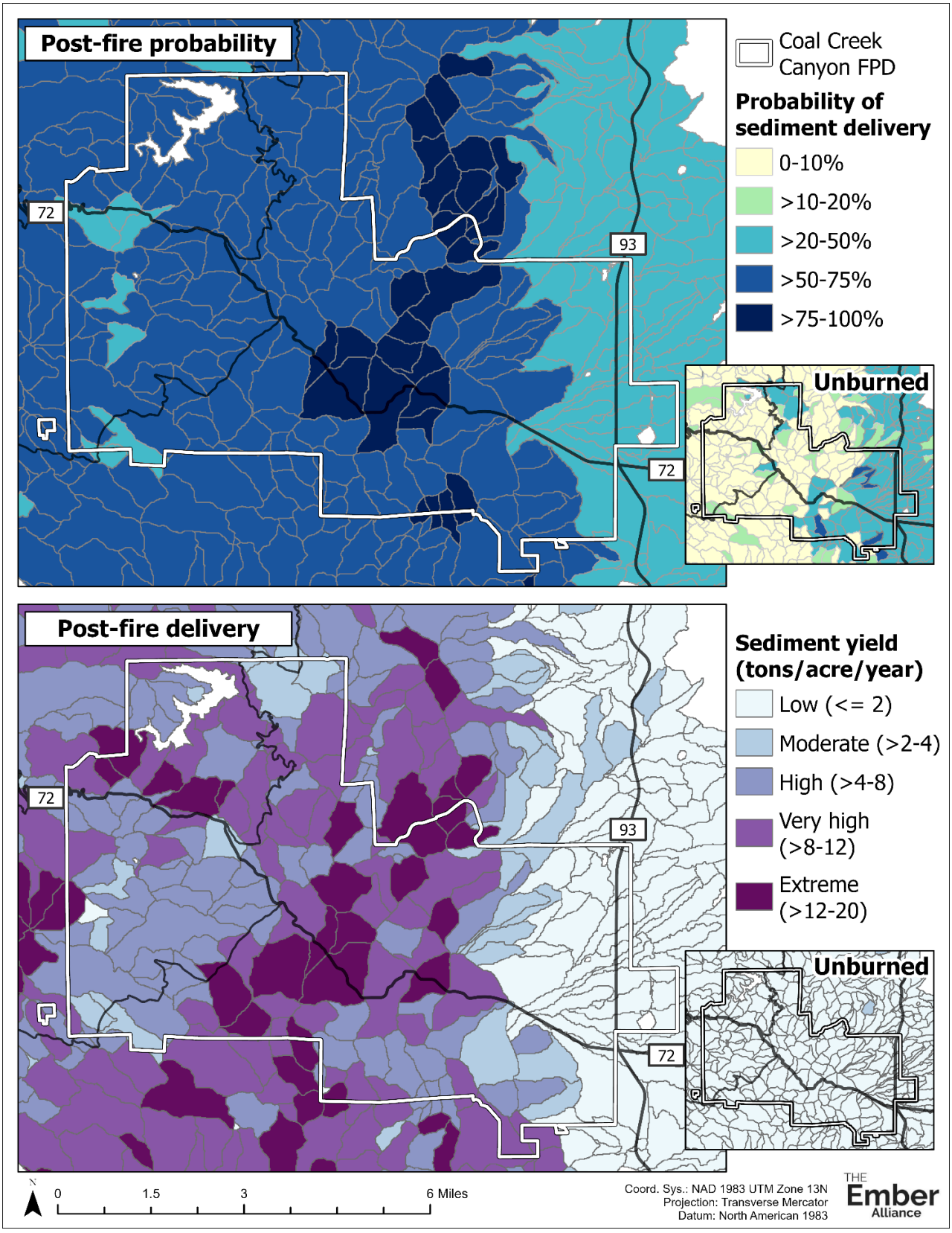


Figure 2.f.9. *Watershed-scale predictions of the probability of sediment delivery (the percentage of 50 simulated weather scenarios that resulted in sediment delivery >0 tons/acre) and the magnitude of sediment delivery (tons/acre/year) for the first year following wildfire vs under current, unburned conditions and 1-in-50-year weather conditions. See* ***Appendix B*** *for a description of post-fire erosion modeling for this CWPP. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

It is important to remember that not all wildfire is damaging and destructive. Many ecosystems along the Colorado Front Range have been shaped by wildfire for centuries, and wildfire creates important habitat for wildlife by removing trees and promoting the growth of a diversity of grasses and forbs. Areas burned by wildfires can serve as fuel breaks for decades afterwards and reduce the potential for damaging wildfire both in the burned area and surrounding landscape. According to an analysis by the U.S. Forest Service, wildfire and/or broadcast prescribed burning could benefit portions of CCCFPD by restoring ecological conditions and reducing fuel loads. Beneficial fire is more likely in areas without homes and where expected fire behavior is moderate (**Figure 2.f.10**).

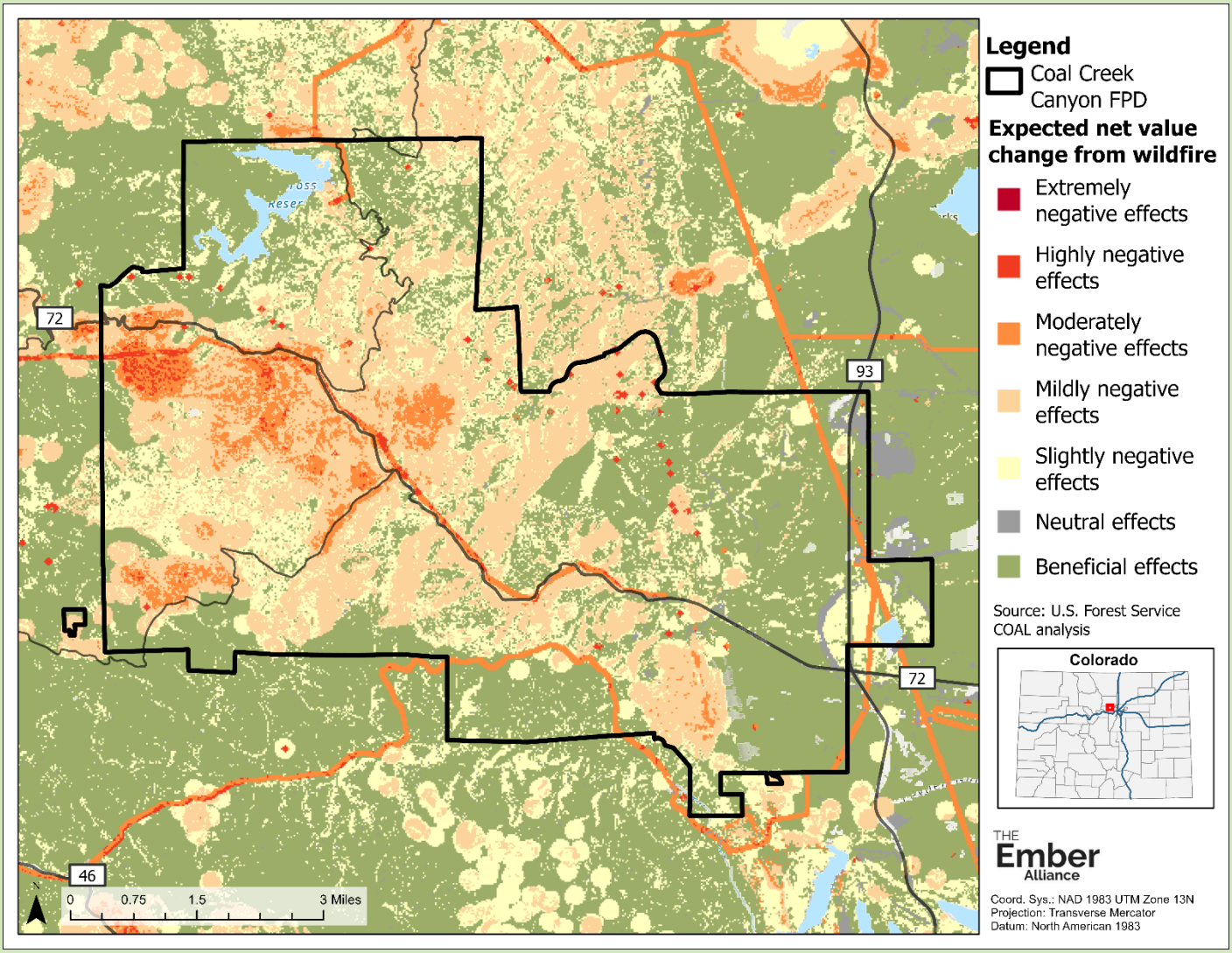


Figure 2.f.10. *According to an analysis by the U.S. Forest Service for the state of Colorado, wildfire and/or broadcast prescribed burning could benefit portions of CCCFPD by restoring ecological conditions and reducing fuel loads. Beneficial fire is more likely in areas without homes and where expected fire behavior is moderate. The analysis considered potential fire behavior, likelihood of wildfire, exposure of values at risk, relative importance of values, and sensitivity of values to different types of fire behavior. Source: U.S. Forest Service COAL dataset.*

2.g. Fuel Treatment History In and Around CCCFPD

Fuel treatments reduce the amount of fuel in strategic locations, reducing fire risk to nearby communities and creating tactical opportunities for wildland firefighters to engage with wildland fires. Fuel treatments can also create healthy, restored forest conditions with abundant understory plants, improved wildlife habitat, and lower the risk of high-severity wildfires. The effectiveness of fuel treatments is influenced by a variety of factors, including the intensity, quality, and extent of treatment, location of treatments, maintenance of treatments, weather conditions and fire behavior, and actions of firefighters (Agee et al., 2000; Jain et al., 2021). Fuel treatment methods include tree thinning, pruning, pile burning, broadcast prescribed burning, and fuel mastication.

Between 2000-2023, public land managers and private residents have conducted fuel treatments to reduce wildfire risk and restore ecosystem health on about 4,200 acres in and around CCCFPD (**Figure 2.g.1**). About 70% of these treatments involve only thinning trees and 30% a combination of thinning and burning. The U.S. Forest Service and CSFS each conducted about 33% of these treatments.

The U.S. Forest Service and partners, including CCCFPD, safely conducted a broadcast prescribed burn on about 307 acres to the west of Gross Reservoir in April 2023. Broadcast prescribed burning can be an extremely effective method to reduce hazardous fuels and restore ecological conditions across a variety of grassland, shrubland, and forest ecosystems (Paysen et al., 2000; Stephens et al., 2009). Less than 1% of prescribed burns escape containment lines, and most of these are rapidly suppressed (Weir et al., 2019). The wildland fire community soberly reviews prescribed burn escapes to produce lessons learned and make improvements (Dether, 2005).

An essential component of this CWPP was identifying locations for additional fuel treatments to protect the community. **Section 4** outlines these priority locations and the land management agency leading these efforts in the coming years.

Firefighters monitored a test fire during the Forsythe II broadcast burn west of Gross Reservoir to ensure fuel and weather conditions were conducive to safe and effective burning. Photo credit: U.S. Forest Service.

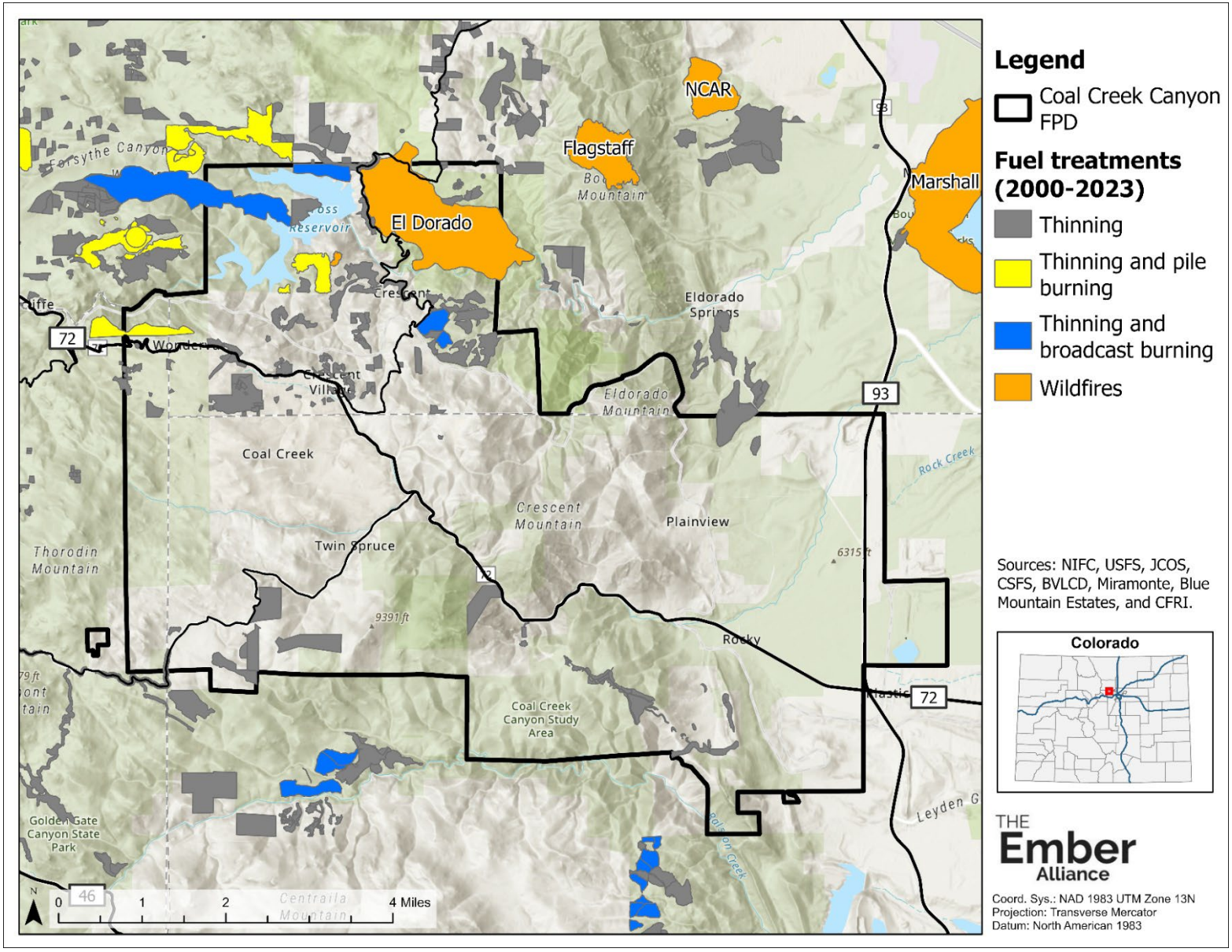


Figure 2.g.1. *Locations of forest management treatments and wildfires in and around CCCFPD from 2000 – 2023. Sources: USFS (data through 2023), JCOS (data through 2023), CSFS (data through 2022), BVLCD (data through 2023), Miramonte and Blue Mountain Forest Stewardship Initiative (data through 2023), and CFRI for other agencies (data through 2018). Wildfire boundaries from NIFC. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

3. Becoming a Fire Adapted Community

It is recommended that CCCFPD, HOAs, and residents embrace the concept of Fire Adapted Communities (FAC), which is defined by the National Wildfire Coordinating Group 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 3.1**).

> *"It takes a community to protect a community" ~ Chief Garret Ball, CCCFPD*

Your community's CWPP sets the stage for fire adaptation, and the next step is on-the-ground action and an ongoing commitment to risk mitigation at all levels of the community, from individuals to neighborhoods and HOAs, to CCCFPD, land managers, and other partners. This section of the CWPP includes recommendations and resources for mitigating wildfire risk and enhancing emergency preparedness. CCCFPD and public land managers have an important role to play in implementing the recommendations in this CWPP, and they have made commitments to take on-the-ground action as outlined in **Section 4.**

Individual 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 across private properties can improve the likelihood of home survival and protect firefighters during wildfire events (Jolley, 2018; Knapp et al., 2021). Blue Mountain Estates and the Crescent Park Community Fire Protection Association are Firewise USA Sites, which recognizes their community-led commitment to reducing wildfire risk.

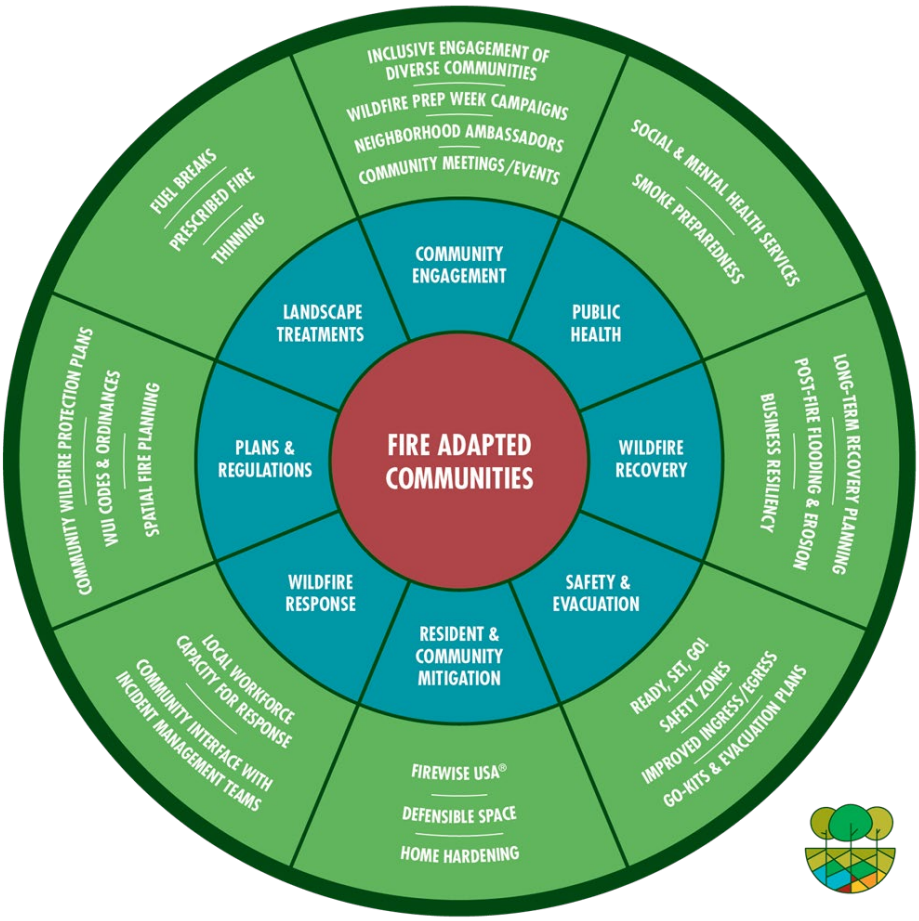


Figure 3.1. *The Fire Adapted Communities graphic provides specific programs and activities that communities can take to reduce their wildfire risk and increase their resilience Source: Fire Adapted Community Learning Network.*

3.a. Recommendations for Residents

Mitigate the Home Ignition Zone

During catastrophic wildfires, property loss happens mostly due to conditions in the **home ignition zone** (HIZ). The HIZ includes your home and other structures (e.g., sheds and garages) and the area within 100 feet of each structure. Firefighter intervention, adequate defensible space, and home hardening measures are common factors for homes that stand strong during major wildfires (IIBHS, 2019; Knapp et al., 2021; Maranghides et al., 2022).

Defensible space is the area around a building (the HIZ) 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. It is encouraged that residents develop defensible space so their homes can stand strong during a wildfire without relying upon limited firefighter resources.

Home hardening is the practice of making a home less likely to ignite from the heat or direct contact with flames or embers. It is important to remember that embers can ignite homes even when the flaming front of a wildfire is far away. Home hardening involves reducing this risk by changing building materials, installation techniques, and structural characteristics of a home. Home hardening measures are particularly important for WUI homes; 50 to 90% of homes ignite due to embers rather than radiant heat during wildfires (Gropp, 2019; Holstrom et al., 2023; Johnston, 2018).

It is important for residents to work together as a community to mitigate shared wildfire risk in the HIZ. Structure-to-structure ignition is a major concern in high-density WUI neighborhoods and can cause substantial property loss. Neighbors can increase their homes' chances of survival during a wildfire if they work together to reduce hazards in their overlapping defensible space. Fortunately, many residents in CCCFPD have already started taking actions to mitigate their home ignition zone (**Figure 3.a.1**). 70% of residents who responded to the CWPP survey keep grass within their zone 2 mowed, half of residents have had wildfire assessments, and half have replaced their roof with a Class A roof.

This home in Coal Creek Canyon has many of the recommended home hardening and defensible space measures completed. Photo credit: The Ember Alliance.

In Coal Creek Canyon, the counties are responsible for developing and enforcing building and zoning codes that affect wildfire mitigation. CCCFPD covers three counties, and each county has different regulations and requirements. These are enforced for all new construction and some remodels or additions. The details of these regulations are different between the counties and residents should work with their local planning and zoning department to ensure they are following the correct codes. As a tool, **Figure 3.a.2** briefly outlines the current types of regulations in each county within CCCFPD.

You can increase the likelihood that your home will stand strong during 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 increasing firefighter access along your driveway.

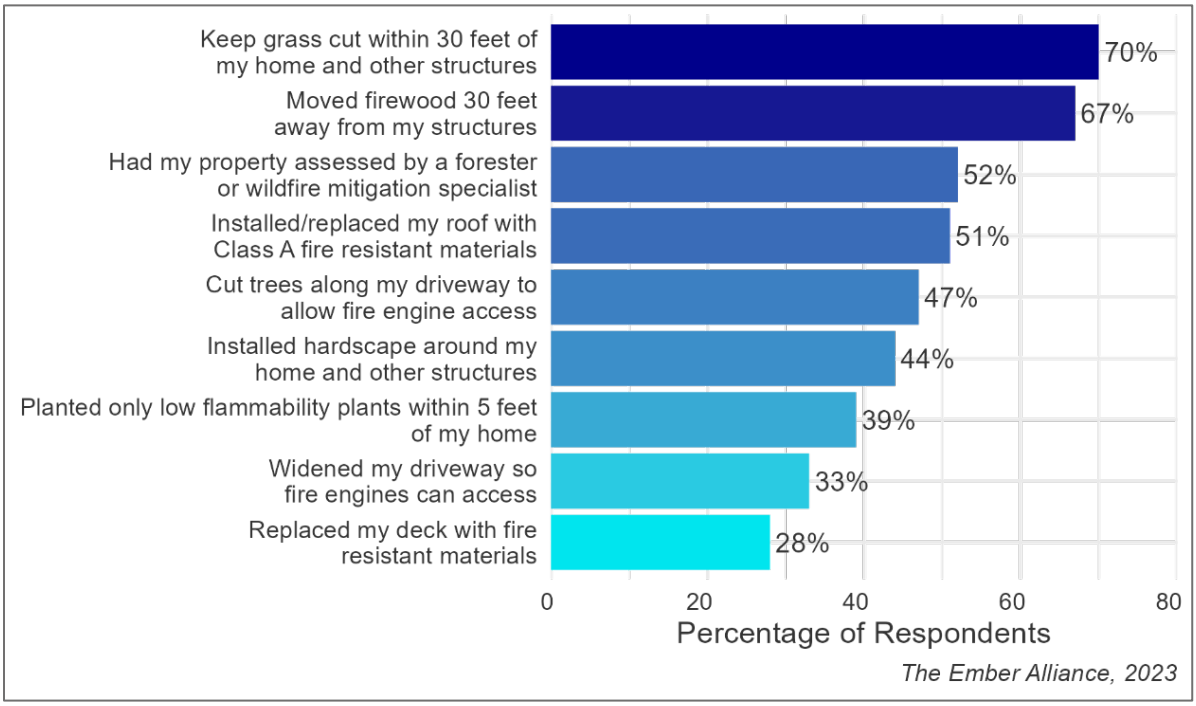


Figure 3.a.1. *Percentage of CCCFPD residents who responded to the CWPP survey and have completed different actions to mitigate risk in their home ignition zone. See* ***Appendix C*** *for a full summary of survey findings.*

County WUI Code Regulations as of March 2024

County:	Jefferson	Boulder	Gilpin
Applies to all CCCFPD residents in this county	X	X	X
Roof, siding, and construction materials requirements	X	X	
Deck requirements	X	X	
Fencing requirements		X	
Home Ignition Zone 1 requirements	X	X	X
Home Ignition Zone 2 requirements		X	X
Reference	Appendix Z Section 39	Wildfire Code	Zoning Section 4.13

Figure 3.a.2*. County WUI Code Regulations, as of the signing of this CWPP in March 2024. Relevant Jefferson County requirements can be found in County Code Appendix Z and Section 39. Boulder County requirements can be found in Building Code Section R327. Gilpin County requirements can be found in Zoning Section 4.13. These are subject to change in the years following this CWPP; please contact your county for the most current codes.*

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 direct flame contact, and reduce the chance that embers will ignite material on or near your home (Hakes et al., 2017). Substantially reducing vegetation within the HIZ 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 three zones around a home or other structure, 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 100 feet from the home (**Figure 3.a.3**).

Do not count on firefighters staying to defend your home—your home should be able to stand strong on its own during a wildfire. There are never enough firefighters to stay and defend every single home during large incidents. Properties that are not defensible will often not receive firefighter resources due to unsafe conditions and the higher likelihood of home loss regardless of firefighter intervention.

Property owners should establish defensible space around each building on their property, including campers / RVs, detached garages, storage buildings, barns, and other structures. RVs are highly flammable and can emit embers that might ignite nearby homes and vegetation. Removing all vegetation under and around campers in zone 1 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).

A 2021 study from the University of Colorado-Boulder showed that homeowners living in the WUI in Bailey, CO typically underestimated the level of risk their home is at due to wildfire, and tended to overestimate the amount of work they have done to protect their property (Simpkins, 2021). Make sure you are informed about best practices for protecting your home. See **Table 3.a.1** and the CSFS publication The home ignition zone for recommendations. **Section 3.c** includes specific defensible space recommendations by forest type for zone 3.

Grasses, shrubs, and wildflowers quickly respond to increased light availability after tree removal, resulting in beautiful ecosystems with lower fire risk and more high-quality wildlife habitat. The yellow star in each photo indicates the same tree. Photo credit: Jefferson Conservation District.

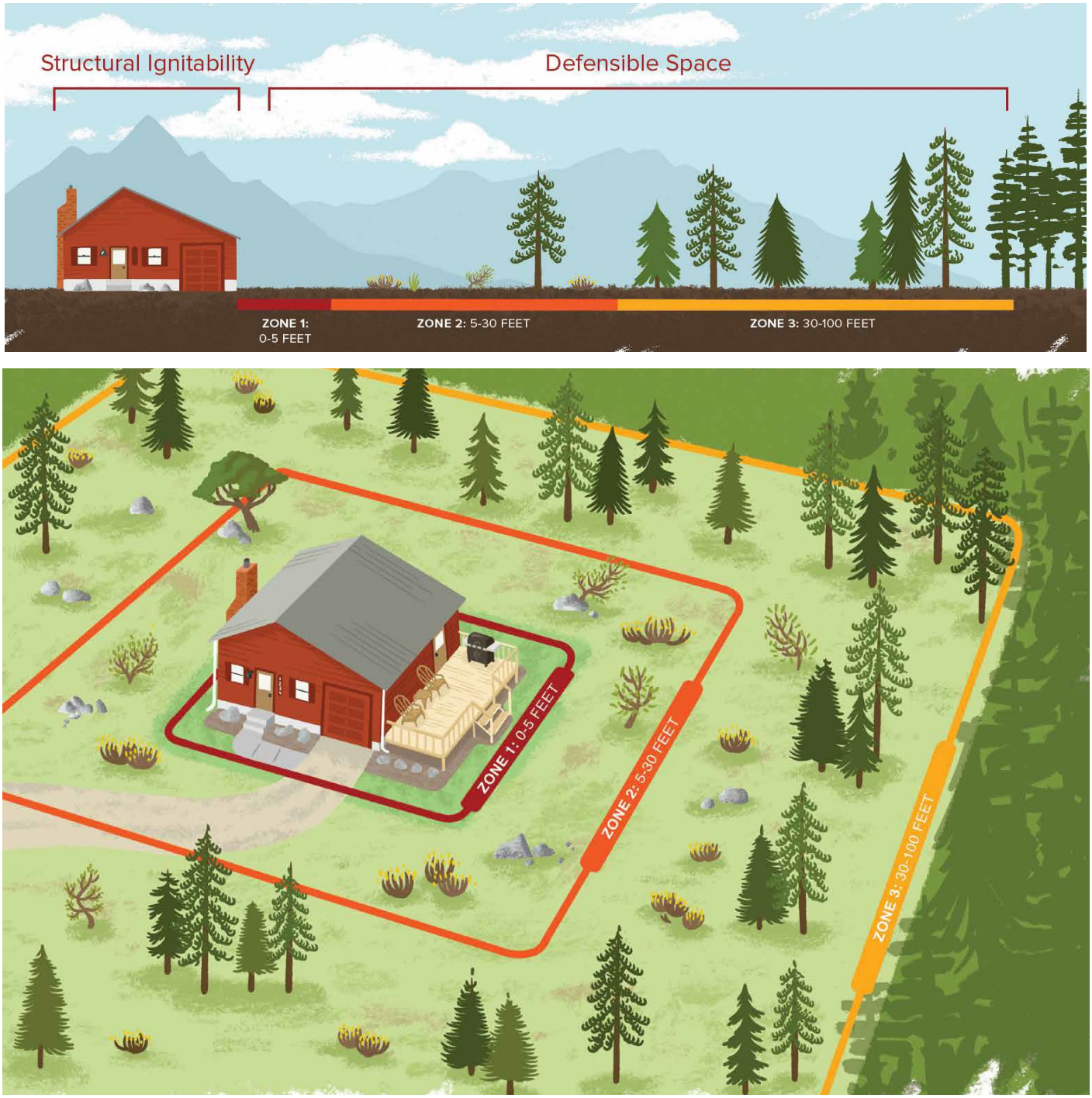


Figure 3.a.3. *Home ignition zones recommended by the Colorado State Forest Service. Using ignition-resistant building materials and removing burnable fuel around primary structures, outbuildings such as sheds, and campers / RVs is crucial for increasing your home's chance of standing strong during a wildfire and creating safe conditions for wildland firefighters. Source: Colorado State Forest Service 2021, The home ignition zone.*

Table 3.a.1. *Home ignition zone recommendations based on the CSFS publication The home ignition zone. Specific measures will depend on the placement and condition of your property.* ***Section 3.c*** *includes specific recommendations for zone 3 by forest type.*

Zone 1: 0 to 5 feet from your home – the noncombustible zone.
Goal: Prevent flames from coming into direct contact with your home.
• Create a noncombustible border 5 feet around your home. Remove all vegetation and replace flammable wood chips or mulch with alternatives like dirt, stone, flagstone, concrete, or gravel. Research shows that the worst materials to use in zone 1 are shredded rubber, pine needles, and shredded western red cedar due to their high flammability (Quarles and Smith, 2011). • Remove branches that hang over your roof and drop needles onto your roof. • Remove all fuels within 10 feet of the chimney. • 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. • Annually remove dead or dry leaves, pine needles, and dead plants within 5 feet of your home and off your deck, roof, and gutters. Raking material farther than 5 feet from structures will not significantly reduce the likelihood of ignition. • Move firewood or other combustible materials to zone 3. • 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 low-flammability plants that are more drought tolerant and less flammable. • Remove any accumulated surface fuels such as logs, branches, slash, and mulch. • 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, like short-statures, deciduous leaves, and higher moisture content. See low-flammability plants from Colorado State University Cooperative Extension for suggestions. • Remove enough coniferous 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 (**Table 3.a.2**). See **Figure 3.a.**4 for how to measure crown spacing. • Favor the retention of aspen trees because this species naturally has high fuel moisture, no low branches, smooth bark, and lower content of resin and other volatile compounds, making them less likely to ignite than conifer trees. Remove only downed or standing dead aspen trees. • Remove ladder fuels under remaining trees. This is any vegetation that can bring fire from the ground up into taller fuels. Keep shrubs at least 10 feet* away from the edge of tree branches. • Remove limbs so branches do not hang below 6 feet above the ground, ideally not below 10 feet above the ground. See **Figure 3.a.3** for a depiction of how to measure limb height. • Keep spacing between shrubs at least 2-3 times their height. • Relocate wood piles and propane tanks to zone 3. • Remove stressed, diseased, dead, or dying trees and shrubs. This reduces the amount of vegetation available to burn and improves forest health.

Zone 3: 30 to 100 feet from your home
If you live on a slope, zone 3 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.
- Follow guidance in **Section 4.c Recommendations by Vegetation Type** to determine the best management practices for the trees and shrubs in your zone 3. This usually involves reducing the number and density of trees and/or altering their arrangement.
- Favor the retention of aspen trees because this species naturally has high fuel moisture, no low branches, smooth bark, and lower content of resin and other volatile compounds, making them less likely to ignite than conifer trees. Remove only downed aspen trees.
- Remove limbs so branches do not hang below 6 feet above the ground, ideally not below 10 feet above the ground. See **Figure 3.a.**4 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.
- 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. Follow principles of ecological restoration as outlined in **Section 4.a**

*Spacing recommendations are a general guideline and should be adjusted based on forest type and increased for properties on steeper slopes. Reach out to CSFS, Boulder County Wildfire Partners, BVLCD, JCD, or other forestry professionals to develop a plan for mitigating wildfire risk on your property.

Aspen trees naturally have high fuel moisture, no low branches, and smooth bark, making them less likely to ignite than conifer trees. Retaining small groups of aspen trees is acceptable in zone 2—just remember to rake up dry leaves that fall onto your roof or on the ground within 5 feet of your home. Photo credit: Fire Adapted Colorado.

Table 3.a.2. *Minimum recommended spacing between tree crowns and shrubs is greater for properties on steeper slopes due to the exacerbating impact of slope on fire behavior (Dennis, 2003). See* ***Home Ignition Zone 3 Recommendations by Vegetation Type*** *for alternative recommendations for lodgepole pine.*

Percent slope	Minimum spacing between tree crowns	Minimum spacing between shrubs / small clumps of shrubs
0 to 10 %	10 feet	2.5 x shrub height
11 to 20%	15 feet	3 x shrub height
21 to 40%	20 feet	4 x shrub height
>40%	30 feet	6 x shrub height

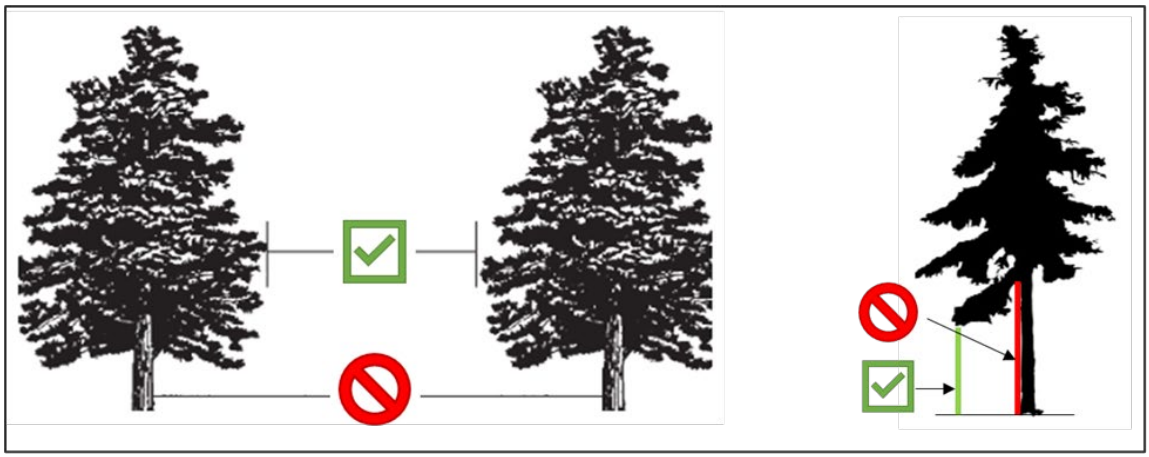


Figure 3.a.4. *Spacing between tree crowns is measured from the edge of tree crown to tree crown, NOT from tree stem to tree stem (left). Height of limbs above the ground is measured from the ground to the lowest point of the limb, NOT from where the limb attaches to the tree (right).*

Some homeowners in the WUI are concerned that removing trees will destroy the forest and reduce the aesthetic and monetary value of their property. In fact, many dense ponderosa pine forests are unhealthy and greatly diverged from historical conditions that were maintained by frequent wildfires (**Figure 2.e.1**). The reality is that nothing will decrease the aesthetic and monetary value of your home as much as a high-severity wildfire burning all the vegetation in the community, even if your home survives the fire. Forest management can look messy and destructive in the first years following treatment; however, grasses, shrubs, and wildflowers will respond to increased light availability after tree removal and create beautiful ecosystems with lower fire risk. It might even be said that the more trees you cut, the more trees you save from wildfire.

Many property owners enjoy their land even more after conducting effective fuel treatments. Removing trees can open incredible views of mountains, rivers, and rock formations, and wildlife are often attracted to forests with lower tree densities and a greater abundance of understory plants. Reducing fuel loads and increasing the spacing between trees increases the chance that your home and your neighbors' homes will stand strong during a wildfire, and most importantly, it increases the safety of wildland firefighters working to protect your community**.**

Linked Defensible Space

The home ignition zone of individual homes can overlap that of their neighbors, so wildfire hazards on one property can threaten adjacent properties. Structures that are on fire can emit significant radiant heat and embers and endanger homes and structures near them**.** Most homes in CCCFPD (82%) could be exposed to short-range ember cast from at least one neighboring home (**Figure 3.a.5**).

Neighbors can increase their homes' chances of survival during a wildfire if they work together to create linked defensible space. Linked defensible space also creates safer conditions and better tactical opportunities for wildland firefighters. According to James White, the Rocky Mountain Region Cooperative Fire Specialist, "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). Defensible space projects that span ownership boundaries are better candidates for grant funding due to their impact and strategic value.

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

- ✓ 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.
- ✓ Volunteer with Blue Mountain Forest Stewardship Initiative, Saws and Slaws, Crescent Park Community Fire Protection Association, or other neighborhood mitigation groups to help educate your community about the benefits of defensible space and home hardening. Work with these organizations to host a mitigation event in your neighborhood. If you don't live in a neighborhood with a fire mitigation group, start a group in your neighborhood. Seek guidance from the CWPP Community Outreach Team.
- ✓ Help organize walking tours in your neighborhood to visit the property of residents with exemplary defensible space. Witnessing the type of work that can be done, and seeing that a mitigated property can still be aesthetically pleasing, can encourage others to follow suit.
- ✓ Apply for grants that support fuels mitigation for multi-homeowner projects (see **Section 3.e. Funding Opportunities**).

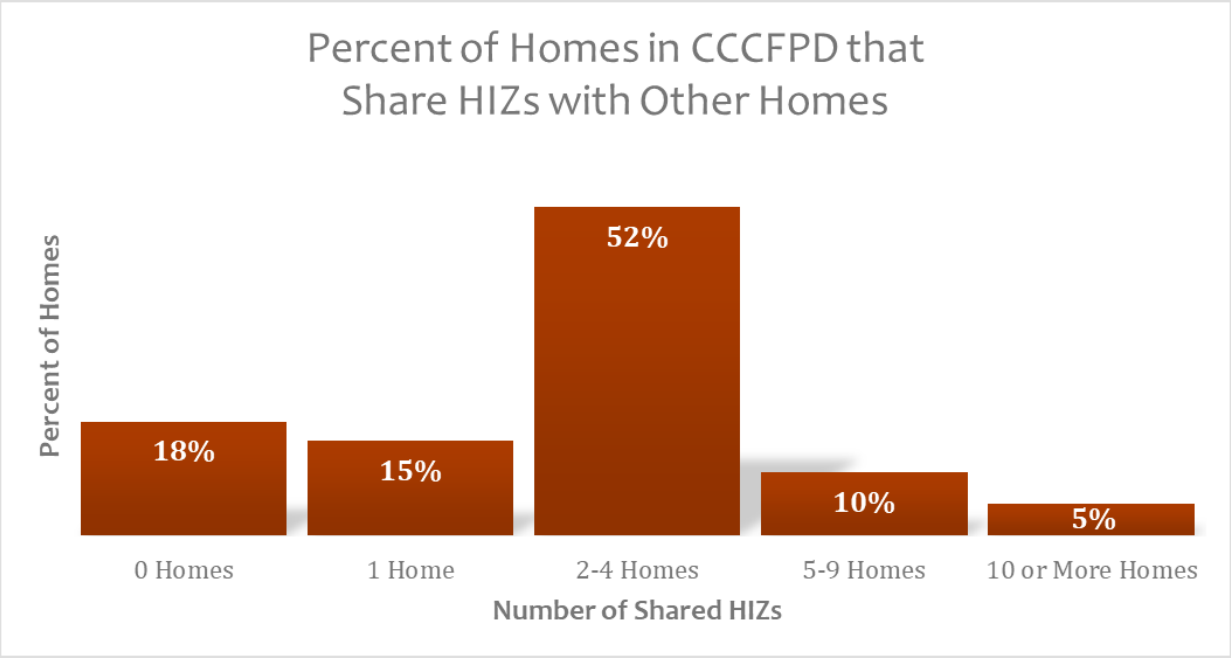


Figure 3.a.5. *82% of structures within CCCFPD have overlapping HIZs with at least one other structure, opening them up to higher risk of short-range embers from other structures. On average, residents should expect to work with 2-4 neighbors to mitigate shared home ignition zones. Source: The Ember Alliance.*

Mosaic Landscapes

Varied fuel types are known to slow the spread of fire, and heterogeneous landscapes (landscapes with multiple fuel types and trees of different sizes and ages) are more typical of historical forest conditions (Duncan et al., 2015). Creating a mosaic landscape in neighborhoods can help slow fire spread by changing the fuel types as it moves across a hill or valley. A mosaic landscape can be created in many ways. For example, a neighborhood could have a stand of old growth conifer trees next to acres of aspen stands, and young regenerating lodgepole pine from a patch cut next to a large grassy meadow that is regularly cleared of trees. This can be arranged in many ways for aesthetic and tactical purposes and will resemble a patchwork quilt or mosaic art (**Figure 3.a.6**).

Neighborhoods that lie on hills of continuous wet mixed conifer or lodgepole pine should consider creating mosaic landscapes in these areas. The homes in each patch still need adequate defensible space, but this would create a more diverse landscape where fire may move slower as it transitions between forest types and unforested locations like shrublands or meadows. Slower fire movement means firefighters have time to defend more homes in the neighborhood. It also creates a diversity of biomes that both residents and wildlife enjoy. Work with both forestry professionals and wildlife professionals to ensure that forestry work still provides the resources and habitat for the wildlife that live there.

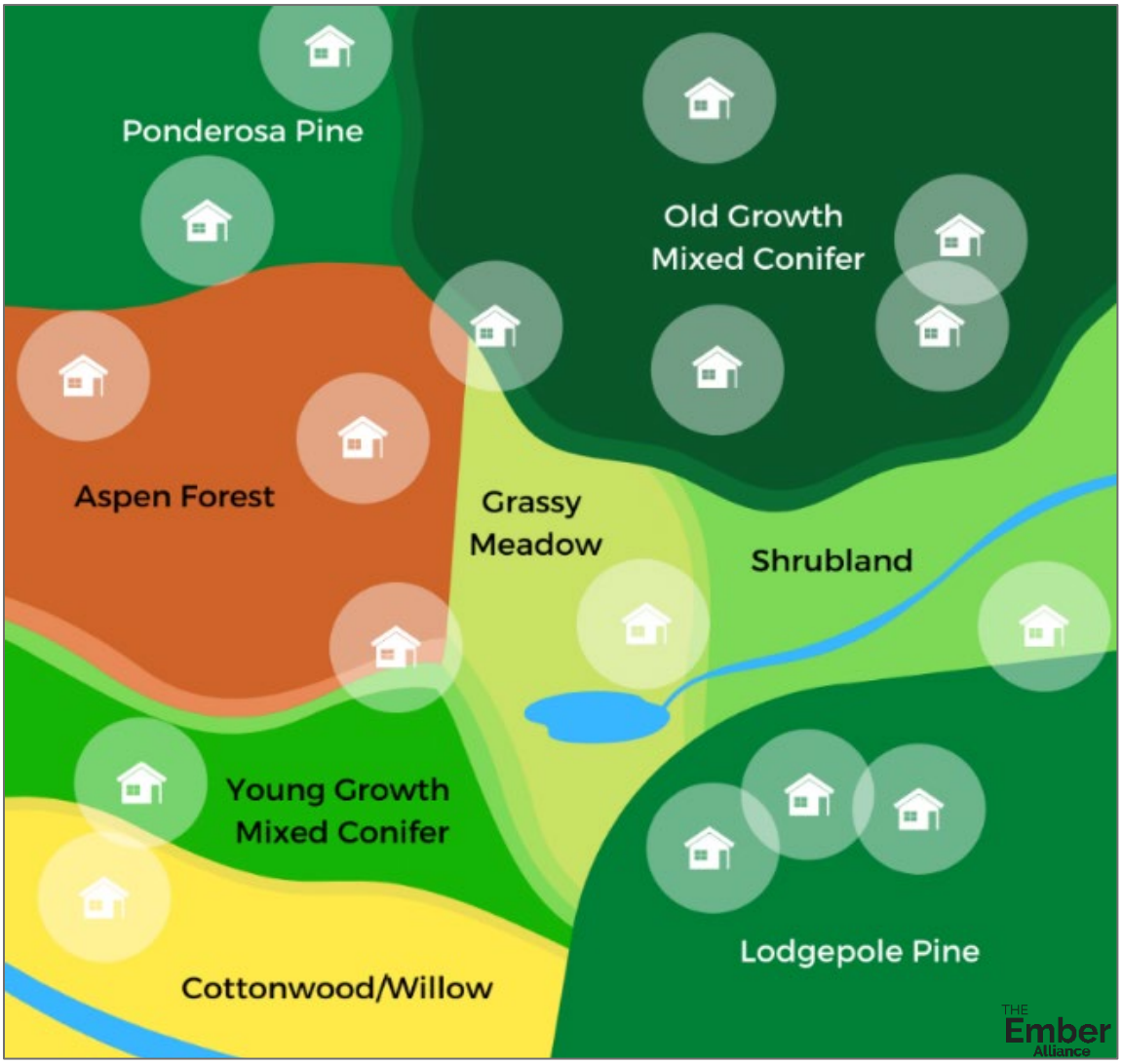
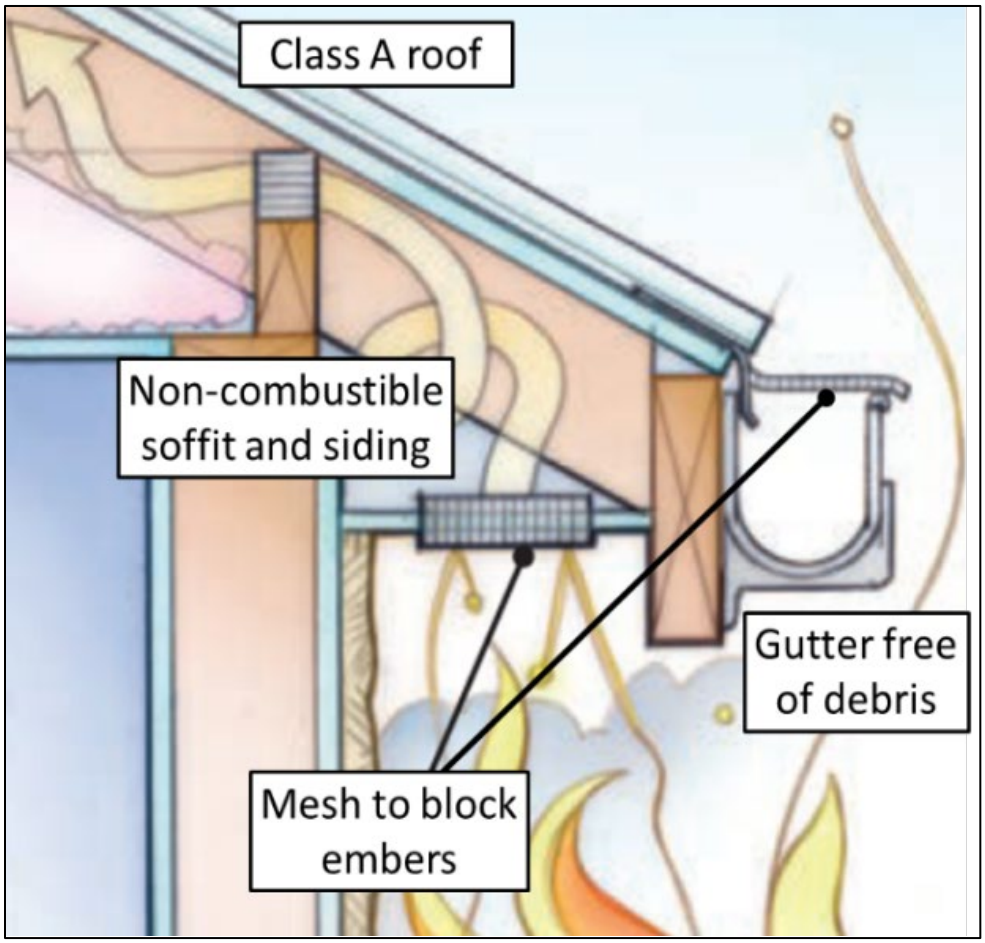


Figure 3.a.6. *Example of a mosaic landscape in a neighborhood. Each home has defensible space around it, and the landscape is varied throughout, providing tactical opportunities for firefighters working to defend homes. Source: The Ember Alliance.*

Home Hardening

Buildings cannot be made fireproof, but the chance of your home standing strong during wildfires increases when you reduce the ignitability of your home through home hardening and the creation and maintenance of defensible space. Research from the Insurance Institute for Business & Home Safety (IBHS) clearly illustrates the benefits of home hardening for reducing the chance of home ignition from embers (watch a video of the research here). During the Marshall Fire, embers were responsible for 70% of recorded structure damage – the other 30% were damaged from direct flame contact (Holstrom et al., 2023). Home hardening is the only defense against embers. Material used to build homes tends to produce larger and more abundant embers that can travel farther distances than embers from burning grasses, shrubs, and trees (Zhou et al., 2019).

Almost all homes in CCCFPD (99%) are at risk of long-range embers, and 62% are at risk of radiant heat from burning vegetation under severe fire weather conditions (**Figure 2.f.8**). Fire models cannot predict ember production and radiant heat produced from burning structures, but the areas in CCCFPD with a high density of structures, such as Wondervu, have elevated risk for home-to-home ignition from radiant heat and embers. Reducing the ability of embers to penetrate and ignite your home is recommended for everyone in CCCFPD.



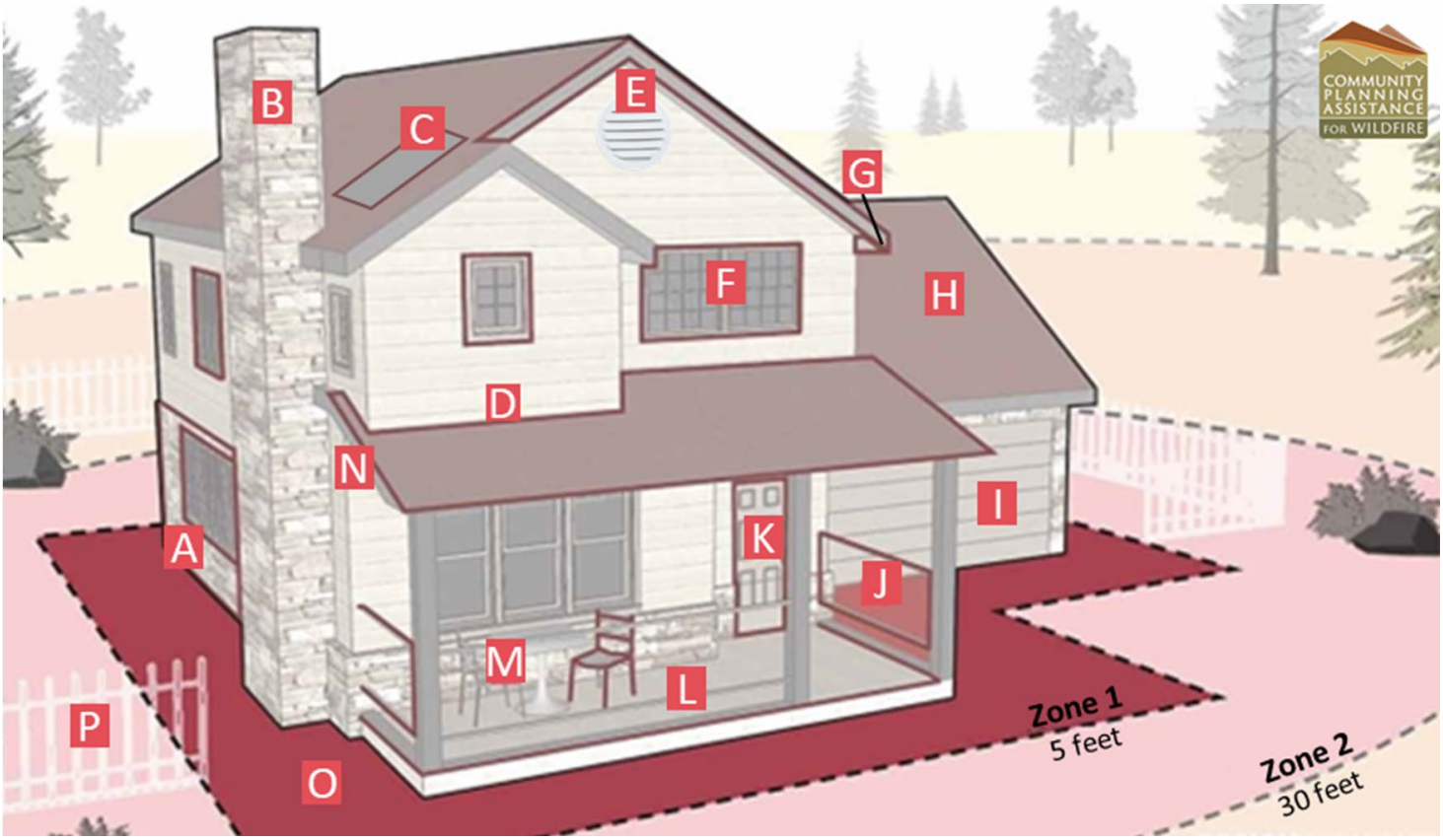
Residents can increase their homes' chance of survival by making it harder for embers to enter and ignite their homes (image from Healthy Building Science).

Roofs, siding, decks, windows, vents, and gutters are particularly vulnerable to embers from wildfire, and actions that prevent embers from penetrating your home can offer additional benefits such as reduced maintenance costs, greater durability, and increased energy efficiency:

- **Roofs** should be rated Class A and made of noncombustible materials[1] such as some composites, metal, cement, or tile, which tend to be more durable against wind, snow, and hail as well as wildfire.
- **Siding and decking** should be made of ignition-resistant or noncombustible materials, which is particularly effective when homes also have a 5-foot noncombustible border of dirt, stone, or gravel around them. Non-wood siding and decking, such as stucco, brick, metal, and some composites, are often more durable and require less routine maintenance than traditional wood.
- **Multi-pane windows** have greater resistance to radiant heat and provide better insulation and energy efficiency to your home. Windows often fail before a home ignites, providing a direct path for flames and airborne embers to enter a home (CSFS, 2021).
- **Enclosed eaves and vent screens** reduce the penetration of wind-born embers into structures, and can deter pests and critters from nesting in your home's vents and eves (Hakes et al., 2017; Syphard and Keeley, 2019).
- **Fences and gates** should be made of noncombustible materials within at least 8 feet from the home (and at least 20 feet away from a home or structure for double combustible fences). Fences can serve as pathways for wildfire to travel between vegetation and structures and from structure to structure (Maranghides et al., 2022). Wooden fences attached to homes served as one of the leading causes of home loss during the Marshall Fire (Holstrom et al., 2023). Ignition-resistant and noncombustible fences are more durable and require less maintenance than wood fences, and are recommended within 8 feet from the home, or beyond when possible.

There are many low-cost actions you can start with to harden your home (**Figure 3.a.7**). Keep home-hardening practices in mind and use ignition-resistant materials if you replace a hail-damaged roof or remodel your home. Also, remember that many home hardening practices are required by Jefferson, Boulder, and Gilpin Counties for new buildings and certain remodels (**Figure 3.a.2**).

[1] See the **Glossary** for the definition of terms used the describe the performance of building materials when exposed to fire (e.g., wildfire-resistant, ignition-resistant, and noncombustible).



Low-cost actions:

B. Cover chimneys and stovepipe outlets with 3/8th to ½ inch corrosion-resistant metal mesh.

C. Minimize debris accumulation under and next to solar panels.

E. Cover vent openings with 1/16th to 1/8th inch corrosion-resistant metal mesh. Install dryer vents with metal flappers and keep clean and closed unless in use.

G. Clear debris from roof and gutters regularly.

I. Install metal flashing around and under garage doors that goes up at least 6 inches inside and outside the door.

J. Use noncombustible lattice, trellis, or other decorative features.

K. Install weather stripping around and under doors.

L. Remove combustible materials from underneath, above, and within 5 feet of deck.

M. Use noncombustible patio furniture.

N. Cover all eaves with screened vents.

O. Establish and maintain a 5-foot noncombustible buffer around the home.

Actions to plan and save for:

A. 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.

C. Use multipaned glass for skylights, not materials that can melt (e.g., plexiglass), and use metal flashing.

D. Install a 6-inch vertical noncombustible surface on all gables above roofs.

F. Install multi-pane windows with at least one tempered-glass pane and metal mesh screens. Use noncombustible materials for window frames.

G. Install noncombustible gutters, gutter covers, and downspouts.

H. Install ignition-resistant or noncombustible roofs (composite, metal, or tile).

I. Install 1-hour fire rated garage doors.

K. Install 1-hour fire rated front and back doors.

L. Use ignition-resistant or noncombustible decking. Enclose crawl spaces.

N. Use noncombustible eaves and soffits.

P. Replace wooden fences with noncombustible materials and keep at least 8 feet away from the home (at least 20 feet away for double combustible fences).

Figure 3.a.7. *A home can never be made fireproof, but home hardening practices decrease the chance that flames, radiant heat, and embers will ignite your home. Infographic by Community Planning Assistance for Wildfire with modifications from The Ember Alliance to include information from CALFIRE 2019 and Maranghides et al. 2022.*

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. During a wildland fire, homes that have clear defensible space are identified as sites for wildland firefighters to engage in structure protection, and homes that are not safely defensible will not usually receive firefighter resources. Suggestions below come from the home ignition zone checklists from the CSFS:

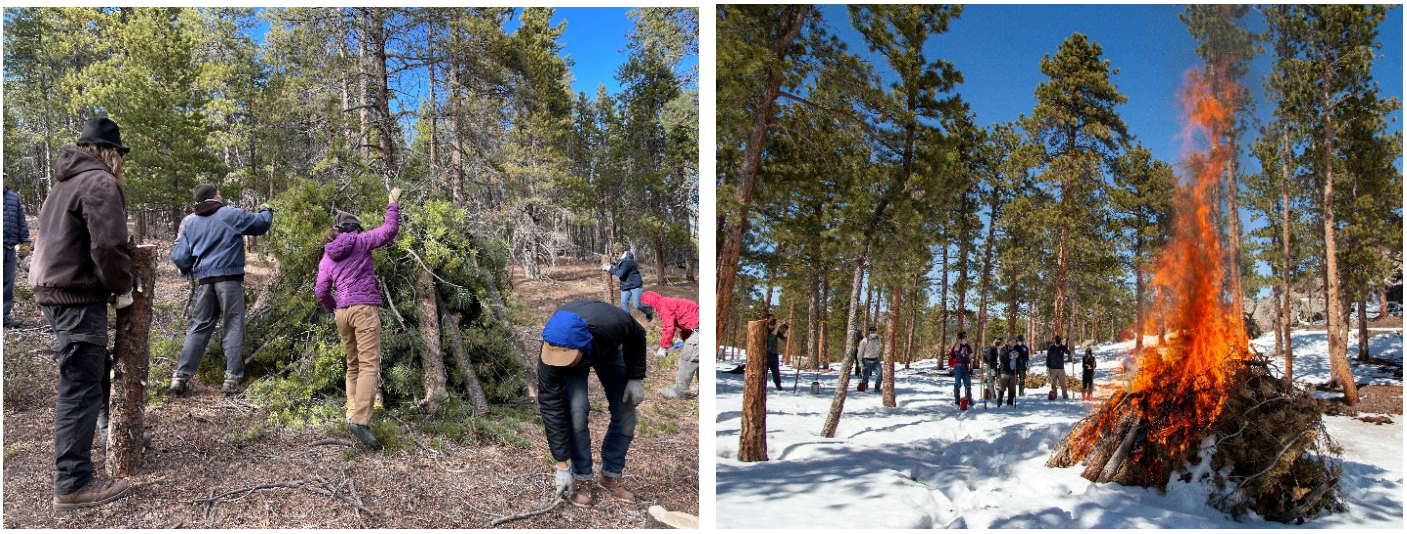
- Clear roof, deck and gutters of pine needles and other debris.
- Rake and remove all pine needles and other flammable debris HIZ 1.
- Remove all flammable debris under your deck or porch.
- Mow grass and weeds in HIZ 2 to a height of 4 inches or less.
- Remove branches that hang over the roof and chimney.
- Remove branches infringing upon driveways.
- Dispose of slash from thinning trees and shrubs by chipping, hauling to a disposal site or piling in open areas for burning later. Any accumulation of slash that's chipped or otherwise should be isolated 30 feet or more from the home (see slash management recommendations below).
- Remove flammable vegetation within 10 feet of woodpiles, propane tanks, and gas meters.
- Post signs at the end of the driveway with your house number that are noncombustible, reflective and easily visible to emergency responders.
- Verify that your home telephone number, cell phone, and/or email are properly registered through emergency alert systems for Gilpin, Boulder, and Jefferson Counties.
- Review the contents of your "go-bag" and make sure it is packed and ready to go. Your go-bag should include supplies to last at least three days, including 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.
- If you have an outdoor water supply that is available to responding firefighters, make sure it is clearly marked. Put a hose and nozzle in a visible location. The hose should be long enough to reach all parts of your home. DO NOT leave sprinklers on in the case of evacuation as this can cause issues with water pressure for firefighters defending your neighborhood.

Pile Burn Cooperatives

Building and burning slash piles is an effective way to remove slash from zone 3, and thus, reduce wildfire risk to your home. Pile Burn Cooperatives (PBCs) are groups of neighbors that get together to help each other burn slash piles, with support from their local fire authority and local organizations. Pile burning is an appropriate method for slash management in the areas of CCCFPD where homes are not densely packed together. Homes should have at least 100 feet of mitigation surrounding them for pile burning to be done safely. We recommend that residents in all plan units[2] form PBCs with support from CCCFPD, The Ember Alliance, and Boulder Watershed Collective to safely and effectively burn slash piles to mitigate wildfire risk. The Colorado Division of Fire Prevention and Control offers a pile burn certification program to landowners who are interested in learning how to safely and effectively burn piles on their property. This is highly recommended for residents who are interested in burning their own slash piles and working with their neighbors to form PBC.

[2] See **Section 3.b** for a map and description of plan units.

The Ember Alliance hosts pile build and burn workshops to assist communities who are interested in forming PBCs. In November of 2021, the organization hosted a pile build workshop at a private property in the Copperdale plan unit with support from Boulder Watershed Collective. Visit The Ember Alliance's website to learn more about PBCs in Colorado.



A pile build workshop that The Ember Alliance hosted in Coal Creek Canyon in the Copperdale Plan Unit (left) and a pile burn workshop near Red Feather Lakes, Larimer County (right). Photo credit: The Ember Alliance (left), Evan Barrientos Photography (right).

Mitigation Barriers and Opportunities

Homeowners and residents in the WUI share concerns about mitigating risk and maintaining safer conditions in their home ignition zone. Top challenges cited in CCCFPD include the financial cost of mitigation work (40% of respondents), lack of knowledge about mitigation (23%) and physical inability to complete the work (22%) (**Figure 3.a.8**).

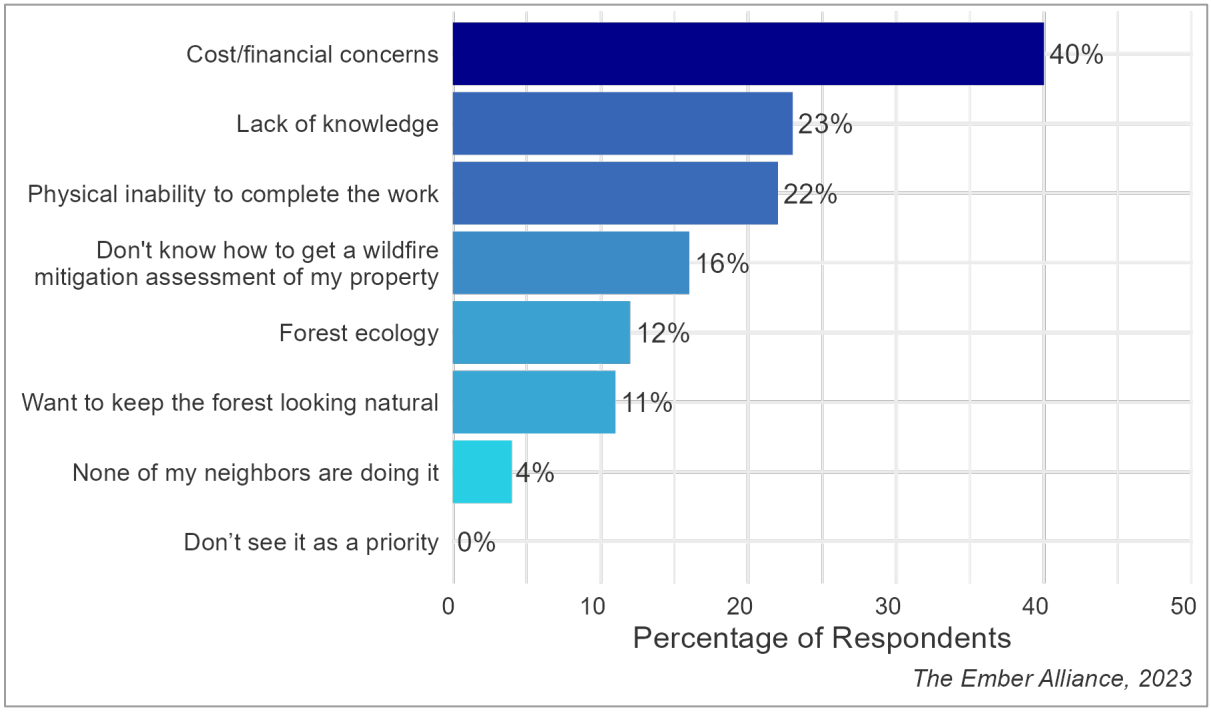


Figure 3.a.8. *Percentage of CCCFPD residents who responded to the 2023 CWPP survey and their barriers to completing further wildfire mitigation on their home/land. See* ***Appendix C*** *for a full summary of survey findings.*

Concern: I don't have the resources to invest in defensible space.

Creating adequate defensible space can take years and a significant financial investment. Fortunately, there are effective, low-cost measures that residents can start with:

- ✓ Annually remove leaves, needles, and other vegetation from roofs, gutters, decks, and around the base of homes.
- ✓ Use hand tools like a pole saw to remove tree branches that hang less than 10 feet above the ground.
- ✓ Remove combustible materials (dry vegetation, wooden picnic tables, juniper shrubs, etc.) from underneath, on top of, or within 5 feet of decks.
- ✓ Remove vegetation and combustible materials within 5 feet of windows and doors.
- ✓ Replace wood mulch within 5 feet of all structures with dirt, stone, or gravel.
- ✓ Remove downed logs and branches within 30 feet of all structures.
- ✓ Participate in community chipping days or slash drop off dates organized by Jefferson County. Drop off material for free at one of two community forestry sort yards in Boulder County. Options for slash disposal are more limited in Gilpin County—see their website for information on materials that are accepted at the transfer site. Advocate for additional sort yards or extended sort yard hours.
- ✓ Apply for cost-sharing grants with your neighbors to subsidize the creation of defensible space (see **Section 3.f** for potential funding sources).
- ✓ Research tax credits that will offset the costs or the work you want to do from the Colorado Department of Revenue.
- ✓ Residents in Boulder County can apply for financial incentives as part of the new Wildfire Mitigation Sales Tax Program, which should be available in 2024.

Concern: I don't have the resources to invest in home hardening.

Retrofitting an existing home to be ignition-resistant can be expensive, particularly actions like replacing flammable roofs and siding. Some of these costs can be divided and prioritized into smaller projects. If you are building a new home, the cost of using ignition-resistant materials is roughly the same as using traditional building materials (Quarles and Pohl, 2018). Ignition-resistant features often come with additional benefits, such as greater durability and reduced maintenance. Jefferson, Boulder, and Gilpin County have building requirements in the WUI that must be complied with for new homes or certain remodels (**Figure 3.a.2**). Residents in Boulder County can apply for financial incentives through the Wildfire Partners Program.

The following are effective, low-cost measures from CAL FIRE's 2024 Low Cost Retrofit List:

- ✓ Install noncombustible metal gutter covers.
- ✓ Cover vent openings with 1/16th to 1/8th inch corrosion-resistant metal mesh.
- ✓ Cover chimney and stovepipe outlets with 3/8th to ½ inch corrosion-resistant metal mesh to prevent embers from escaping and igniting a fire.
- ✓ Caulk and plug gaps greater than 1/16th inch in siding or around exposed rafters.
- ✓ Install weather stripping around and under garage doors to reduce gaps to less than 1/16th inch.
- ✓ Remove combustible materials from underneath, on top of, and within 5 feet of a deck.
- ✓ Replace wood mulch within 5 feet of all structures with noncombustible products like dirt, stone, or gravel.
- ✓ Store all combustible and flammable liquids away from potential ignition sources.
- ✓ Keep a fire extinguisher and tools such as a shovel, rake, bucket, and hose available in your garage for fire emergencies.

Concern: I don't know where to start with creating defensible space.

- ✓ Review **Table 3.a.1** and the CSFS home ignition zone Guide for mitigation recommendations.
- ✓ Residents in Boulder County can reach out to Wildfire Partners to schedule a home assessment.
- ✓ Talk to neighbors who have taken steps to mitigate fire risk on their property.
- ✓ Reach out to the Colorado State Forest Service, Boulder County Wildfire Partners, Boulder Valley and Longmont Conservation Districts, or Jefferson Conservation District to learn about defensible space and home hardening tactics from their qualified specialists.

Concern: I am afraid that removing trees will destroy the forest and reduce the aesthetic and monetary value of my property.

The reality is that nothing will decrease the value of your home as much as a high-severity wildfire burning all the vegetation in the community, even if your home survives the fire. Some ideas to help reconcile different values you hold for your property are to:

- ✓ Drive around the community and look for homes that have followed the guidelines in **Figure 3.a.3** and **Table 3.a.1**. Some properties in CCCFPD have exemplary defensible space and beautiful landscaping at the same time.
- ✓ Read about low-flammability plants from Colorado State University Cooperative Extension and Firescaping from Fire Safe Marin for suggestions on beautiful, fire-resistant landscaping. As an added benefit, fire-resistant landscaping is often more drought tolerant.
- ✓ Learn about the ecology of frequent-fire forests along the Colorado Front Range by reading *Back to the future: Building resilience in Colorado Front Range forests using research findings and a new guide for restoration of ponderosa and dry-mixed conifer landscapes* (Miller, 2018). 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 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.

Evacuation Preparedness

Evacuation can weigh heavily on the minds of residents in CCCFPD. The death of 86 people in Paradise, California during the 2018 Camp Fire, many of whom were stranded on roadways during evacuation, underscores the importance of evacuation preparedness and fuel mitigation along evacuation routes. Roads lined closely with dense, tall vegetation can create flame lengths and heat that are dangerous to evacuees. Roads that may be unpassable during a wildfire event are referred to as potentially non-survivable in this CWPP.

Evacuation preparedness is the responsibility of each resident in CCCFPD. The best way to get out quickly and safely during an evacuation is to be prepared. Unfortunately, only 62% of respondents to the CWPP survey have evacuation plans for their family and only 48% have go-bags at the ready. Visit the Rotary Wildfire Ready website to learn about go-bags and evacuation planning—simple and crucial actions that can save lives.

In addition to preparing a go-bag, have a family emergency plan **before** the threat of wildfire is in your area. Some residents have family members or neighbors with physical limitations who might struggle to evacuate in a timely manner. Develop specific emergency plans that address these unique needs and vulnerabilities. Parents should work with their neighbors to develop a plan for how to evacuate children that might be home alone.

Residents with livestock trailers should plan to leave during voluntary evacuation notices to allow time for their preparations and create more space on the roads for other residents during a mandatory evacuation. It is important to have a plan for where to take livestock to reduce some of the chaos and uncertainty created by wildfire evacuations. FEMA provides tips for protecting livestock during a disaster. In Jefferson County, Horse Evacuation Assistance Team (HEAT), provides large animal evacuation assistance response for wildland fires and natural disasters. The Jefferson County Animal Control Rescue team and Gilpin County Animal Response Team

works in conjunction with law enforcement, fire, emergency management and the Jefferson County Incident Management Team to safely and efficiently evacuate and shelter animals.

All residents in CCCFPD should sign up for local emergency notifications from Boulder, Gilpin, *and* Jefferson Counties to ensure timely and accurate information during emergencies. Information on emergency notifications was accurate and current as of the writing of the CCCFPD CWPP in early 2024. Understanding types of emergency alerts and terminology can help you be prepared and take appropriate action during emergencies. Each county uses its own terminology.

Boulder County	BOCO ALERT	**Click here to sign up for BOCO Alert via Everbridge** For more information, visit the Boulder County Disaster Management website on emergency notifications.
Gilpin County	hyper-reach the power of instant communication	**Click here to sign up for Hyper-Reach** For more information, visit the Gilpin County Sheriff's Office website on emergency notifications.
Jefferson Couty	Lookout Alert EMERGENCY NOTIFICATIONS	**Click here to sign up for Lookout Alert** For more information, visit the Jefferson County Sheriff's Office website on emergency notifications.

Emergency Notification Terminology: Boulder County Source: Boulder County Disaster Management		
Alert Severity	**Advisory**	Used to share information about an emergency situation that is likely to impact communities.
	Warning	Used to prepare you to take action or take immediate action if you need extra time to mobilize.
	Order	Used when you need to take immediate action due to an imminent life threat.
Alert Actions	***Climb to higher ground***	A directive to move to a location nearby that is higher than your current position.
	Evacuation	A directive to leave the area immediately.
	Shelter in place	A directive to remain indoors until the situation is resolved.

	Missing/endangered person	Information about a missing or endangered person is shared to increase community awareness.
	All clear	Follow-up information issued after officials have determined the hazard no longer presents a threat to the community.

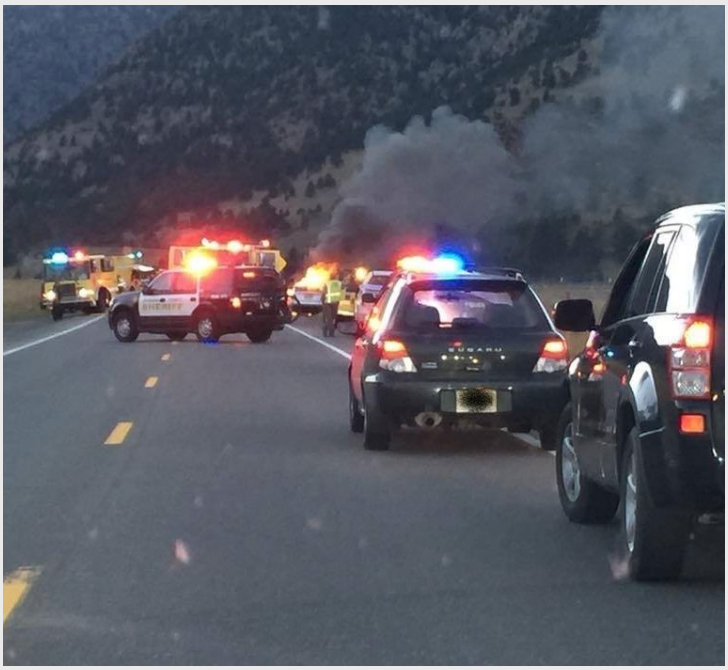
Emergency Notification Terminology: Gilpin County Source: Gilpin County Sheriff's Office	
Shelter in place	There is a hazard in your area, and you should remain or go indoors, not go outdoors, and not evacuate the area. This may be the safest strategy for hazardous materials, law enforcement, or other incidents wherein an evacuation could actually increase the danger to you.
Evacuation orders	
Pre-evacuation	There is a hazard in your area that may require you to evacuate in the near future. Everyone should be prepared to leave at a moment's notice. **If you feel you are in danger and want to leave, do so.** If you need additional time to evacuate, you should consider leaving now. If you need to arrange for transportation assistance, you should do so immediately. If you have livestock or other large animals, you should consider removing them from the hazard area now.
Evacuation	There is a hazard in your area, and you have been ordered to evacuate immediately. If you need assistance evacuating yourself or need help evacuating animals, call 911. You will be provided the safest escape routes known, so make sure you follow the instructions as other routes may be closed or unpassable. You will also be told where an evacuation point has been established to provide information and a safe place if you have nowhere else to go. **Do not delay – evacuation means you need to leave immediately!**

Emergency Notification Terminology: Jefferson County Source: Jefferson County Sheriff's Office	
Advisory messages	Advisories provide information but do not require any action on your part.
Instruction messages	Instruction messages provide information AND require you to take some action to be safe. There are three types of standard instructions: shelter in place, pre-evacuation, and evacuation.
Shelter in place	There is a hazard in your area, and you should remain or go indoors, not go outdoors, and not evacuate the area. This may be the safest strategy for hazardous materials, law enforcement, or other incidents wherein an evacuation could actually increase the danger to you.
Pre-evacuation	There is a hazard in your area that may require you to evacuate in the near future. Everyone should be prepared to leave at a moment's notice. **If you feel you are in danger and want to leave, do so.** If you need additional

	time to evacuate, you should consider leaving now. If you need to arrange for transportation assistance, you should do so immediately. If you have livestock or other large animals, you should consider removing them from the hazard area now.
Evacuation	There is a hazard in your area, and you have been ordered to evacuate immediately. If you need assistance evacuating yourself or need help evacuating animals, call 911. You will be provided the safest escape routes known, so make sure you follow the instructions as other routes may be closed or unpassable. You will also be told where an evacuation point has been established to provide information and a safe place if you have nowhere else to go. **Do not delay – evacuation means you need to leave immediately!**

Follow evacuation etiquette to increase the chance of everyone exiting CCCFPD in a safe and timely manner during a wildfire or other emergency:

- ✓ Register for emergency notifications in Boulder, Gilpin, and Jefferson Counties.
- ✓ Leave as quickly as possible after receiving an evacuation notice.
- ✓ Have a go-bag packed and ready during the wildfire season, especially on days with Red Flag Warnings.
- ✓ Leave with as few vehicles as possible 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.



Residents in CCCFPD have experienced both mandatory and voluntary evacuations. Photo above shows a roadblock in Loveland during evacuations in 2020. Photo credit: Jenny Sparks / Loveland Reporter-Herald.

Accessibility and Navigability for Firefighters

Address Signs

Installing reflective address numbers can save lives by making it easier for firefighters to find your home at night and under smokey conditions. Reflective signs are available from CCCFPD for $25, making it an easy and inexpensive action you can accomplish to protect firefighters and your family. Mount reflective address signs near your driveway on noncombustible posts, not on stumps, trees, wooden posts, or chains across driveways. Chains across driveways might be removed during wildfire suppression to permit access to your property. Make sure the numbers are clearly visible from both directions on the roadway. Ask your county to install reflective metal street signs where missing or damaged.

Many driveways within CCCFPD do not meet current access requirements and pose safety issues that are difficult to mitigate. Long, narrow, steep driveways lacking turnarounds, and dense trees on the sides of the road can create challenges for emergency response vehicles during wildfires. Photo credit: The Ember Alliance.

Driveways

It is important to ensure emergency responders can locate and access your home. Narrow driveways without turnarounds, tree limbs hanging over the driveway, and dead and down trees may make it unsafe for firefighters to defend your home during a wildfire event (Brown, 1994).

Some driveways and private roads in CCCFPD 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). Residents should remove trees and low-hanging limbs along driveways to facilitate firefighter access, as well as removing all dead trees that could fall across the driveway and block access.

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 and extending culverts to accommodate fire engines.

If you or your neighborhood has a private bridge, post the bridge weight limits. Not all firefighting equipment will cross unmarked bridges, so knowing and posting weight limits may help firefighters access and defend your home.

Private Water Resources

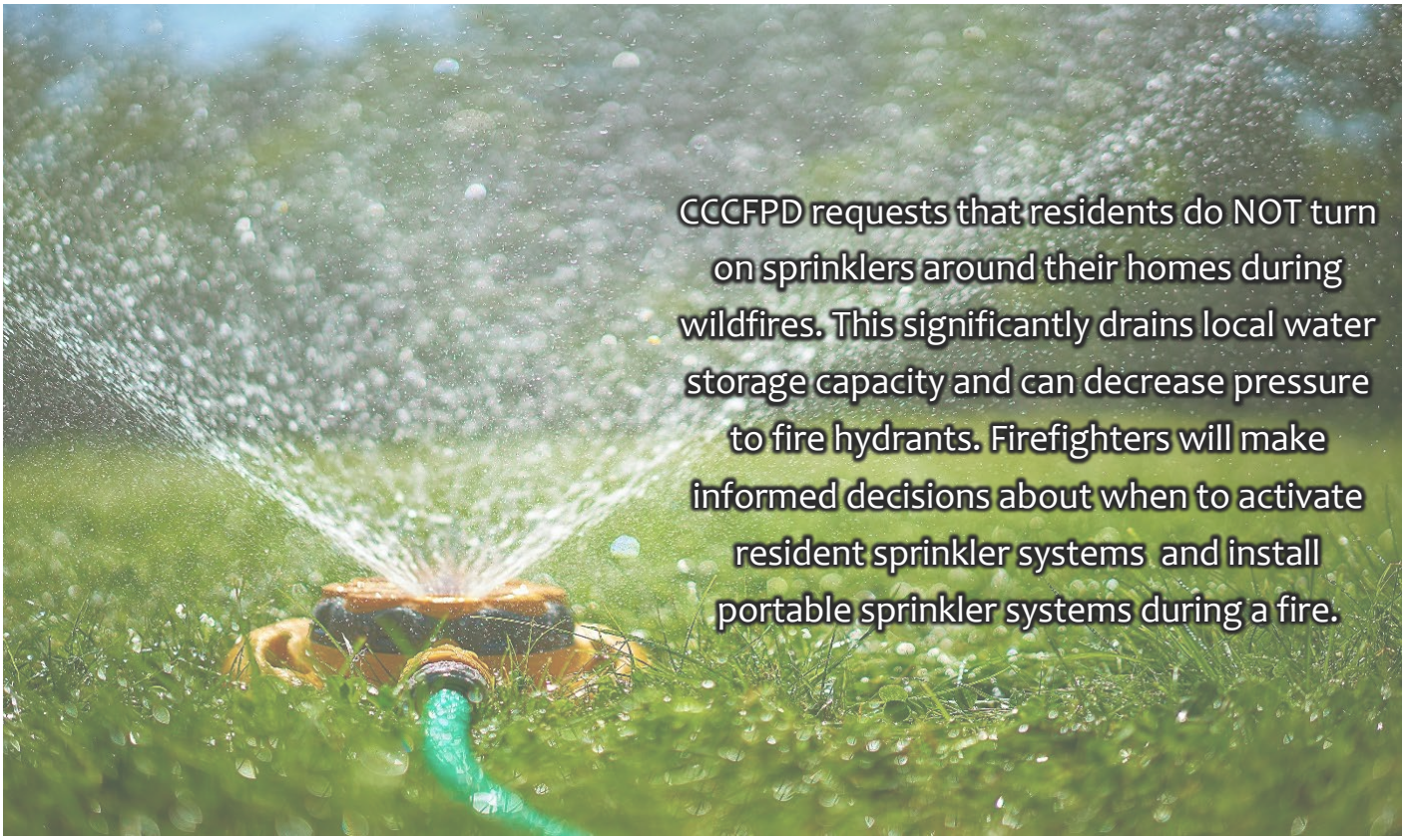
Water resources to fight fires in the foothills can be scarce, especially during the fire season in late summer and fall. Firefighters are skilled at determining the most beneficial ways to use water to protect structures from

an approaching fire. Providing clear access to suitable water resources around your home or neighborhood can help them defend your home.

Do not turn sprinklers on around your home as you evacuate. This is counterproductive to protecting your home because continuous use of water far in advance of the fire can drain local wells and cisterns long before the fire reaches your neighborhood. This leaves firefighters with less resources to defend your home, putting their lives and your property at higher risk. Leave sprinklers visible but **turned off** so firefighters can determine whether they will be useful or not. Read this post by Fire Safe Marin about why it is unwise to leave water running when you evacuate during a wildfire.

Before you evacuate, prepare personal water resources by making them easily accessible and clearly labelling how to access them. Unlock pump house doors and remove vegetation or other obstructions. If you have a generator, leave it in an accessible location in case the power is turned off. Contact CCCFPD when planning a new cistern to ensure it is compatible with their fire equipment.

Most importantly, create defensible space around your home and buildings so that water resources can be used effectively. Water is not a reliable resource in the Colorado foothills and mountains. Maintaining a property that requires less water and resources to defend is more likely to stand strong during and be more resilient to wildfire.



Support Your Local Fire Protection District

Education and outreach are incredibly important to CCCFPD–connecting with their constituents is a vital part of building relationships and providing the highest quality services. Your support for CCCFPD can improve the safety of this community:

- Consider volunteering with CCCFPD. Check the CCCFPD website for volunteer opportunities.
- Provide financial support in the form of monetary donations or initiate and vote for local ballot measures that provide tax revenue for CCCFPD so they can better respond to residents in their time of need.
- Attend events hosted by CCCFPD and their partner organizations about wildfire mitigation and emergency preparedness. Protecting your home from wildfire can also protect your local firefighters. Share information you learn with neighbors to build community resilience and magnify the impact of individual actions.

Photo credit: CCCFPD

When you volunteer with Coal Creek Canyon Fire, you become an asset to your community & part of our family!

Steps to enhance firefighter safety and access BEFORE a fire:

- Install reflective address numbers on the street to make it easier for firefighters to navigate to your home under smoky conditions and at night. **Installing reflective address numbers can save lives and is inexpensive and easy to accomplish.**
    - Make sure the numbers are clearly visible from both directions on the roadway.
    - Use noncombustible materials for your address sign and sign supports.
- Improve 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 drives and driveways.
    - Remove trees along narrow private drives and driveways so the horizontal clearance is a total of 20 feet wide, and prune low-hanging branches of remaining trees so the unobstructed vertical clearance is at least 13.5 feet per National Fire Protection Association recommendations.
- Post the load limit at any private bridges or culverts on your property.

Steps to enhance firefighter safety and access DURING a fire:

- 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.

3.b. Relative Risk Ratings and Targeted Action for CWPP Plan Units

This CWPP is a useful planning document, but it will only affect real change if residents, neighbors, plan units, CCCFPD, local forestry and watershed groups like Saws and Slaws and Boulder Watershed Collective, community groups such as Coal Creek Canyon Collaborative, Crescent Park Community Fire Protection Association, and Blue Mountain Forest Stewardship Initiative, and agency partners come together to address shared risk and implement strategic projects. This section of the CWPP provides relative risk ratings for CWPP plan units in CCCFPD and outlines priority recommendations for collective action to address shared risk and magnify the impact of mitigation actions by individual residents. Guidelines for priority action could be spearheaded by neighborhood ambassadors in each plan unit with support from fellow residents (see **Neighborhood Ambassador Program**).

CWPP plan units are areas with shared fire risk where residents can organize and support each other to effectively reduce wildfire risk and enhance emergency preparedness. We delineated 15 plan units in CCCFPD by considering clusters of addresses, connectivity of roads, topographic features, land parcels, land ownership, and local knowledge of community organization. Amendments were made to boundaries based on local knowledge of the CWPP Core Team.

The Ember Alliance conducted on-the-ground observations to assess fire risk, fire suppression challenges, evacuation hazards, and home ignition zone (HIZ) hazards between June 19-22, 2023, and combined these observations with output from our fire behavior and evacuation analyses. See **Appendix B** for a description of hazard rating methodology. Plan unit hazard ratings are specific to CCCFPD and not suitable for comparing this fire protection district to other communities in Colorado or the country.

The potential for wildfires to pose a threat to lives and property is high across CCCFPD, but risk is relatively higher in some parts of the district than others (**Figure 3.b.1**). Plan units with higher relative risk are strong candidates for more urgent action and additional support to mitigate hazardous conditions. However, plan units with moderate relative risk still possess conditions that could threaten life and/or property in the case of a wildfire.

The northern and western plan units (Wondervu, Burke, Camp Eden, Miramonte, Upper Twin Spruce, and Chute Road) have extreme relative risk ratings due to the potential for extreme fire behavior in dense vegetation on steep slopes, in addition to hazards in the HIZ. The Burke and Wondervu plan units have the most extreme relative risk rating due to a combination of dense vegetation and steep topography, HIZ hazards, and limited roadway access for fire engines and evacuation. The southeastern part of CCCFPD (Plainview and Blue Mountain plan units) and the far north (Pika) have the lowest relative risk rating. Homes in the Plainview, Blue Mountain, and Pika plan units have fewer HIZ hazards, and the vegetation is less dense, with more open grassy areas. Some plan units are at extreme risk from post-fire flooding and sediment delivery (**Figure 2.f.9**). All plan units contain potentially non-survivable roads in a wildfire evacuation scenario. (**Appendix B**)

The following section is a breakdown of relative risk for each plan unit in CCCFPD, followed by a list of recommendations that homeowners can take in their plan unit to mitigate risk. Recommendations are prioritized based on what actions can have the greatest impact on risk reduction. If it is not feasible for homeowners within the plan unit to do the top priorities, they should still do what they can. In all plan units, it will be valuable for homeowners to get an HIZ assessment to identify action steps that are specific to their home.

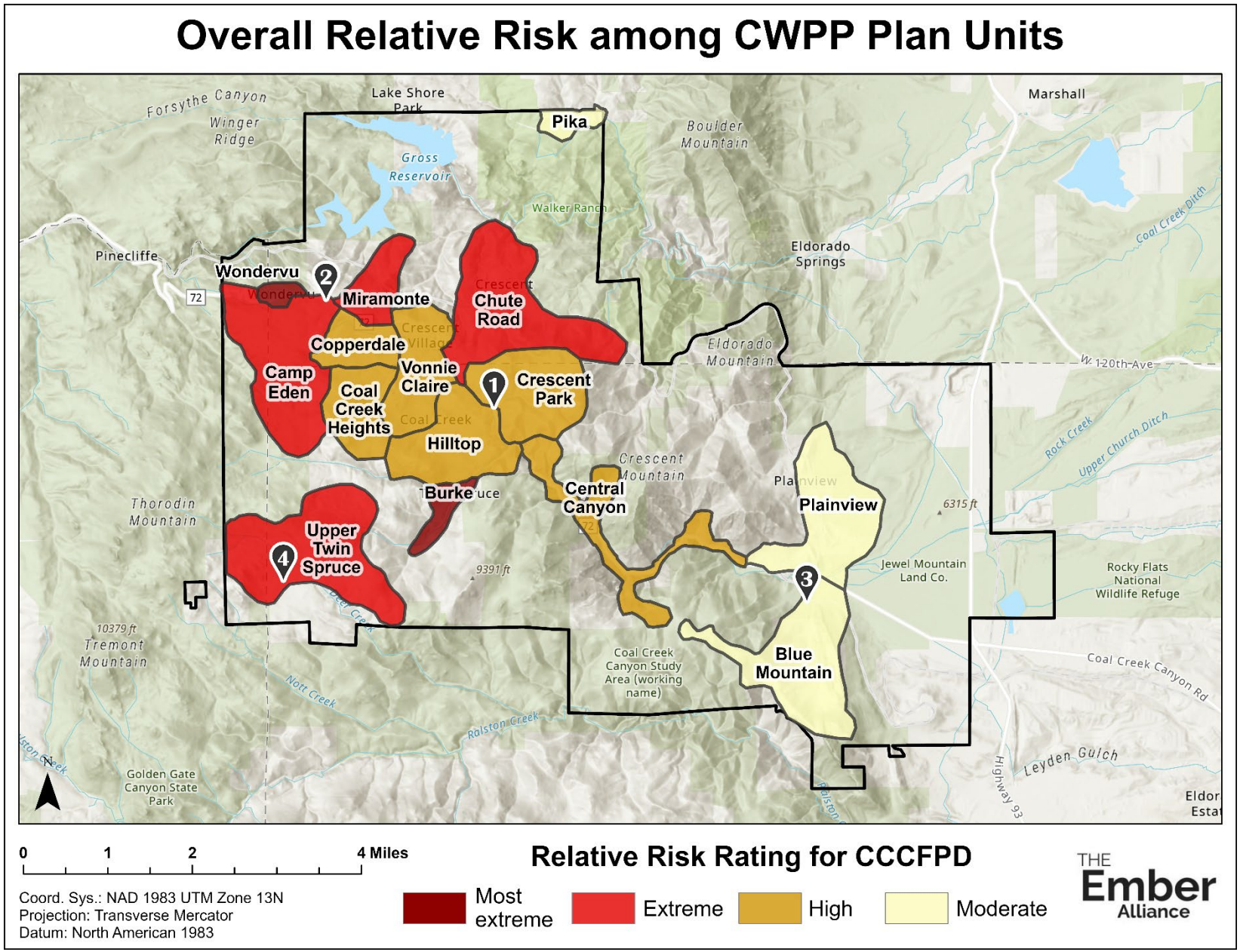


Figure 3.b.1*. Relative risk rating for plan units across CCCFPD. "Moderate" risk is a relative term – most residents within CCCFPD are exposed to elevated fire danger due to topography and fuels in this part of Colorado and should take recommended actions in this CWPP seriously. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

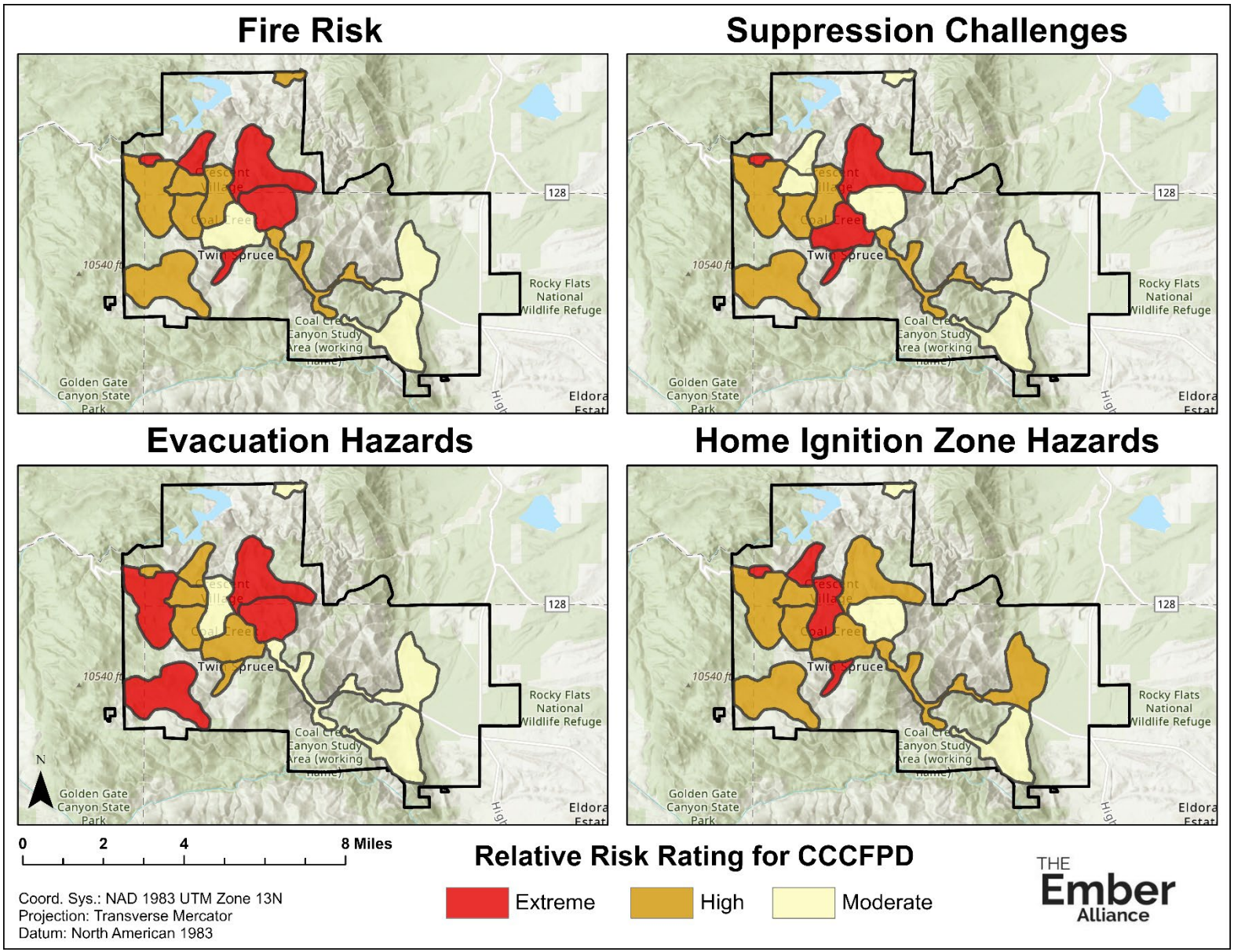


Figure 3.b.2*. Plan unit relative risk for each component used to determine overall risk ratings in CCCFPD. Fire Risk incorporates the type and probability of wildfire in the area, Evacuation hazards includes roadway quality, quantity, and estimated evacuation times. Suppression Challenges incorporates accessibility of the roads by fire engines, water sources, and home/road signage, and home ignition zone Hazards is an average of the quality of home hardening and defensible space work on structures in the area. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

Blue Mountain

Moderate relative risk rating

Under extreme fire weather and during a fire:

- **23%** of the area could experience very high to extreme fire behavior.
- **27%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **25%** of the roads (3.7 miles) have potentially non-survivable conditions.

County: The entire plan unit is in Jefferson County.

Vegetation, topography, and potential fire behavior: The Blue Mountain plan unit has a diversity of vegetation types. Open meadows dominate the valley bottoms, ponderosa pine savannahs exist at mid-elevations, and dense mixed conifer stands at high elevations create the potential for some extreme fire behavior. The topography is complex, with many steep slopes, narrow valleys, and ridges that could create unpredictable fire behavior.

Hazards in the home ignition zone: Less than half the homes in Blue Mountain are built with ignition-resistant materials such as stucco, stone, or brick siding. Over half of homes have a non-combustible barrier installed within the first 5 feet of the home made of gravel or other non-combustible landscaping materials. Moving further away from the home, mitigation is inadequate. Homeowners should remove some trees within 30 ft of the home to create 10-12 ft of space between canopies, prune tree limbs to 6-10 feet above ground level, mow grasses, and move additional hazards including wood piles and propane tanks at least 30 ft away from the home. The main threat to homes in this plan unit is embers landing within 30 ft of the home or other structures and igniting them.

Roadway accessibility and evacuation capacity: Roads in the Blue Mountain plan unit are accessible for firefighters and can accommodate two-way traffic. However, there is only one primary egress route for community members in this plan unit, which limits the ability of residents to evacuate quickly during an emergency. There is a railroad crossing in this plan unit, which has the potential to delay evacuation times and trap residents in case of an emergency. Some residents in this plan unit have livestock, which could further slow down evacuation time.

Post-fire flooding and sediment delivery potential: The southwest edge of the plan unit is at high risk of post-fire sediment delivery, as well as a small portion of the northwest edge. Some homes are within this area of elevated risk, as well as two sites of Blue Mountain Water District infrastructure.

Fire suppression considerations: Fire hydrants are available near practically all homes in this plan unit. Many homes do not have visible and reflective address signs, which makes it difficult for firefighters to find them in smokey wildfire conditions. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents.

Recommendations for residents in Blue Mountain:

1. Join, support, and participate in activities with the Blue Mountain Forest Stewardship Initiative (BMFSI).
2. Prepare your home for wildfire. Home ignition zone (HIZ) mitigation in zones 2 and 3 is the highest priority in this plan unit, since more than half of the homeowners have mitigated zone 1 and hardened their homes (see **Figure 3.a.3**). It is recommended that every homeowner in this plan unit gets an HIZ assessment from BMFSI to identify specific mitigation actions that need to be taken, as actions will vary among homes.
3. Move hazards such as wood piles, propane tanks, and old wooden sheds at least 30 ft away from homes and structures.
4. Develop an evacuation plan for your family, sign up for emergency notifications from Jefferson County (and consider signing up for Boulder County emergency notifications too), and coordinate with neighbors who might need additional support during evacuations.
5. Install visible, reflective address signs near driveways. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
6. Remove trees, shrubs and tall grasses along private roads and driveways to improve evacuation safety and firefighter access during a wildfire.
7. Contact your HOA, BMFSI, or the county to remove vegetation along shared roads in the community. Work with individual landowners to install a shaded fuelbreak along the section of Eastridge Road identified as non-survivable (see **Figure 3.b.3.**).
8. Work with CCCFPD and Jefferson County to identify a feasible secondary egress route out of the plan unit. There is currently only one primary egress route along Blue Mountain Dr.
9. Support the Blue Mountain Water District in completing the **Blue Mountain Water District Infrastructure Protection** project. Support BMFSI and the USFS in working on the **Central Corridor Rail Line Ignition Reduction** project. Support CDOT and partners for the **Highway 72 Roadside Fuel Reduction** project (see **Figure 3.b.3.**).
10. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Blue Mountain should expect to work with 1-2 neighbors to ensure their HIZ is mitigated.
11. Monitor and maintain the two strategic fuelbreaks in Blue Mountain.
12. Advocate for county support from Jefferson County to implement a program like Wildfire Partners and host a slash sort yard or more collection events located in the fire district.
13. Homes in the southern part of Blue Mountain could be exposed to damaging post-fire flooding and sediment delivery (see analysis in **Appendix B**). Homeowners are encouraged to take proactive measures to prepare, including (1) working with your insurance agent to determine your need for flood insurance and/or an earth movement, earthquake, and landslide rider to your homeowner's policy, (2) elevating and anchoring electrical panels, propane tanks, wiring, appliance, and heating systems, (3) securing important documents in waterproof deposit boxes, (4) ensuring sump pumps are working and have battery-operated backup power sources, (5) installing professionally engineered terraces or slope drains that could protect your home but without altering drainage patterns that could worsen conditions for your neighbors, and (6) consulting with a qualified forester to discuss pre-fire fuel treatments to limit sediment delivery damages from burn scars. Reducing fuel loading in areas of concern can reduce wildfire severity, decrease the likelihood that hydrophobic soils (soils that repel water) form, and reduce the loss of roots, vegetation, and plant litter that hold soil in place. Reduced fire severity can therefore reduce the potential for flooding and sediment transport in some cases. Visit the storymap "A dangerous path" from the Boulder Watershed Collective for more information on preparing for debris flows.

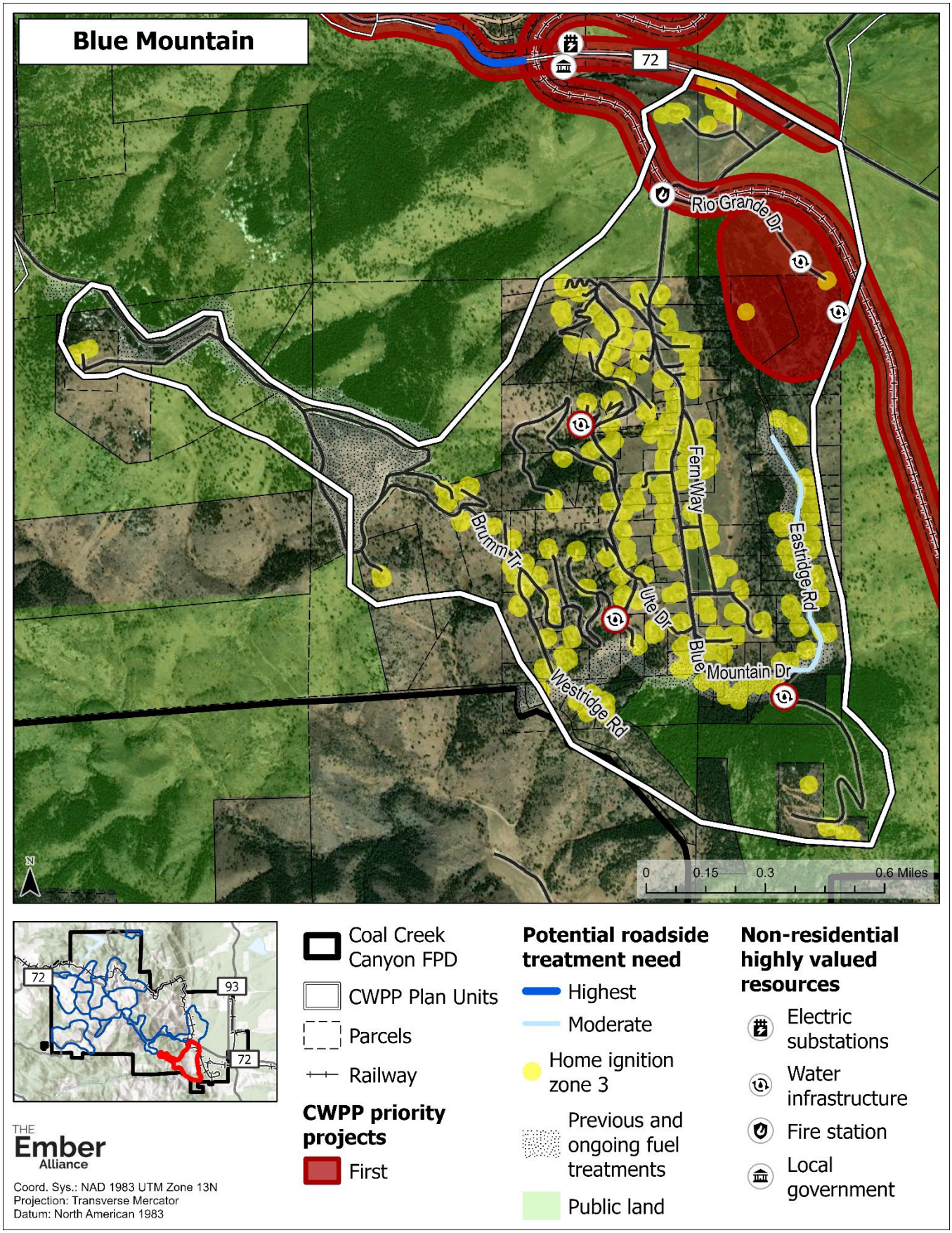


Figure 3.b.3. *HIZ, roadway, and landscape-scale priority projects recommended within the Blue Mountain plan unit.*

Burke

Most extreme relative risk rating

Under extreme fire weather and during a fire:

- **65%** of the area could experience very high to extreme fire behavior.
- **55%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **42%** of roads (1.1 miles) have potentially non-survivable conditions.

County: The entire plan unit is in Jefferson County.

Vegetation, topography, and potential fire behavior: Burke is situated at the bottom of a drainage with dense mixed conifer covering the area. There are steep slopes and valleys that could increase unpredictable fire behavior. Extreme fire behavior is very likely to occur here.

Hazards in the home ignition zone: The main threat to the homes in this plan unit is embers landing on roofs or within 30 feet of the home and igniting it. Most homes in this neighborhood are built on hillsides and are at higher fire risk. Firefighters may not be able to protect these homes in an extreme wildfire event due to the slopes and limited road access with no escape routes.

Most homes in the unit are older and were not built with ignition-resistant materials. For example, wood siding and decking can easily ignite when exposed to direct flames or embers from a wildfire. Many homes have older asphalt roofs that are vulnerable to embers. Many of the homes have fire hazards in home ignition zones 1, 2, and 3, including stacks of wood pallets, fencing, and other flammable materials under decks and next to the home.

Roadway accessibility and evacuation capacity: There is only one way in and out of this community. Burke Road and Fischer Road are one-lane roads without good turnarounds for fine engines, which will make it difficult for residents to evacuate and for firefighters to access and protect homes during a wildfire.

Post-fire flooding and sediment delivery potential: Most of this plan unit is at high risk of post-fire sediment delivery. Nearly every home is within this area of elevated risk, as well as a major aboveground power line.

Fire suppression considerations: Burke does not have any fire hydrants, and there are no other quality water sources for firefighters. Some homes do not have reflective address signs, and there are overhead powerlines that are hanging too low for some engines to make it under without assistance.

Due to the quantity of overlapping hazards in this plan unit, it is designated as the highest risk area within Coal Creek Canyon.

Priority recommendations for residents in Burke:

1. Develop an evacuation plan for your family, sign up for emergency notifications from Jefferson County (and consider signing up for Boulder County emergency notifications too), and coordinate with neighbors who might need additional support during evacuations.
2. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in home ignition zones 1 and 2 (see **Figure 3.a.3**). It is recommended that every homeowner in this plan unit gets a home assessment from their county or CCCFPD's partners to identify specific mitigation actions that need to be taken, as actions will vary among homes.
3. Form a fire mitigation group in your plan unit or neighborhood. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
4. Move hazards such as wood piles, propane tanks, and old wooden sheds at least 30 ft away from the home. Replace wooden fences with non-combustible fencing material.
5. Contact your local road association or the county to remove vegetation along shared roads in the community, particularly along Burke Rd and Fischer Rd (see **Figure 3.b.4**).
6. Install visible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
7. Work with CCCFPD and Jefferson County to improve road access within the Burke residential areas for firefighters and residents. There are currently no adequate turnarounds or exit locations.
8. Work with CCCFPD and Jefferson County to identify a feasible secondary egress route out of the community.
9. Install community cisterns in coordination with CCCFPD.
10. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Burke should expect to work with 4-5 neighbors to ensure their HIZ is mitigated.
11. Support Jefferson County Road and Bridge, Colorado Parks and Wildlife, and their partners in initiating and completing the **Twin Spruce Road / Gap Road Roadside Fuel Reduction** project (see **Figure 3.b.4**).
12. Advocate for county support from Jefferson County to implement a program like Wildfire Partners and host a slash sort yard or more collection events located in the fire district.
13. Almost all homes in Burke could be exposed to damaging post-fire flooding and sediment delivery (see analysis in **Appendix B**). Homeowners are encouraged to take proactive measures to prepare, including (1) working with your insurance agent to determine your need for flood insurance and/or an earth movement, earthquake, and landslide rider to your homeowner's policy, (2) elevating and anchoring electrical panels, propane tanks, wiring, appliance, and heating systems, (3) securing important documents in waterproof deposit boxes, (4) ensuring sump pumps are working and have battery-operated backup power sources, (5) installing professionally engineered terraces or slope drains that could protect your home but without altering drainage patterns that could worsen conditions for your neighbors, and (6) consulting with a qualified forester to discuss pre-fire fuel treatments to limit sediment delivery damages from burn scars. Reducing fuel loading in areas of concern can reduce wildfire severity, decrease the likelihood that hydrophobic soils (soils that repel water) form, and reduce the loss of roots, vegetation, and plant litter that hold soil in place. Reduced fire severity can therefore reduce the potential for flooding and sediment transport in some cases. Visit the storymap "A dangerous path" from the Boulder Watershed Collective for more information on preparing for debris flows.

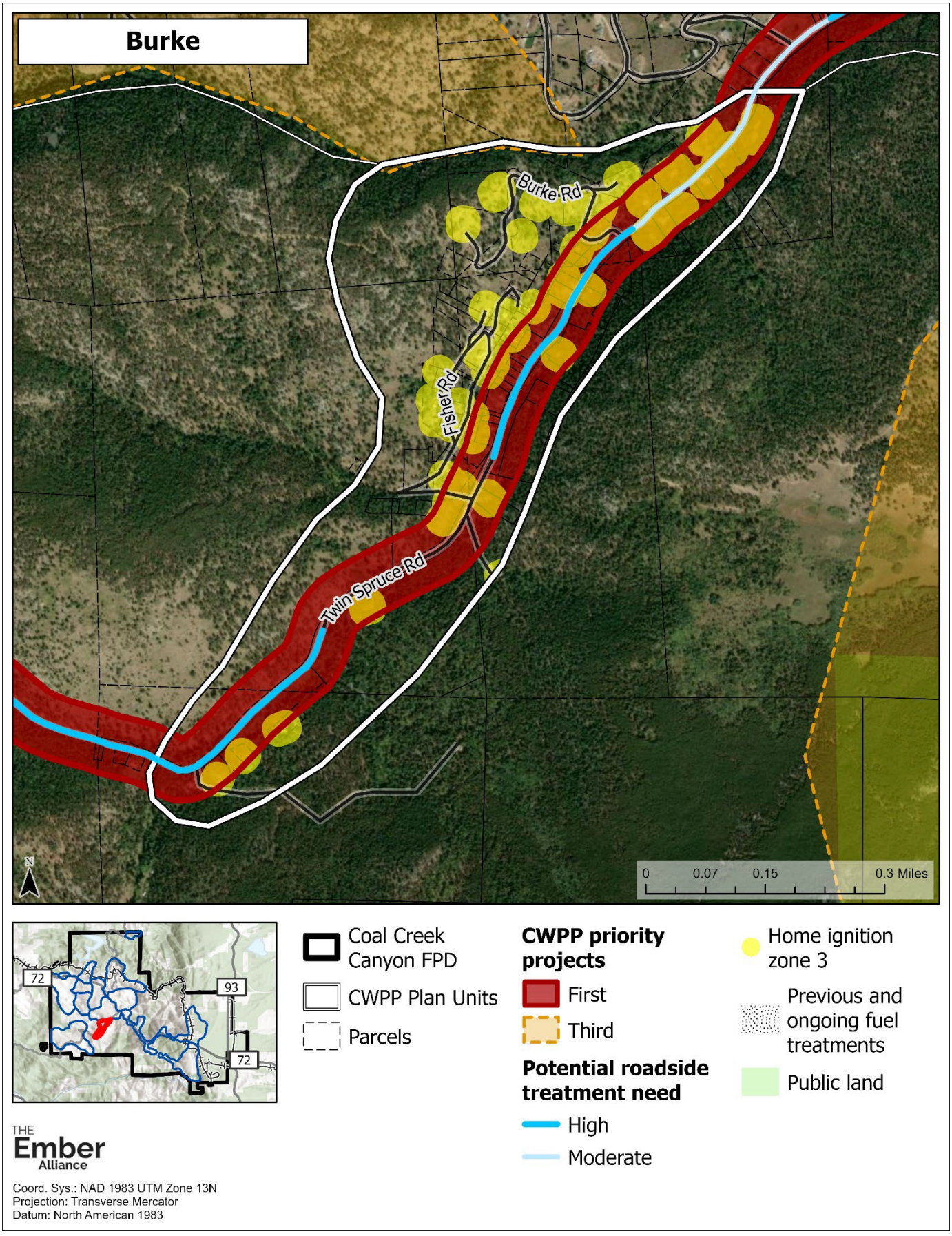


Figure 3.b.4. *HIZ, roadway, and landscape-scale priority projects recommended within the Burke plan unit.*

Camp Eden

Extreme relative risk rating

Under extreme fire weather and during a fire:

- **60%** of the area could experience very high to extreme fire behavior.
- **79%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **65%** of roads (9.4 miles) have potentially non-survivable conditions.

County: About one third of the plan unit is in Jefferson County, one third in Boulder County, and one third in Gilpin County.

Vegetation, topography, and potential fire behavior: Camp Eden has north-facing slopes with mixed conifer, lodgepole, and spruce-fir with aspen intermixed. The dense vegetation creates a potential for extreme fire behavior. There are many steep slopes, with many narrow valleys and ridges that could increase unpredictable fire behavior.

Hazards in the home ignition zone: The main threat to the homes in this plan unit is embers landing on roofs or within 30 feet of the home and igniting it. Some homes are built on hillsides and are at higher fire risk. Firefighters may not be able to protect these homes in an extreme wildfire event due to the steep slopes and limited road access with no escape routes.

Many homes in the unit are older and were not built with ignition-resistant materials. For example, wood siding and decking, found on most homes in the unit, can easily ignite when exposed to direct flames or embers from a wildfire. Some homes have older asphalt roofs that are vulnerable to embers. Many of the homes have fire hazards in home ignition zones 1, 2, and 3. Some have branches near or over the roof, pine needles and leaves in the gutters, and other flammable items within 30 ft including wood piles, dilapidated sheds, and propane tanks. A few homes here have mitigation in zone 1, but not in zone 2 and 3. Dense vegetation surrounding many homes presents the need to focus on home hardening and defensible space.

Roadway accessibility and evacuation capacity: There are multiple ways in and out of this community. Practically all roads can accommodate two-way traffic. There are steep roads, switchbacks, and limited turnarounds that can cause traffic to get backed up or move slowly. There are some paved roads and many dirt roads that are generally well maintained.

Post-fire flooding and sediment delivery potential: The west-central portion of this plan unit and a small area north of Highway 72 are at high risk of post-fire sediment delivery. There are homes within these areas of elevated risk, but no critical infrastructure.

Fire suppression considerations: Camp Eden has no fire hydrants and very limited access to water for firefighters from other sources. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents. Some homes do not have consistent and legible address signs, which make them difficult for firefighters to find.

Recommendations for residents in Camp Eden:

1. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in home ignition zones 1 and 2 (see **Figure 3.a.3**). It is recommended that every homeowner in this plan unit gets a home assessment to identify specific mitigation actions that need to be taken, as actions will vary among homes.
2. Move hazards such as wood piles, propane tanks, and old wooden sheds at least 30 ft away from the home. Replace wooden fences with non-combustible fencing material.
3. Develop an evacuation plan for your family, sign up for emergency notifications from Boulder County, and coordinate with neighbors who might need additional support during evacuations.
4. Join, volunteer with, and support the Copperdale/Camp Eden fire mitigation group. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
5. Install visible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
6. Work with CCCFPD and the counties to identify feasible secondary egress routes out of neighborhoods including the end of Camp Eden Rd.
7. Remove trees, shrubs and tall grasses along private roads and driveways to improve evacuation safety and firefighter access during a wildfire.
8. Contact your local HOA, road association, or the appropriate county to remove vegetation along shared roads in the community, particularly along Camp Eden Rd, Ronnie Rd, Aspen Dr, Elliot Ln, and Skyline Dr (see **Figure 3.b.5**).
9. Install community cisterns in coordination with CCCFPD.
10. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Camp Eden should expect to work with 4-5 neighbors to ensure their HIZ is mitigated.
11. Support CDOT and partners for the **Highway 72 Roadside Fuel Reduction** project. Support the USFS, private landowners, and organizations that work with private landowners to implement landscape-scale work on the **Black Gulch Fuel Reduction project** (see **Figure 3.b.5**).
12. Advocate for county support from Jefferson and Gilpin Counties to implement a program like Wildfire Partners and host a slash sort yard or more collection events located in the fire district. If you live in Boulder County, become Wildfire Partners certified.
13. Many homes in the western part of Camp Eden could be exposed to damaging post-fire flooding and sediment delivery (see analysis in **Appendix B**). Homeowners are encouraged to take proactive measures to prepare, including (1) working with your insurance agent to determine your need for flood insurance and/or an earth movement, earthquake, and landslide rider to your homeowner's policy, (2) elevating and anchoring electrical panels, propane tanks, wiring, appliance, and heating systems, (3) securing important documents in waterproof deposit boxes, (4) ensuring sump pumps are working and have battery-operated backup power sources, (5) installing professionally engineered terraces or slope drains that could protect your home but without altering drainage patterns that could worsen conditions for your neighbors, and (6) consulting with a qualified forester to discuss pre-fire fuel treatments to limit sediment delivery damages from burn scars. Reducing fuel loading in areas of concern can reduce wildfire severity, decrease the likelihood that hydrophobic soils (soils that repel water) form, and reduce the loss of roots, vegetation, and plant litter that hold soil in place. Reduced fire severity can therefore reduce the potential for flooding and sediment transport in some cases. Visit the

storymap "A dangerous path" from the Boulder Watershed Collective for more information on preparing for debris flows.

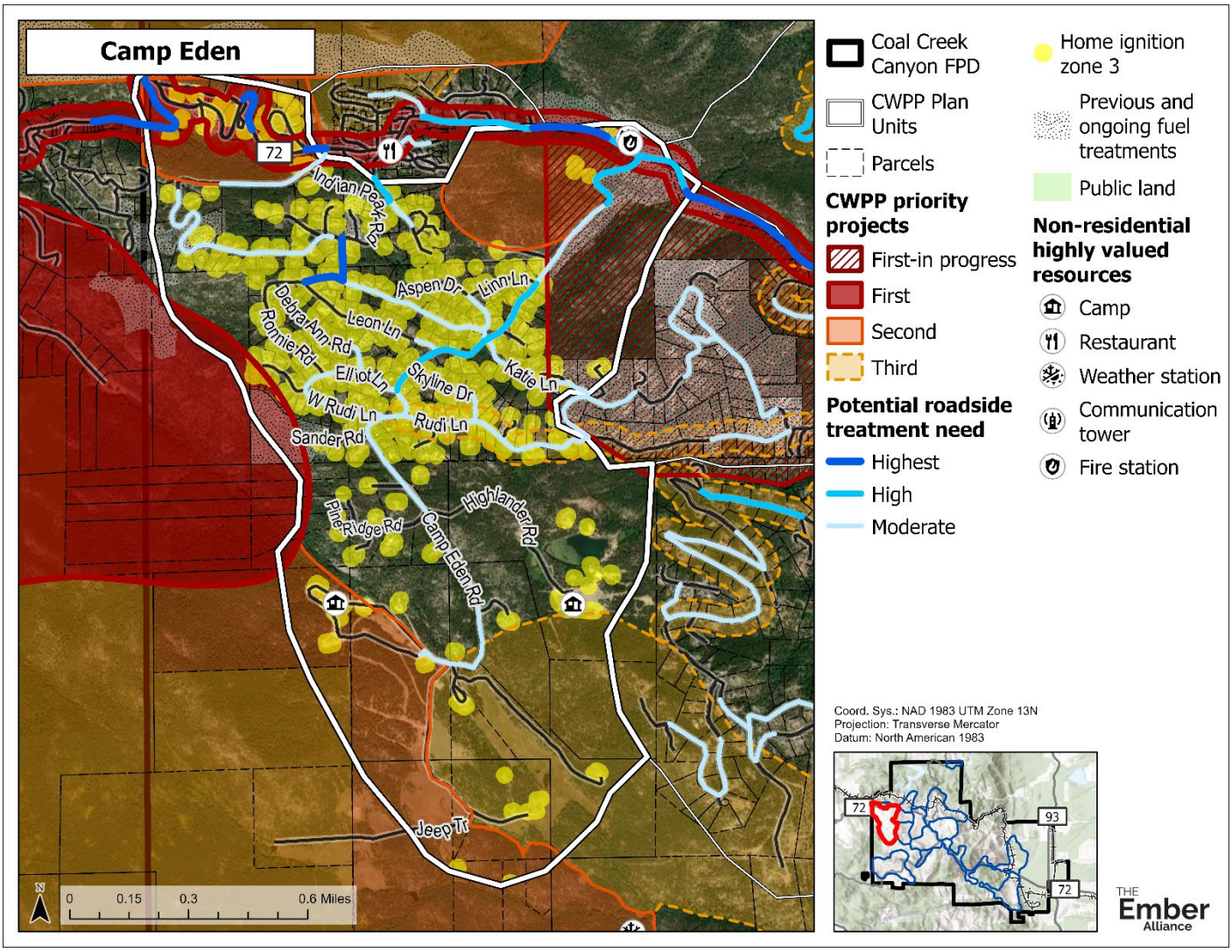


Figure 3.b.5. *HIZ, roadway, and landscape-scale priority projects recommended within the Camp Eden plan unit.*

Central Canyon

High relative risk rating

Under extreme fire weather and during a fire:

- **56%** of the area could experience very high to extreme fire behavior.
- **44%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **38%** of roads (3.5 miles) have potentially non-survivable conditions.

County: The entire plan unit is in Jefferson County.

Vegetation, topography, and potential fire behavior: The Central Canyon plan unit has dense forested vegetation comprised of ponderosa pine, Douglas-fir, other conifers, and aspen trees. The slopes are steep on either side of the canyon, creating the potential for extreme fire behavior. Most of the homes are built mid-slope, which puts them at risk of a fire that could be spreading through the canyon.

Hazards in the home ignition zone: Homes throughout this plan unit have mixed construction materials. About half of the homes are older and were not built with fire-resistant materials, while the other half of homes are built with fire-resistant materials such as metal roofs. Some homes have hazards in home ignition zones 1, 2, and 3 such as branches overhanging roofs, pine needles accumulated in gutters, and vegetation within the first 5 feet of homes. The main threat to homes in this plan unit is embers igniting in zones 1 and 2.

Roadway accessibility and evacuation capacity: The main roads in this plan unit are well maintained and accessible for firefighters. Highway 72 (Coal Creek Canyon Rd) can accommodate two-way traffic, but residential roads are one-way with some pullouts and turnarounds. There are only 2 egress routes for residents in this plan unit (i.e., NW up the canyon or SE down the canyon).

Post-fire flooding and sediment delivery potential: Nearly all this plan unit is at high risk of post-fire sediment delivery. Most homes along Highway 72, Brumm Trail, and Cattle Trail Dr are at elevated risk. Highway 72 itself, as well as three bridges and major aboveground powerlines are located in this area of high risk.

Fire suppression considerations: Central Canyon does not have fire hydrants, but there is one cistern at CCCFPD Station 1. Many homes do not have visible and reflective address signs, which makes it difficult for firefighters to find them in smokey wildfire conditions. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents.

Recommendations for residents in Central Canyon:

1. Form a fire mitigation group in your plan unit or with your neighbors. Organize home hardening and defensible space tours to demonstrate effective mitigation practices. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
2. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in zones 1 and 2 (see **Figure 3.a.3**). It is recommended that every homeowner in this plan unit gets a home assessment from their county or CCCFPD's partners to identify specific mitigation actions that need to be taken, as actions will vary among homes.
3. Move hazards such as wood piles, propane tanks, and old wooden sheds at least 30 ft away from the home.
4. Develop evacuation plans for your family, sign up for emergency notifications from Jefferson County (and consider signing up for Boulder County emergency notifications too), and coordinate with neighbors who might need additional support during evacuations.
5. Install consistent, legible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
6. Remove vegetation along roadways to reduce the risk of non-survivable conditions during wildfires, particularly along residential roads and long driveways.
7. Following initial fuel reduction on Highway 72 by CDOT, support the **Highway 72 Roadside Fuel Reduction** project by working with community groups and neighbors to treat fuels far enough back from the edge of the road to create a healthy fuelbreak (see **Figure 3.b.6**).
8. Widen residential roads and clear vegetation along narrow roads and driveways to improve accessibility for firefighters during a wildfire.
9. Install community cisterns in coordination with CCCFPD.
10. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Central Canyon should expect to work with 1 neighbor to ensure their HIZ is mitigated.
11. Advocate for county support from Jefferson County to implement a program like Wildfire Partners and host a slash sort yard or more collection events located in the fire district.
12. Homes in the Central Canyon Plan Unit could be exposed to damaging post-fire flooding and sediment delivery (see analysis in **Appendix B**). Homeowners are encouraged to take proactive measures to prepare, including (1) working with your insurance agent to determine your need for flood insurance and/or an earth movement, earthquake, and landslide rider to your homeowner's policy, (2) elevating and anchoring electrical panels, propane tanks, wiring, appliance, and heating systems, (3) securing important documents in waterproof deposit boxes, (4) ensuring sump pumps are working and have battery-operated backup power sources, (5) installing professionally engineered terraces or slope drains that could protect your home but without altering drainage patterns that could worsen conditions for your neighbors, and (6) consulting with a qualified forester to discuss pre-fire fuel treatments to limit sediment delivery damages from burn scars. Reducing fuel loading in areas of concern can reduce wildfire severity, decrease the likelihood that hydrophobic soils (soils that repel water) form, and reduce the loss of roots, vegetation, and plant litter that hold soil in place. Reduced fire severity can therefore reduce the potential for flooding and sediment transport in some cases. Visit the storymap "A dangerous path" from the Boulder Watershed Collective for more information on preparing for debris flows.

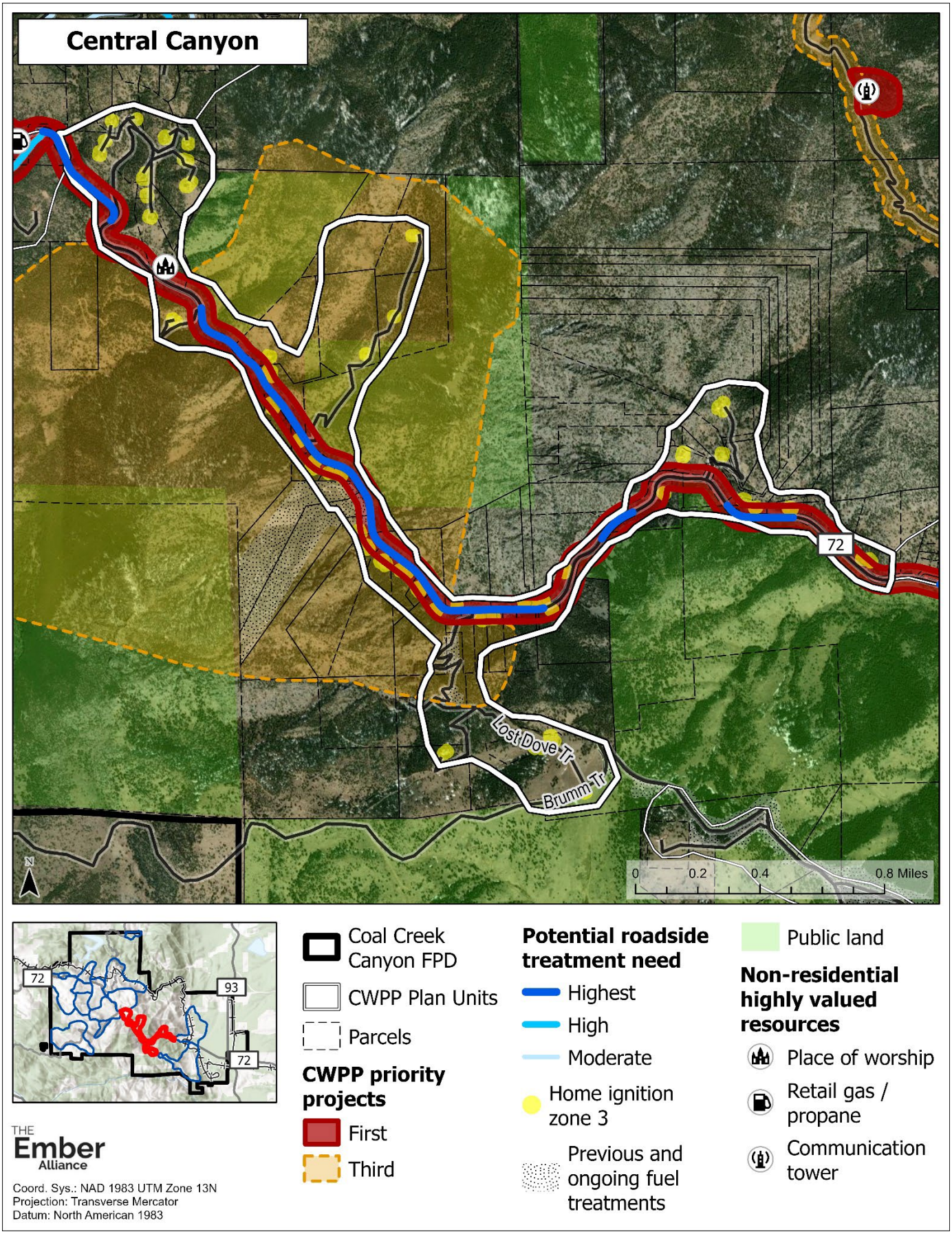


Figure 3.b.6. *HIZ, roadway, and landscape-scale priority projects recommended within the Central Canyon plan unit.*

Chute Road

Extreme relative risk rating

Under extreme fire weather and during a fire:

- **58%** of the area could experience very high to extreme fire behavior.
- **88%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **82%** of roads (10.5 miles) have potentially non-survivable conditions.

County: Nearly the entire plan unit is in Boulder County, except the southernmost tip in Jefferson County.

Vegetation, topography, and potential fire behavior: Chute Road is covered by dense mixed conifer stands that have a lot of ladder fuels and understory vegetation. With the steep slopes and valleys here, there is the potential for extreme fire behavior in this area.

Hazards in the home ignition zone: The main threat to the homes in this plan unit is embers landing within 30 feet of the home and igniting it. Some homes in the unit were not built with ignition-resistant siding, but most homes have Class A ignition-resistant roofs. There are many wood decks, and wood siding and decking can easily ignite when exposed to direct flames or embers from a wildfire. Most of the homes have fire hazards in home ignition zones 1, 2, and 3.

Roadway accessibility and evacuation capacity: Gross Dam Road is well maintained and two lanes, but some of the neighborhood side roads have one lane and some are washed out, which will make it difficult for residents to evacuate and for firefighters to access and protect homes during a wildfire. Residents may be evacuating livestock, which can make evacuation times even longer.

Post-fire flooding and sediment delivery potential: Most of Chute Road and the area west of Gross Dam Road are at high risk of post-fire sediment delivery. Most homes along Chute Rd, Tunnel 19 Rd, and Juniper Heights Dr are at elevated risk, and a major aboveground powerline travels through this area of high risk.

Fire suppression considerations: Chute Road does not have any fire hydrants, and there are no other local water sources for firefighters. There are overhead powerlines throughout the plan unit. Downed powerlines can

be an ignition source and hazard to firefighters and residents. Many of the homes do not have consistent and legible address signs, which make them difficult for firefighters to find.

Recommendations for residents in Chute Road:

1. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in home ignition zones 1 and 2 (see **Figure 3.a.3**). Most homes have Class A roofs in this plan unit, but many homes have combustible siding, decking, and wooden fences attached to the homes that should be replaced with ignition-resistant materials. It is recommended that every homeowner in this plan unit gets a home assessment from their county or CCCFPD's partners to identify specific mitigation actions that need to be taken, as actions will vary among homes.
2. Move hazards such as wood piles, propane tanks, and old dilapidated wooden sheds at least 30 ft away from the home.
3. Form a fire mitigation group in your plan unit. Organize community-wide home hardening and defensible space tours to demonstrate effective mitigation practices. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
4. Develop an evacuation plan for your family, sign up for emergency notifications from both Boulder and Jefferson Counties, and coordinate with neighbors who might need additional support during evacuations.
5. Install visible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
6. Contact the appropriate county to remove vegetation along shared roads in the community, particularly along Chute Rd, Gross Dam Rd, Tunnel 19 Rd, and Juniper Heights Rd (see **Figure 3.b.7**).
7. Work with CCCFPD and the counties to identify a feasible secondary egress route out of the plan unit.
8. Advocate for county support from Jefferson County to implement a program like Wildfire Partners and host a slash sort yard or more collection events located in the fire district. If you live in Boulder County, become Wildfire Partners certified.
9. Install community cisterns in coordination with CCCFPD.
10. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Chute Road should expect to work with 1 neighbor to ensure their HIZ is mitigated.
11. Support Denver Water and partners for the **Gross Dam Road / Flagstaff Road Roadside Fuel Reduction** project. Support your local community organizations and the USFS in working on the **Central Corridor Rail Line Ignition Reduction** project. Support CDOT and partners for the **Highway 72 Roadside Fuel Reduction** project (see **Figure 3.b.7**).
12. Homes scattered around Chute Canyon could be exposed to damaging post-fire flooding and sediment delivery (see analysis in **Appendix B**). Homeowners are encouraged to take proactive measures to prepare, including (1) working with your insurance agent to determine your need for flood insurance and/or an earth movement, earthquake, and landslide rider to your homeowner's policy, (2) elevating and anchoring electrical panels, propane tanks, wiring, appliance, and heating systems, (3) securing important documents in waterproof deposit boxes, (4) ensuring sump pumps are working and have battery-operated backup power sources, (5) installing professionally engineered terraces or slope drains that could protect your home but without altering drainage patterns that could worsen conditions for your neighbors, and (6) consulting with a qualified forester to discuss pre-fire fuel treatments to limit sediment delivery damages from burn scars. Reducing fuel loading in areas of concern can reduce wildfire severity, decrease the likelihood that hydrophobic soils (soils that repel water) form, and reduce the loss of roots, vegetation, and plant litter that hold soil in place. Reduced fire severity can therefore reduce the potential for flooding and sediment transport in some cases. Visit the storymap "A dangerous path" from the Boulder Watershed Collective for more information on preparing for debris flows.

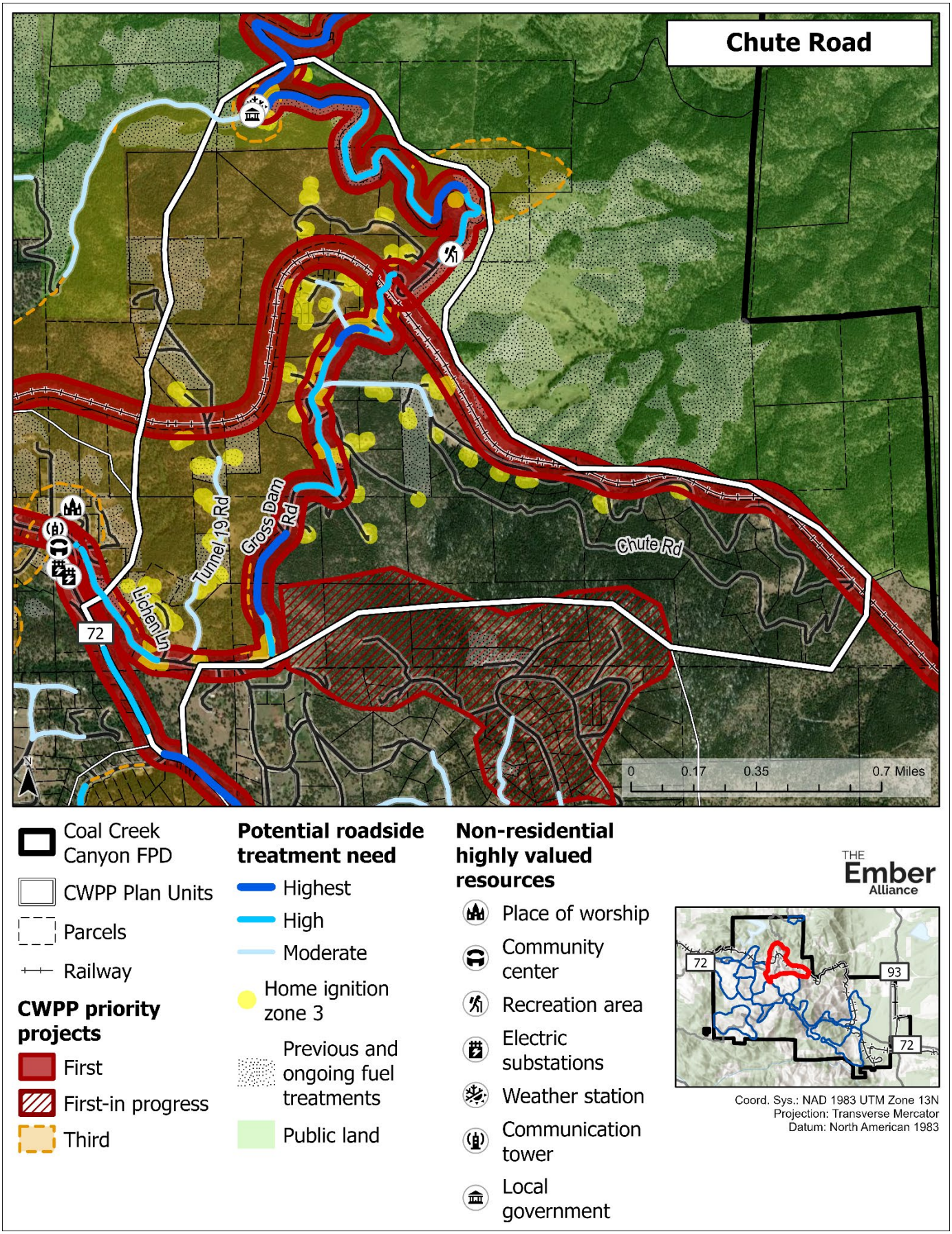


Figure 3.b.7. *HIZ, roadway, and landscape-scale priority projects recommended within the Chute Road plan unit.*

Coal Creek Heights

High relative risk rating

Under extreme fire weather and during a fire:

- **54%** of the area could experience very high to extreme fire behavior.
- **77%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **59%** of roads (3.8 miles) have potentially non-survivable conditions.

County: The entire plan unit is in Jefferson County.

Vegetation, topography, and potential fire behavior: Coal Creek Heights is mostly covered by very dense lodgepole with aspen intermixed. These conditions create a potential for extreme fire behavior. There are many very steep slopes, with many narrow valleys and ridges that could increase unpredictable fire behavior.

Hazards in the home ignition zone: The main threat to the homes in this plan unit is embers landing on roofs or within 30 feet of the home and igniting it. All homes in the unit are built on the hillside, which puts them at a higher fire risk. Firefighters may not be able to protect these homes in an extreme wildfire event due to the steep slopes and limited road access with no escape routes. While there are some newer homes with good roofs and siding, many homes in the unit are older and were not built with ignition-resistant materials. For example, wood siding and decking, found on most homes in the unit, can easily ignite when exposed to direct flames or embers from a wildfire. Some homes have older asphalt roofs that are vulnerable to embers. Many of the homes have fire hazards in zones 1, 2, and 3. Some have branches near or over the roof, pine needles and leaves in the gutters, and other flammable items within 30 ft of the home including wood piles, old wooden sheds, and debris.

Roadway accessibility and evacuation capacity: There are only two ways in and out of this community, and only one exit for residents on Coal Creek Heights Drive. The main roads can accommodate two-way traffic. Coal Creek Heights Road is well maintained and wide with hammerheads at sharp switchback turns, which makes the road easily accessible for a type 3 engine. However, many driveways and steep and narrow with limited space for a type 3 engine to turn around at the top.

Fire suppression considerations: Coal Creek Heights has no pressurized fire hydrants and very limited access to water for firefighters from other sources. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents. Some homes do not have consistent and legible address signs, which make them difficult for firefighters to find.

Recommendations for residents in Coal Creek Heights:

1. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in home ignition zones 1 and 2 (see **Figure 3.a.3**). It is recommended that every homeowner in this plan unit gets a home assessment to identify specific mitigation actions that need to be taken, as actions will vary among homes.
2. Move hazards such as wood piles, propane tanks, and old dilapidated wooden sheds at least 30 ft away from the home.
3. Form a fire mitigation group in your plan unit. Organize community-wide home hardening and defensible space tours to demonstrate effective mitigation practices. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
4. Develop an evacuation plan for your family, sign up for emergency notifications from Jefferson and Boulder Counties, and coordinate with neighbors who might need additional support during evacuations.
5. Install visible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
6. Remove trees, shrubs and tall grasses along private roads and driveways to improve evacuation safety and firefighter access during a wildfire.
7. Contact your local HOA, road association, or the county to remove vegetation along shared roads in the community, particularly along Coal Creek Heights Dr (see **Figure 3.b.8**).
8. Work with CCCFPD and Jefferson County to identify a feasible secondary egress route for residents.
9. Install community cisterns in coordination with CCCFPD.
10. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Coal Creek Heights should expect to work with 2-3 neighbors to ensure their HIZ is mitigated.
11. Advocate for county support from Jefferson County to implement a program like Wildfire Partners and host a slash sort yard or more collection events located in the fire district.

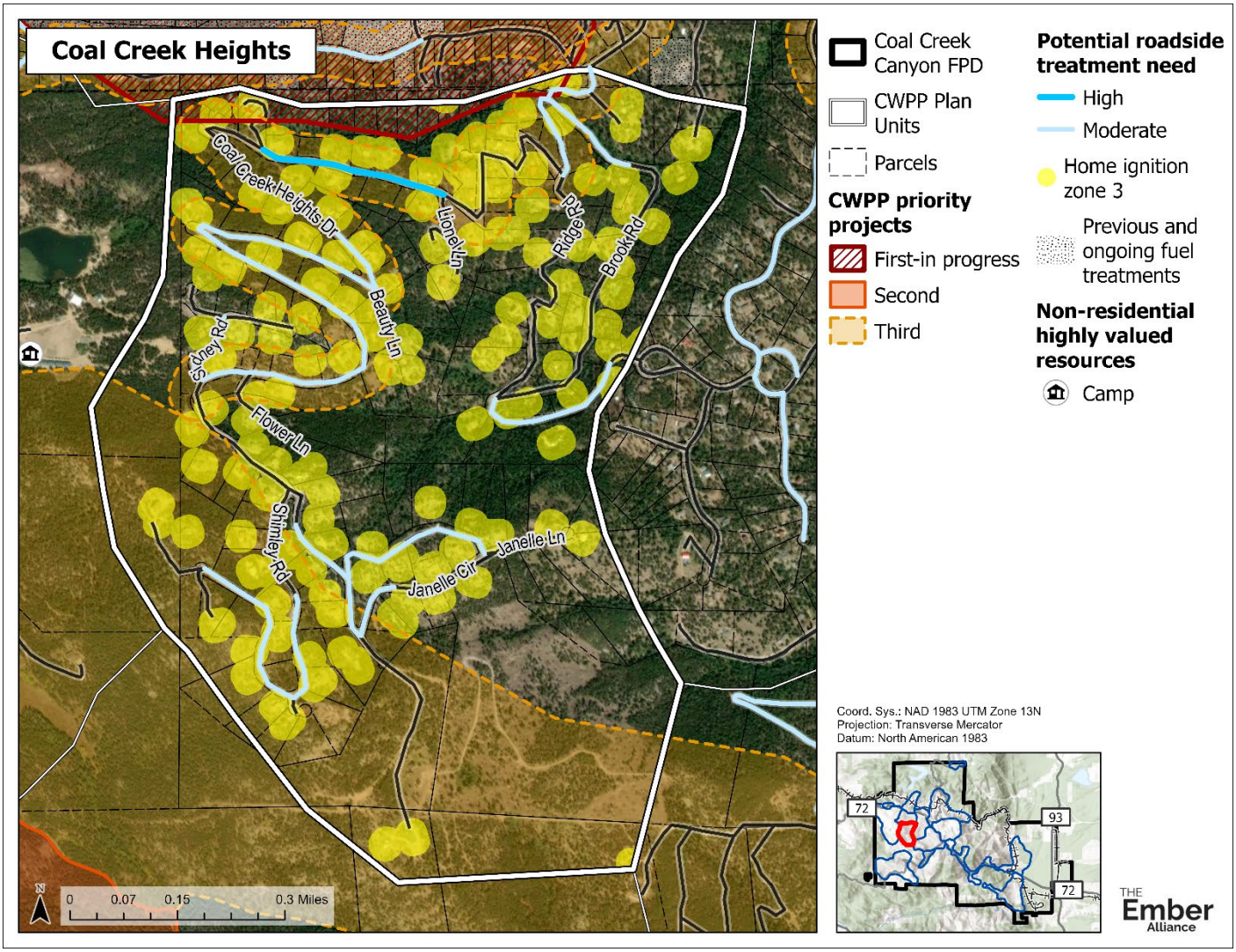


Figure 3.b.8. *HIZ, roadway, and landscape-scale priority projects recommended within the Coal Creek Heights plan unit.*

Copperdale

High relative risk rating

Under extreme fire weather and during a fire:

- **55%** of the area could experience very high to extreme fire behavior.
- **70%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **45%** of roads (2.6 miles) have potentially non-survivable conditions.

County: The entire plan unit is in Boulder County.

Vegetation, topography, and potential fire behavior: Copperdale is mostly covered by very dense mixed conifer, lodgepole and spruce-fir forest with some aspen. These conditions create a potential for extreme fire behavior. There are many steep slopes, with many narrow valleys and ridges that could increase unpredictable fire behavior.

Hazards in the home ignition zone: The main threat to the homes in this plan unit is embers landing on roofs or within 30 feet of the home and igniting it. Many homes are built on hillsides and are at higher fire risk. Firefighters may not be able to protect these homes in an extreme wildfire event due to the steep slopes and limited road access with no escape routes.

Many homes in the unit are older and were not built with ignition-resistant materials. For example, wood siding and decking, found on most homes in the unit, can easily ignite when exposed to direct flames or embers from a wildfire. Some homes have older asphalt roofs that are vulnerable to embers. A few homes have good mitigation in zone 1, but this generally does not extend into zones 2 and 3. There is dense vegetation directly adjacent to many homes here. Some have branches near or over the roof, pine needles and leaves in the gutters, and other flammable items within 30 ft of the home including wood piles, dilapidated sheds, and propane tanks.

Roadway accessibility and evacuation capacity: There are three ways in and out of this community. Practically all roads can accommodate two-way traffic. There are steep roads, switchbacks, and limited turnarounds that can cause traffic to get backed up or move slowly. There are some paved roads and many dirt roads that are generally well maintained.

Fire suppression considerations: Copperdale has no pressurized fire hydrants and very limited access to water for firefighters from other sources. There are overhead powerlines throughout the plan unit. Downed powerlines

can be an ignition source and hazard to firefighters and residents. Some homes do not have consistent and legible address signs, which make them difficult for firefighters to find.

Recommendations for residents in Copperdale:

1. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in home ignition zones 1 and 2 (see **Figure 3.a.3**). It is recommended that every homeowner in this plan unit gets a home assessment to identify specific mitigation actions that need to be taken, as actions will vary among homes. Contact Boulder County Wildfire Partners about getting a home assessment and becoming Wildfire Partner Certified.
2. Move hazards such as wood piles, propane tanks, and old dilapidated wooden sheds at least 30 ft away from the home. Replace wooden fences with non-combustible fencing material.
3. Join, volunteer with, and support the Copperdale/Camp Eden fire mitigation group. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events. Organize community-wide home hardening and defensible space tours to demonstrate effective mitigation practices.
4. Develop an evacuation plan for your family, sign up for emergency notifications from Boulder County, and coordinate with neighbors who might need additional support during evacuations.
5. Install visible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
6. Remove trees, shrubs and tall grasses along private roads and driveways to improve evacuation safety and firefighter access during a wildfire, especially along Rudi Lane.
7. Contact your local HOA, road association, or the county to remove vegetation along shared roads in the community. Following initial fuel reduction on Highway 72 by CDOT, support the **Highway 72 Roadside Fuel Reduction** project by working with community groups and neighbors to treat fuels far enough back from the edge of the road to create a healthy fuelbreak (see **Figure 3.b.9**).
8. Install community cisterns in coordination with CCCFPD.
9. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Copperdale should expect to work with 3-4 neighbors to ensure their HIZ is mitigated.

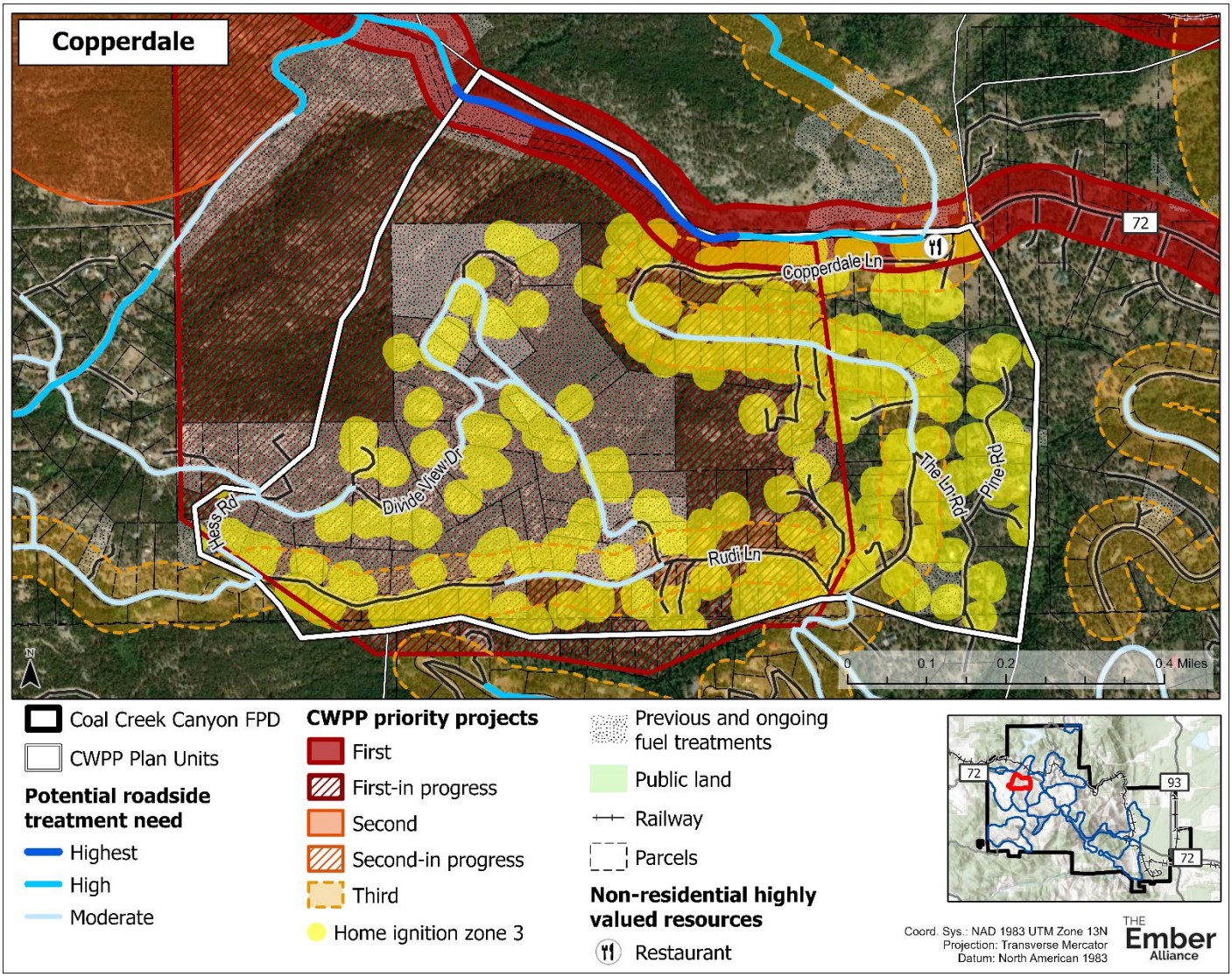


Figure 3.b.9. *HIZ, roadway, and landscape-scale priority projects recommended within the Copperdale plan unit.*

Crescent Park

High relative risk rating

Under extreme fire weather and during a fire:

- **61%** of the area could experience very high to extreme fire behavior.
- **66%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **53%** of roads (5.1 miles) have potentially non-survivable conditions.

County: Most of the plan unit is in Jefferson County, with a section to the north in Boulder County.

Vegetation, topography, and potential fire behavior: Vegetation throughout the Crescent Park plan unit is primarily dense mixed conifer and lodgepole forests with tall grassy understory, ladder fuels, and steep topography. More than 25% of the homes in this plan unit are built mid-slope. The combination of fuels, topography, and the position of homes creates the potential for extreme fire behavior that poses a threat to residents in Cresent Park.

Hazards in the home ignition zone: Homes in this plan unit are generally built with fire-resistant materials such as metal roofs and stucco siding. However, less than 50% of homes have adequate defensible space. A few homeowners in this plan unit have done a great job of mitigating risk in their home ignition zones 1 & 2. Fellow residents in Crescent Park should look to the well-mitigated homes as examples. The main threat to homes in this plan unit is embers igniting in home ignition zones 1 and 2.

Roadway accessibility and evacuation capacity: Roads in this plan unit are well maintained and accessible for firefighters. All roads can accommodate two-way traffic, and there are many pullouts and turnarounds. There are two egress routes on Crescent Park Drive and Gross Dam Road, but residents on Spruce Canyon Drive only have one way in and out from that neighborhood.

Fire suppression considerations: Crescent Park does not have hydrants, and there are only a few cisterns throughout the plan units. Most homes have visible and reflective address signs. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents.

Recommendations for residents in Crescent Park:

1. Join, support, and participate in events held by the Crescent Park Community Fire Protection Association (CPCFPA). Organize community-wide home hardening and defensible space tours to demonstrate effective mitigation practices. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
2. Prepare your home for wildfire. Mitigating wildfire risk in home ignition zones 1 and 2 is highest priority for homeowners here (see **Figure 3.a.3**). Most homeowners have taken actions to harden their home such as by replacing combustible construction materials with Class A roofs and ignition-resistant siding. It is recommended that every homeowner in this plan unit gets a home assessment from CPCFPA or Wildfire Partners to identify specific mitigation actions that need to be taken, as actions will vary among homes.
3. Move hazards such as wood piles, propane tanks, and old dilapidated wooden sheds at least 30 ft away from the home.
4. Develop evacuation plans for your family, sign up for emergency notifications from Boulder and Jefferson Counties, and coordinate with neighbors who might need additional support during evacuations.
5. Install consistent, legible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
6. Contact your local HOA, road association, or the county to remove vegetation along shared roads in the community, particularly along Butte Dr and Spruce Canyon Dr. Following initial fuel reduction on Highway 72 by CDOT, support the **Highway 72 Roadside Fuel Reduction** project by working with community groups and neighbors to treat fuels far enough back from the edge of the road to create a healthy fuelbreak (see **Figure 3.b.10**).
7. Work with CCCFPD and Jefferson County to identify a feasible secondary egress route for residents who live off Spruce Canyon Dr.
8. If you live in Boulder County, contact Boulder County Wildfire Partners about becoming Wildfire Partners Certified. If you live in Jefferson County, advocate for the county to implement a program like Wildfire Partners and host a slash sort yard or more collection events located in the fire district.
9. Install community cisterns in coordination with CCCFPD.
10. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Crescent Park should expect to work with 1-2 neighbors to ensure their HIZ is mitigated.

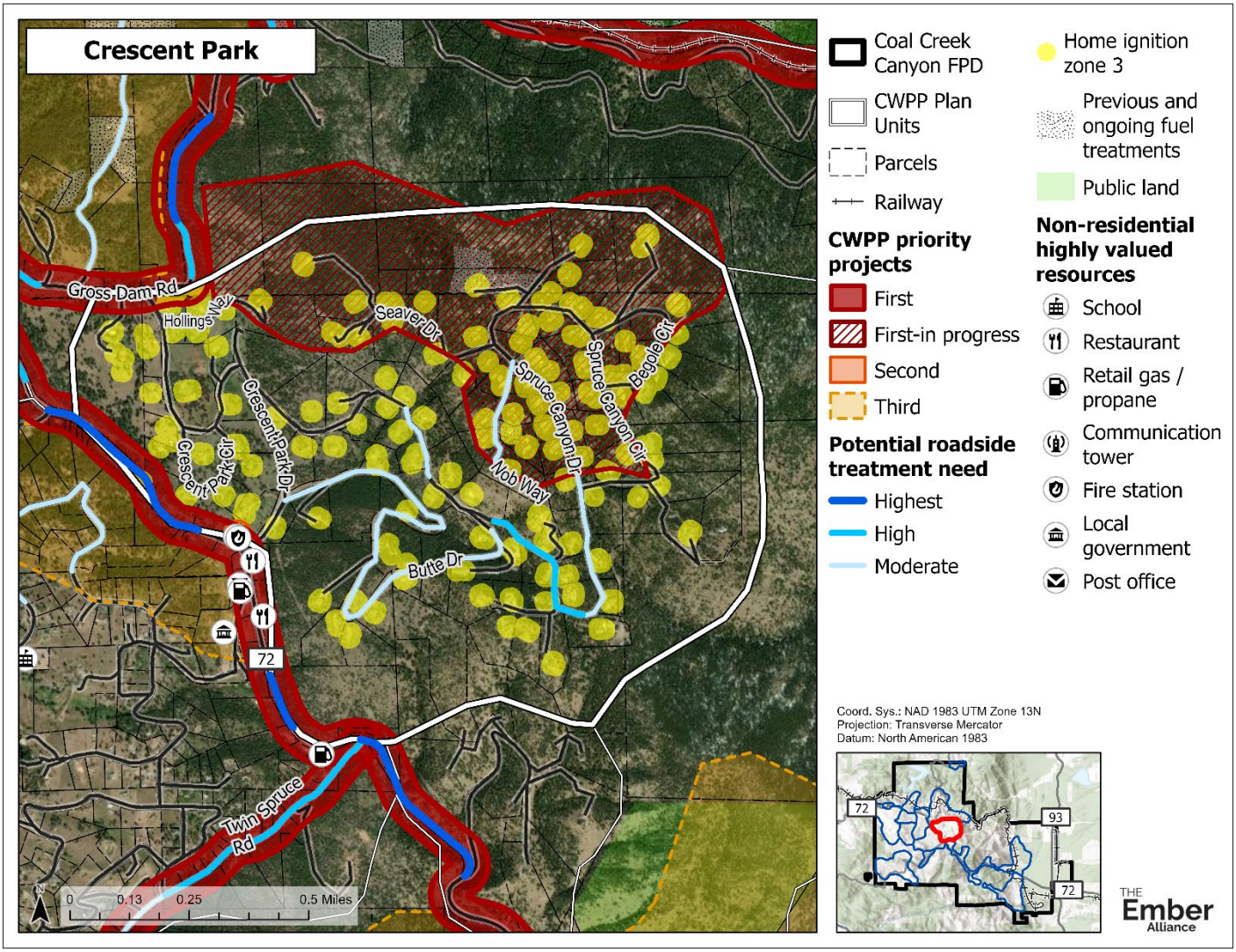


Figure 3.b.10. *HIZ, roadway, and landscape-scale priority projects recommended within the Crescent Park plan unit.*

Hilltop

High relative risk rating

Under extreme fire weather and during a fire:

- **52%** of the area could experience very high to extreme fire behavior.
- **48%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **40%** of roads (5.0 miles) have potentially non-survivable conditions.

County: The entire plan unit is in Jefferson County**.**

Vegetation, topography, and potential fire behavior: Vegetation ranges from dry mixed conifer to lodgepole, spruce fir, and aspen, with open ponderosa savannahs in the valley. Vegetation on the north facing slopes is very dense. There are many steep slopes, with narrow valleys and ridges that could increase unpredictable fire behavior. More than half the homes here are built mid-slope or on ridgetops, which puts them at risk of higher fire behavior.

Hazards in the home ignition zone: The main threat to the homes in this plan unit is embers landing on roofs or within 30 feet of the home and igniting it. Home construction is varied here, with some homes having ignition-resistant roofing and decking while others have untreated wood siding and decking. Wood siding and decking can easily ignite when exposed to direct flames or embers from a wildfire. At least a quarter of the homes have fire hazards in zones 1 and 2, and most homes do not have adequate defensible space out to zone 3.

Roadway accessibility and evacuation capacity: There are many ways out of the Hilltop neighborhood, going in different directions. Roads can accommodate two-way traffic and are generally maintained and accessible. Residents evacuating livestock can make evacuation times even longer.

Fire suppression considerations: Hilltop does not have fire hydrants, and there are not enough cisterns to defend all the homes in this area. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents. Many of the homes do not have consistent and legible address signs, which make them difficult for firefighters to find. There are additional hazards in this community, including two gas stations and large piles of tires that can be hazardous during a wildfire if not properly mitigated.

Recommendations for residents in Hilltop:

1. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in home ignition zones 1 and 2 (see **Figure 3.a.3**). It is recommended that every homeowner in this plan unit gets a home assessment from their county or CCCFPD's partners to identify specific mitigation actions that need to be taken, as actions will vary among homes.
2. Move hazards such as wood piles, propane tanks, and old dilapidated wooden sheds at least 30 ft away from the home. Replace wooden fences with non-combustible fencing material.
3. Form a fire mitigation group in your plan unit. Organize community-wide home hardening and defensible space tours to demonstrate effective mitigation practices. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
4. Develop an evacuation plan for your family, sign up for emergency notifications from Jefferson County (and consider signing up for Boulder County emergency notifications too), and coordinate with neighbors who might need additional support during evacuations.
5. Install visible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
6. Contact your local HOA, road association, or the county to remove vegetation along shared roads in the community, particularly along Twin Spruce Road, Ranch Elise Road, and Warrens Road. Following initial fuel reduction on Highway 72 by CDOT, support the **Highway 72 Roadside Fuel Reduction** project by working with community groups and neighbors to treat fuels far enough back from the edge of the road to create a healthy fuelbreak. Support Jefferson County Road and Bridge, Colorado Parks and Wildlife, and their partners in initiating and completing the **Twin Spruce Road / Gap Road Roadside Fuel Reduction** project (see **Figure 3.b.11**).
7. Install community cisterns in coordination with CCCFPD.
8. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Hilltop should expect to work with 3-4 neighbors to ensure their HIZ is mitigated.
9. Advocate for county support from Jefferson County to implement a program like Wildfire Partners and host a slash sort yard or more collection events located in the fire district.

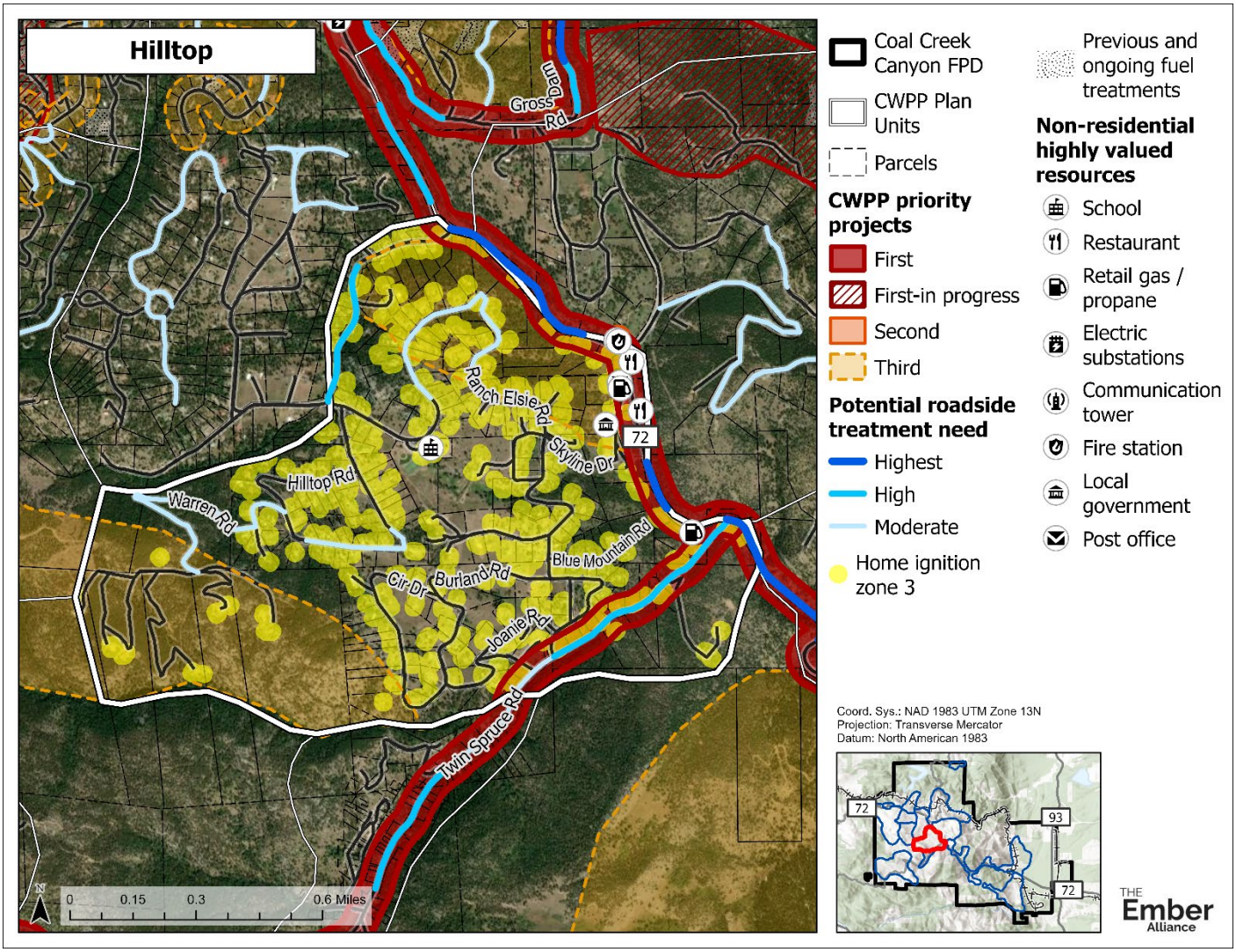


Figure 3.b.11. *HIZ, roadway, and landscape-scale priority projects recommended within the Hilltop plan unit.*

Miramonte

Extreme relative risk rating

Under extreme fire weather and during a fire:

- **70%** of the area could experience very high to extreme fire behavior.
- **75%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **93%** of roads (3.4 miles) have potentially non-survivable conditions.

County: The entire plan unit is in Boulder County.

Vegetation, topography, and potential fire behavior: Miramonte has very dense mixed conifer and lodgepole with aspen intermixed. The dense vegetation creates a potential for extreme fire behavior. There are many steep slopes, with many narrow valleys and ridges that could increase unpredictable fire behavior.

Hazards in the home ignition zone: The main threat to the homes in this plan unit is embers landing on roofs or within 30 feet of the home and igniting it. Some homes are built on hillsides and are at higher fire risk. Firefighters may not be able to protect these homes in an extreme wildfire event due to the steep slopes and limited road access with no escape routes.

Many homes in the unit are older and were not built with ignition-resistant materials. For example, wood siding and decking, found on most homes in the unit, can easily ignite when exposed to direct flames or embers from a wildfire. Many homes here have older asphalt or cedar shake roofs that are vulnerable to embers. Most of the homes have fire hazards in home ignition zones 1, 2, and 3. Many have branches near or over the roof, pine needles and leaves in the gutters, and other flammable items near the home.

Roadway accessibility and evacuation capacity: There is one primary way in and out of this community, with a secondary egress route available. Most roads cannot accommodate two-way traffic. Few people live here so congestion is not a concern. Residents evacuating livestock can make evacuation times longer.

Fire suppression considerations: Miramonte has few pressurized fire hydrants and very limited access to water for firefighters from other sources. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents. Many homes do not have consistent and legible address signs, which make them difficult for firefighters to find.

Recommendations for residents in Miramonte:

1. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in home ignition zones 1 and 2 (see **Figure 3.a.3**). Contact Boulder County Wildfire Partners about getting a home assessment and becoming Wildfire Partner Certified.
2. Move hazards such as wood piles, propane tanks, and old dilapidated wooden sheds at least 30 ft away from the home.
3. Develop an evacuation plan for your family and visitors, sign up for emergency notifications from Boulder County, and coordinate with neighbors who might need additional support during evacuations.
4. Install visible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective signs.
5. Remove vegetation along the roads, particularly along Highway 72 and continued work on Miramonte Rd. Support local community organizations and the USFS in working on the **Central Corridor Rail Line Ignition Reduction** project. Support CDOT and partners for the **Highway 72 Roadside Fuel Reduction** project (see **Figure 3.b.12**).
6. Install cisterns in coordination with CCCFPD.
7. Create linked defensible space between structures in this plan unit.

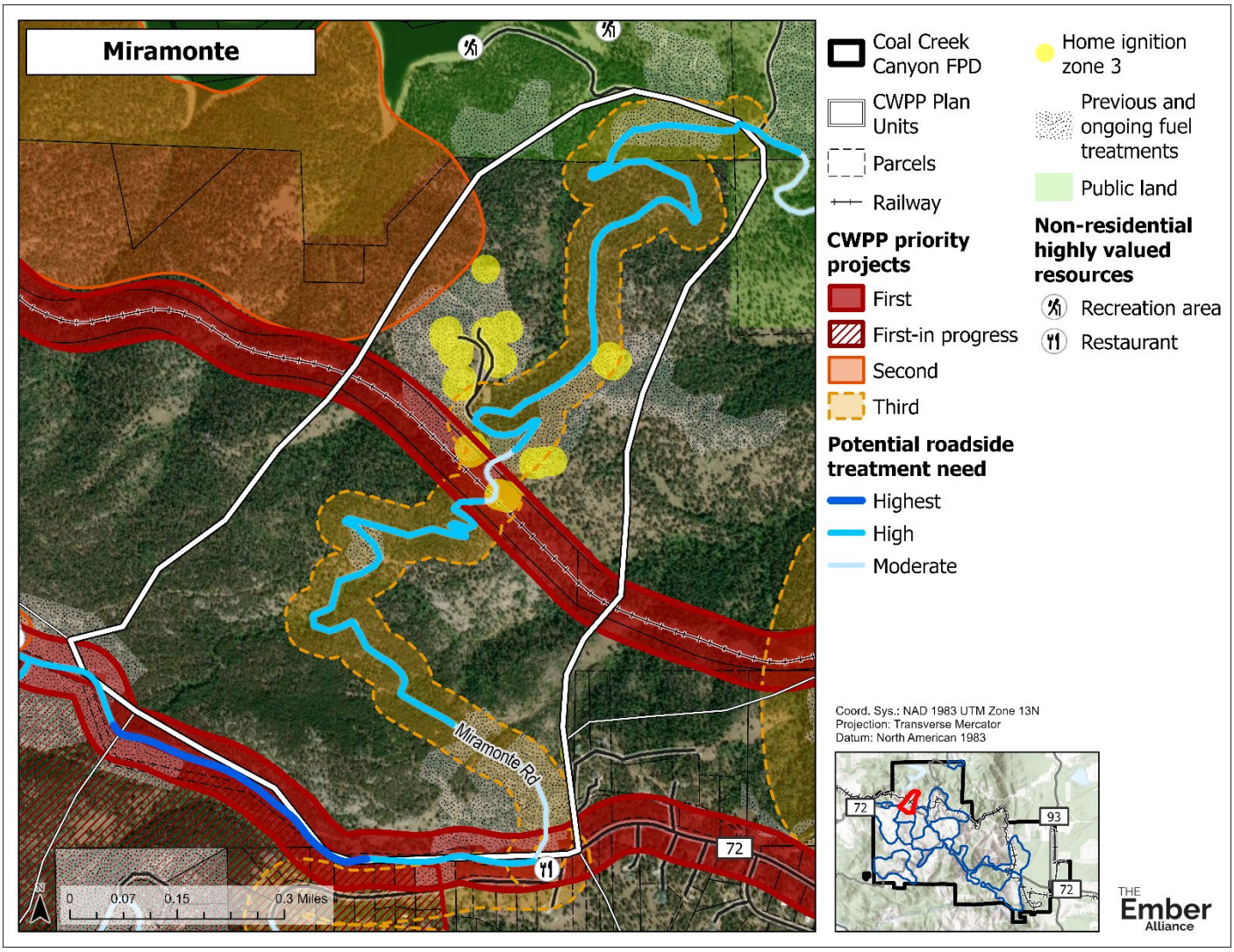


Figure 3.b.12. *HIZ, roadway, and landscape-scale priority projects recommended within the Miramonte plan unit.*

Pika

Moderate relative risk rating

Under extreme fire weather and during a fire:

- **39%** of the area could experience very high to extreme fire behavior.
- **56%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **23%** of roads (0.5 miles) have potentially non-survivable conditions.

County: The entire plan unit is in Boulder County**.**

Vegetation, topography, and potential fire behavior: Pika has a mix of dense mixed conifer and open ponderosa stands with tall grasses throughout. Dense vegetation creates the potential for extreme fire behavior. There are many steep slopes, with many narrow valleys and ridges that could increase unpredictable fire behavior.

Hazards in the home ignition zone: The main threat to the homes in this plan unit is embers landing on roofs or within 30 feet of the home and igniting it. Many homes are built on hillsides and are at higher fire risk. Firefighters may not be able to protect these homes in an extreme wildfire event due to the steep slopes and limited road access with no escape routes.

Many homes in the unit are newer and were built with ignition-resistant materials. However, most of the homes have fire hazards in home ignition zones 1, 2, and 3. Many have branches near or over the roof, pine needles and leaves in the gutters.

Roadway accessibility and evacuation capacity: There are two ways in and out of this community. Most roads are wide and accommodate two-way traffic. Switchbacks would make evacuation here slow.

Fire suppression considerations: Pika has few pressurized fire hydrants and very limited access to water for firefighters from other sources. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents. Some homes do not have consistent and legible address signs, which make them difficult for firefighters to find.

Recommendations for residents in Pika:

1. Prepare your home for wildfire. Mitigating wildfire risk in home ignition zones 1 and 2 is highest priority for homeowners here (see **Figure 3.a.3**). Most homeowners have taken actions to harden their home such as by replacing combustible construction materials with Class A roofs and ignition-resistant siding. It is recommended that every homeowner in this plan unit gets a home assessment to identify specific mitigation actions that need to be taken, as actions will vary among homes. Contact Boulder County Wildfire Partners about getting a home assessment and becoming Wildfire Partner Certified.
2. Develop an evacuation plan for your family, sign up for emergency notifications from Boulder County, and coordinate with neighbors who might need additional support during evacuations.
3. Form a fire mitigation group in your plan unit and with neighbors in Mountain View Fire Protection District. Organize community-wide home hardening and defensible space tours to demonstrate effective mitigation practices. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
4. Install visible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
5. Remove trees, shrubs and tall grasses along private roads and driveways to improve evacuation safety and firefighter access during a wildfire.
6. Install community cisterns in coordination with CCCFPD.
7. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Pika should expect to work with 1 neighbor to ensure their HIZ is mitigated.

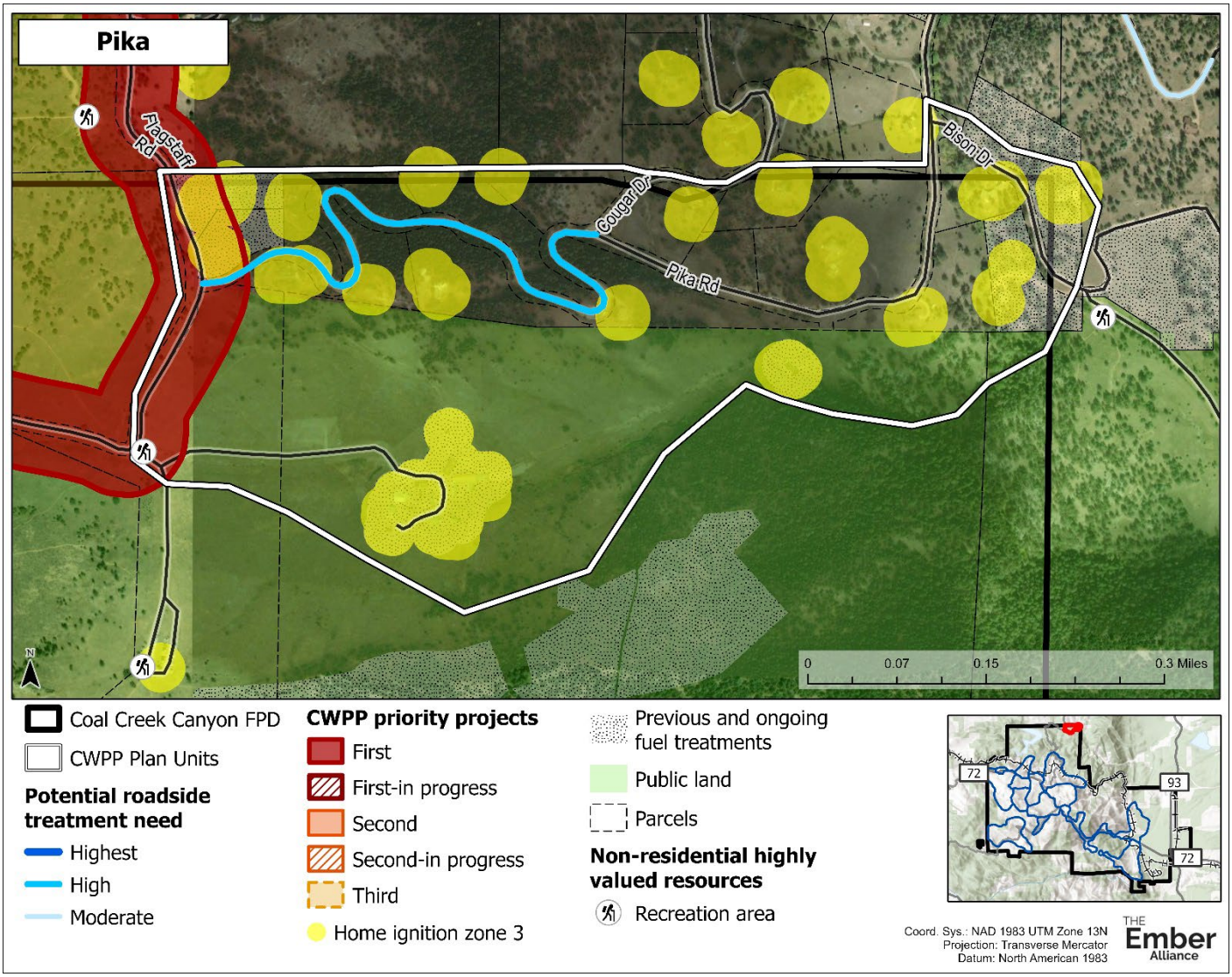


Figure 3.b.13. *HIZ, roadway, and landscape-scale priority projects recommended within the Pika plan unit.*

Plainview

Moderate relative risk rating

Under extreme fire weather and during a fire:

- **15%** of the area could experience very high to extreme fire behavior.
- **0%** of homes are exposed to radiant heat from burning vegetation.
- **83%** of homes are exposed to embers from burning vegetation.
- **4%** of the roads (0.2 miles) have potentially non-survivable conditions.

County: This plan unit is in Jefferson County**.**

Vegetation, topography, and potential fire behavior: In the Plainview plan unit, foothills transition into plains, and homes are nestled against the gentle slopes, with some in forested locations. Due to the lack of continuous forest cover in this plan unit, there is little risk of active crown fire. However, fire can move quickly through tall grasses and, if left unmitigated, can cause homes to ignite.

Hazards in the home ignition zone: Homes in this plan unit are a mix of construction materials. About 50% of homes have class A roofs made of non-combustible materials such as metal, while the other 50% are made of combustible materials such as wood shingles and old asphalt with many cracks, making them susceptible to embers landing on the roof and igniting the home. Similarly, many homes have untreated wood siding and decking that is not fire-resistant. Homes in this plan unit do not have adequate mitigation in home ignition zones 1 & 2. Many homes have hazards including wood piles, old wooden sheds, and propane tanks within 30 ft of the home. The main threat to the homes in this plan unit is embers landing within 30 feet of the home and igniting it.

Roadway accessibility and evacuation capacity: Roads in the Plainview plan unit are accessible for firefighters and can accommodate two-way traffic. However, there is only one primary egress route for community members in this plan unit, which limits the ability of residents to evacuate quickly during an emergency. There is a railroad crossing in this plan unit, which has the potential to delay evacuation times and trap residents in case of an emergency. There is a new development in this plan unit underway that will significantly increase the population here. It is recommended that this neighborhood have at least two quality egress routes.

Fire suppression considerations: The Plainview plan unit does not have hydrants, and there are only a few cisterns. Most homes have visible and reflective address signs. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents.

Recommendations for residents in the Plainview plan unit:

1. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in home ignition zones 1 and 2 (see **Figure 3.a.3**). It is recommended that every homeowner in this plan unit gets a home assessment from their county or CCCFPD's partners to identify specific mitigation actions that need to be taken, as actions will vary among homes.
2. Move hazards such as wood piles, propane tanks, and old dilapidated wooden sheds at least 30 ft away from the home. Replace wooden fences with non-combustible fencing material.
3. Form a fire mitigation group in your plan unit. Organize community-wide home hardening and defensible space tours to demonstrate effective mitigation practices. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
4. Develop an evacuation plan for your family, sign up for emergency notifications from Jefferson County (and consider signing up for Boulder County emergency notifications too), and coordinate with neighbors who might need additional support during evacuations.
5. Remove vegetation along the roads, particularly along Highway 72. Support local community organizations and the USFS in working on the **Central Corridor Rail Line Ignition Reduction** project. Support CDOT and partners for the **Highway 72 Roadside Fuel Reduction** project (**Figure 3.b.14**).
6. Install community cisterns in coordination with CCCFPD.
7. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Plainview should expect to work with 1-2 neighbors to ensure their HIZ is mitigated.
8. Work with CCCFPD and Jefferson County to identify a feasible secondary egress route out of the community.
9. Advocate for county support from Jefferson County to implement a program like Wildfire Partners and host a slash sort yard or more collection events located in the fire district.

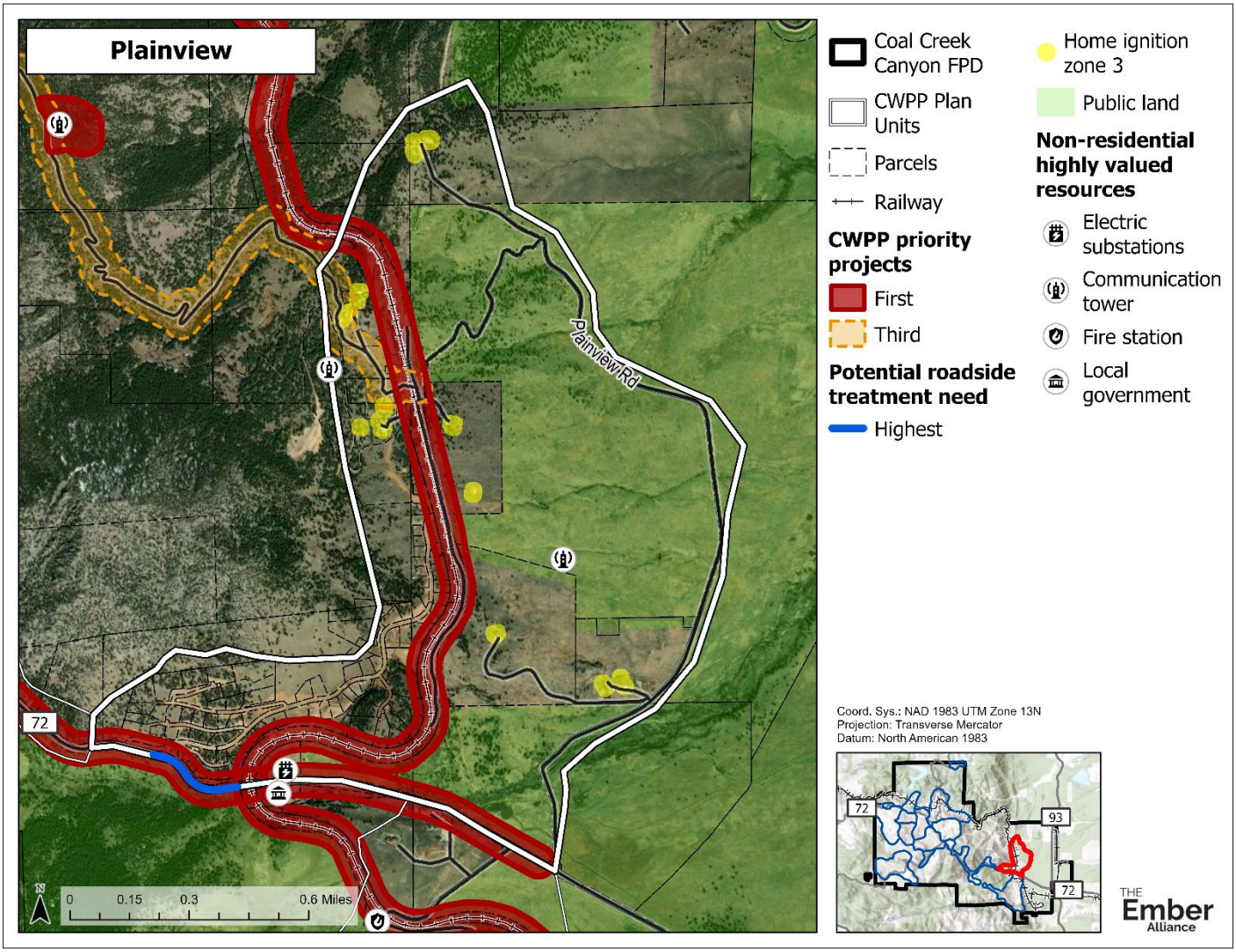


Figure 3.b.14. *HIZ, roadway, and landscape-scale priority projects recommended within the Plainview plan unit.*

Upper Twin Spruce

Extreme relative risk rating

Under extreme fire weather and during a fire:

- **54%** of the area could experience very high to extreme fire behavior.
- **69%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **44%** of roads (7.6 miles) have potentially non-survivable conditions.

County: About two-thirds of the plan unit residents are in Jefferson County and one third in Gilpin County.

Vegetation, topography, and potential fire behavior: Upper Twin Spruce is mostly covered by dense mixed conifer, with lodgepole pine stands and some ponderosa pine scattered throughout. Slopes are steep with many narrow valleys and ridges that could increase unpredictable fire behavior. There is some potential for extreme fire behavior due to the slopes and dense vegetation.

Hazards in the home ignition zone: The main threat to the homes in this plan unit is embers landing on roofs or within 30 feet of the home and igniting it. Most homes here are older and were not built with ignition-resistant materials. For example, wood siding and decking can easily ignite when exposed to direct flames or embers from a wildfire. Homes located along Skyline Drive appear to be built with more ignition-resistant materials and tend to have mitigation completed in zones 1 and 2, but other areas of the neighborhood are more varied in their construction and defensible space.

Roadway accessibility and evacuation capacity: There are two ways out of the area once residents get to Gap Road. However, a couple of the neighborhood roads are steep, narrow, or only have one-lane, which will make it difficult for residents to evacuate and for firefighters to access and protect homes during a wildfire. Some properties had livestock that may require additional time to evacuate.

Fire suppression considerations: Upper Twin Spruce does not have hydrants and there are not enough cisterns in the area to defend the homes. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents. Many of the homes do not have clear and reflective address signs, which make them difficult for firefighters to find.

Recommendations for residents in Upper Twin Spruce:

1. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in home ignition zones 1 and 2 (see **Figure 3.a.3**). It is recommended that every homeowner in this plan unit gets a home ignition zone (HIZ) assessment from their county or CCCFPD's partners to identify specific mitigation actions that need to be taken, as actions will vary among homes.
2. Move hazards such as wood piles, propane tanks, and old dilapidated wooden sheds at least 30 ft away from the home. Replace wooden fences with non-combustible fencing material.
3. Form a fire mitigation group in your plan unit. Organize community-wide home hardening and defensible space tours to demonstrate effective mitigation practices. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
4. Develop an evacuation plan for your family, sign up for emergency notifications from Jefferson and Gilpin County (and consider signing up for Boulder County emergency notifications too), and coordinate with neighbors who might need additional support during evacuations.
5. Install visible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
6. Contact the appropriate county to remove vegetation along shared roads in the community, particularly along Gap Rd, Lyttle Dowdle Dr, Nadm Dr, and Standing Pines. Support Jefferson County Road and Bridge, Colorado Parks and Wildlife, and their partners in initiating and completing the **Twin Spruce Road / Gap Road Roadside Fuel Reduction** project (see **Figure 3.b.15**).
7. Install community cisterns in coordination with CCCFPD.
8. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Upper Twin Spruce should expect to work with 2 neighbors to ensure their HIZ is mitigated.
9. Advocate for county support from Jefferson and Gilpin Counties to implement a program like Wildfire Partners and host a slash sort yard or more collection events located in the fire district.

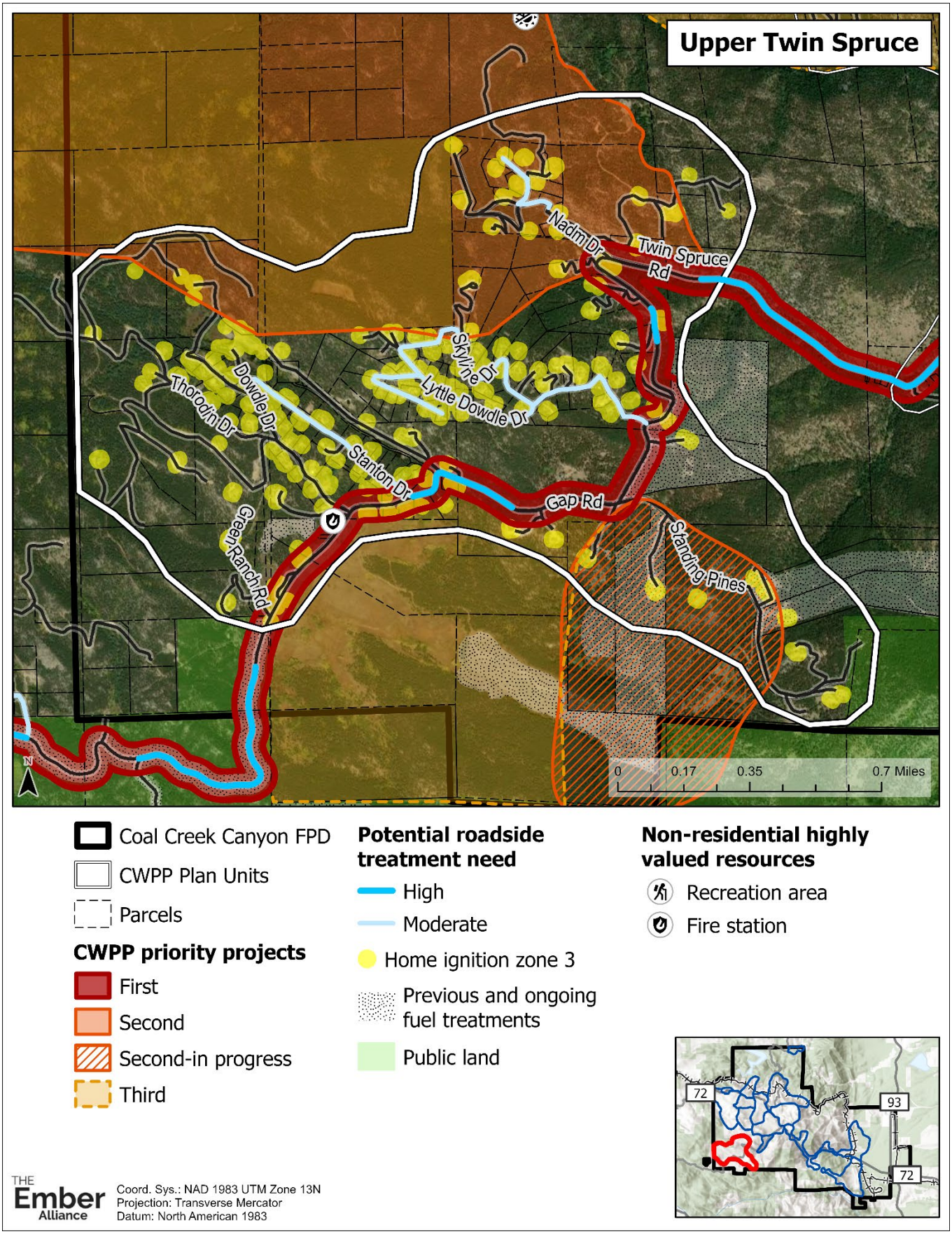


Figure 3.b.15. *HIZ, roadway, and landscape-scale priority projects recommended within the Upper Twin Spruce plan unit.*

Vonnie Claire

High relative risk rating

Under extreme fire weather and during a fire:

- **54%** of the area could experience very high to extreme fire behavior.
- **65%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **33%** of roads (3.4 miles) have potentially non-survivable conditions.

County: The plan unit is half in Jefferson County and half in Boulder County, with most homes in Jefferson County.

Vegetation, topography, and potential fire behavior: Vonnie Claire is mostly covered by very dense mixed conifer, lodgepole and spruce-fir forest, which create a potential for extreme fire behavior. There are many steep slopes, with many narrow valleys and ridges that could increase unpredictable fire behavior.

Hazards in the home ignition zone: The main threat to the homes in this plan unit is embers landing on roofs or within 30 feet of the home and igniting it. Many homes are built on hillsides and are at higher fire risk. Firefighters may not be able to protect these homes in an extreme wildfire event due to the steep slopes and limited road access with no escape routes. Many homes in the unit are older and were not built with ignition-resistant materials. For example, wood siding and decking, found on most homes in the unit, can easily ignite when exposed to direct flames or embers from a wildfire. Most homes here have good roofs, but poor siding and decking with additional hazards within 30 ft of home. Some homes have older asphalt roofs that are vulnerable to embers. Many of the homes have fire hazards in home ignition zones 1, 2, and 3. Some have branches near or over the roof, pine needles and leaves in the gutters, and other flammable items near the home. While some homes here have mitigation done in zones 1 and 2, residents in Vonnie Claire need to focus on reducing the presence of hazards in the home ignition zone.

Roadway accessibility and evacuation capacity: There are only two ways in and out of most of this community. Crescent Lake Road has only one in and out. Practically all roads can accommodate two-way traffic. There are steep roads, switchbacks, and limited turnarounds that can cause traffic to get backed up or move slowly. The roads are generally well maintained with pullouts and turnarounds at dead ends. Residents evacuating livestock can make evacuation times even longer.

Post-fire flooding and sediment delivery potential: The portion of this plan unit that is north of Highway 72 is at high risk of post-fire sediment delivery. Nearly all the homes north of Highway 72 and one place of worship are located in this area of high risk.

Fire suppression considerations: Vonnie Claire has few pressurized fire hydrants and very limited access to water for firefighters from other sources. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents. Many of the homes do not have consistent and legible address signs, which make them difficult for firefighters to find.

Recommendations for residents in Vonnie Claire:

1. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in home ignition zones 1 and 2 (see **Figure 3.a.3**). It is recommended that every homeowner in this plan unit gets a home assessment to identify specific mitigation actions that need to be taken, as actions will vary among homes. Contact Boulder County Wildfire Partners about getting a home assessment and becoming Wildfire Partner Certified.
2. Move hazards such as wood piles, propane tanks, and old dilapidated wooden sheds at least 30 ft away from the home. Replace wooden fences with non-combustible fencing material.
3. Form a fire mitigation group in your plan unit or neighborhood. Organize community-wide home hardening and defensible space tours to demonstrate effective mitigation practices. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
4. Develop an evacuation plan for your family, sign up for emergency notifications from both Boulder and Jefferson Counties, and coordinate with neighbors who might need additional support during evacuations.
5. Install visible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your county for installation of reflective street signs.
6. Contact your local HOA or the appropriate county to remove vegetation along shared roads in the community, especially along Highway 72, Crescent Lake Road, Vonnie Claire Road, and Lillis Way. Following initial fuel reduction on Highway 72 by CDOT, support the **Highway 72 Roadside Fuel Reduction** project by working with community groups and neighbors to treat fuels far enough back from the edge of the road to create a healthy fuelbreak (see **Figure 3.b.16**).
7. Install community cisterns in coordination with CCCFPD.
8. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Vonnie Claire should expect to work with 3 neighbors to ensure their HIZ is mitigated.
9. Work with CCCFPD and the counties to identify a feasible secondary egress route for residents along Crescent Lake Rd.
10. If you live in Boulder County, contact Boulder County Wildfire Partners about becoming Wildfire Partners Certified. If you live in Jefferson County, advocate for the county to implement a program like Wildfire Partners and host a slash sort yard or more collection events located in the fire district.
11. Homes north of Coal Creek Canyon Drive in the Vonnie Claire Plan Unit could be exposed to damaging post-fire flooding and sediment delivery (see analysis in **Appendix B**). Homeowners are encouraged to take proactive measures to prepare, including (1) working with your insurance agent to determine your need for flood insurance and/or an earth movement, earthquake, and landslide rider to your homeowner's policy, (2) elevating and anchoring electrical panels, propane tanks, wiring, appliance, and heating systems, (3) securing important documents in waterproof deposit boxes, (4) ensuring sump pumps are working and have battery-operated backup power sources, (5) installing terraces or slope drains that could protect your home but without altering drainage patterns that could worsen conditions for your neighbors, and (6) consulting with a qualified forester to discuss pre-fire fuel treatments to limit sediment delivery damages from burn scars. Reducing fuel loading in areas of concern can reduce wildfire severity, decrease the likelihood that hydrophobic soils (soils that repel water) form, and reduce the loss of roots, vegetation, and plant litter that hold soil in place. Reduced fire severity can therefore reduce the potential for flooding and sediment transport in some cases. Reduced

fire severity can therefore reduce the potential for flooding and sediment transport in some cases. Visit the storymap "A dangerous path" from the Boulder Watershed Collective for more information on preparing for debris flows.

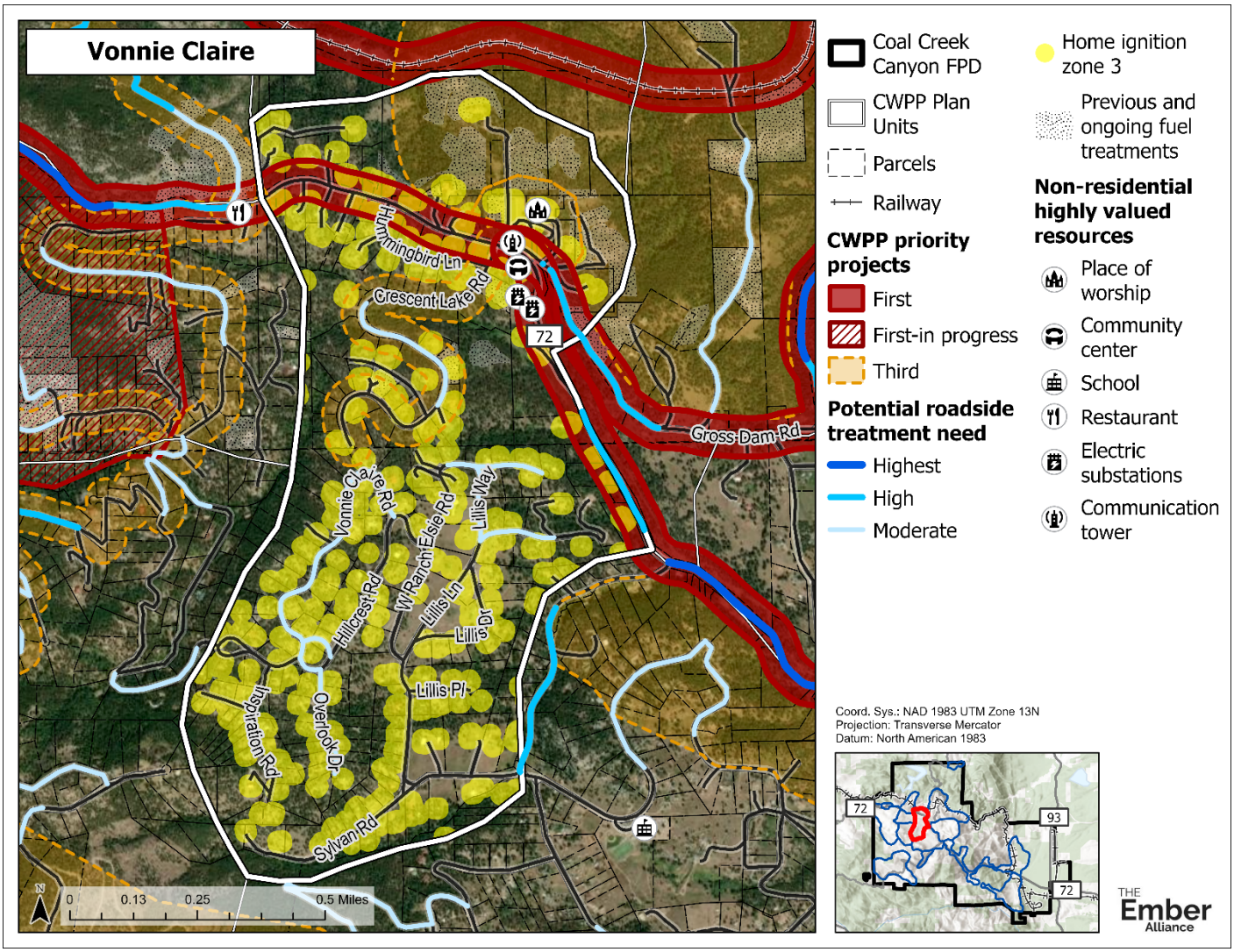


Figure 3.b.16. *HIZ, roadway, and landscape-scale priority projects recommended in the Vonnie Claire plan unit.*

Wondervu

Most extreme relative risk rating

Under extreme fire weather and during a fire:

- **66%** of the area could experience very high to extreme fire behavior.
- **49%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **27%** of roads (0.8 miles) have potentially non-survivable conditions.

County: The plan unit is mainly in Boulder County, with a small portion in Gilpin County.

Vegetation, topography, and potential fire behavior: Wondervu has very dense mixed conifer and lodgepole with aspen intermixed. This dense vegetation creates a potential for extreme fire behavior. There are many steep slopes, with many narrow valleys and ridges that could increase unpredictable fire behavior.

Hazards in the home ignition zone: The main threat to the homes in this plan unit is embers landing on roofs or within 30 feet of the home and igniting it. Most homes are built on hillsides above dense vegetation and are at higher fire risk. Firefighters may not be able to protect these homes in an extreme wildfire event due to the steep slopes and limited road access with no escape routes. The dense construction of the area is an added concern as it can allow for building-to-building ignitions. Many homes in the unit are older and were not built with ignition-resistant materials. For example, wood siding and decking, found on most homes in the unit, can easily ignite when exposed to direct flames or embers from a wildfire. Many homes here have older asphalt or cedar shake roofs that are vulnerable to embers. Most of the homes have fire hazards in home ignition zones 1, 2, and 3 including outbuildings. Many have branches near or over the roof, pine needles and leaves in the gutters, and other flammable items near the home. There are lots of flammable, dilapidated structures.

Roadway accessibility and evacuation capacity: There are two ways in and out of this community. Most roads cannot accommodate two-way traffic. There are limited turnarounds, which can cause traffic to get backed up or move slowly. The roads in this area are washed out and poorly maintained, which makes them even more difficult to navigate.

Post-fire flooding and sediment delivery potential: The northwest portion of this plan unit is at high risk of post-fire sediment delivery. Many homes are located in this area of high risk, but no critical infrastructure is present.

Fire suppression considerations: Wondervu has no pressurized fire hydrants and very limited access to water for firefighters from other sources. There are overhead powerlines throughout the plan unit. Downed powerlines can be an ignition source and hazard to firefighters and residents. Many homes do not have consistent and legible address signs, which make them difficult for firefighters to find.

Due to the quantity of overlapping hazards in this plan unit, it is designated as the highest risk area within Coal Creek Canyon.

Recommendations for residents in Wondervu:

1. Form a fire mitigation group in your plan unit. Organize home hardening and defensible space tours to demonstrate effective mitigation practices. Find out how to organize a neighborhood event with your local Saws and Slaws group and volunteer at those events.
2. Prepare your home for wildfire. Residents should start with hardening their homes, then complete mitigation actions in home ignition zones 1 and 2 (see **Figure 3.a.3**). Most of the homes in this plan unit are built of highly flammable construction materials such as cedar shake roofs. It is recommended that every homeowner in this plan unit gets a home assessment to identify specific mitigation actions that need to be taken, as actions will vary among homes. Contact Boulder County Wildfire Partners about getting a home assessment and becoming Wildfire Partner Certified.
3. Move hazards such as wood piles, propane tanks, and old dilapidated wooden sheds at least 30 ft away from the home. Replace wooden fences with non-combustible fencing material.
4. Work with neighbors to create linked defensible space. Projects that span multiple properties are more effective at reducing wildfire risk. Contractor costs can sometimes be shared among homeowners, reducing the cost for everyone involved. On average, residents in Wondervu should expect to work with 19 neighbors to ensure their HIZ is mitigated.
5. Develop an evacuation plan for your family, sign up for emergency notifications from Boulder County, and coordinate with neighbors who might need additional support during evacuations.
6. Remove trees, shrubs and tall grasses along private roads and driveways. Where possible, widen roads and driveways and create pullouts and turnarounds to improve evacuation safety and firefighter access.
7. Contact your local road association or the appropriate county to remove vegetation along shared roads in the community, particularly along Outlook Dr. Following initial fuel reduction on Highway 72 by CDOT, support the **Highway 72 Roadside Fuel Reduction** project by working with community groups and neighbors to treat fuels far enough back from the edge of the road to create a healthy fuelbreak (see **Figure 3.b.17**).
8. Install visible, reflective address and street signs. Address signs can be purchased from CCCFPD. Contact your local county for installation of reflective street signs.
9. Install community cisterns in coordination with CCCFPD.
10. Most homes in Wondervu could be exposed to damaging post-fire flooding and sediment delivery (see analysis in **Appendix B**). Homeowners are encouraged to take proactive measures to prepare, including (1) working with your insurance agent to determine your need for flood insurance and/or an earth movement, earthquake, and landslide rider to your homeowner's policy, (2) elevating and anchoring electrical panels, propane tanks, wiring, appliance, and heating systems, (3) securing important documents in waterproof deposit boxes, (4) ensuring sump pumps are working and have battery-operated backup power sources, (5) installing professionally engineered terraces or slope drains that could protect your home but without altering drainage patterns that could worsen conditions for your neighbors, and (6) consulting with a qualified forester to discuss pre-fire fuel treatments to limit sediment delivery damages from burn scars. Reducing fuel loading in areas of concern can reduce wildfire severity, decrease the likelihood that hydrophobic soils (soils that repel water) form, and reduce the loss of roots, vegetation, and plant litter that hold soil in place. Reduced fire severity can therefore reduce the potential for flooding and sediment transport in some cases. Reduced fire severity can therefore reduce the potential for flooding and sediment transport in some cases. Visit the storymap "A dangerous path" from the Boulder Watershed Collective for more information on preparing for debris flows.

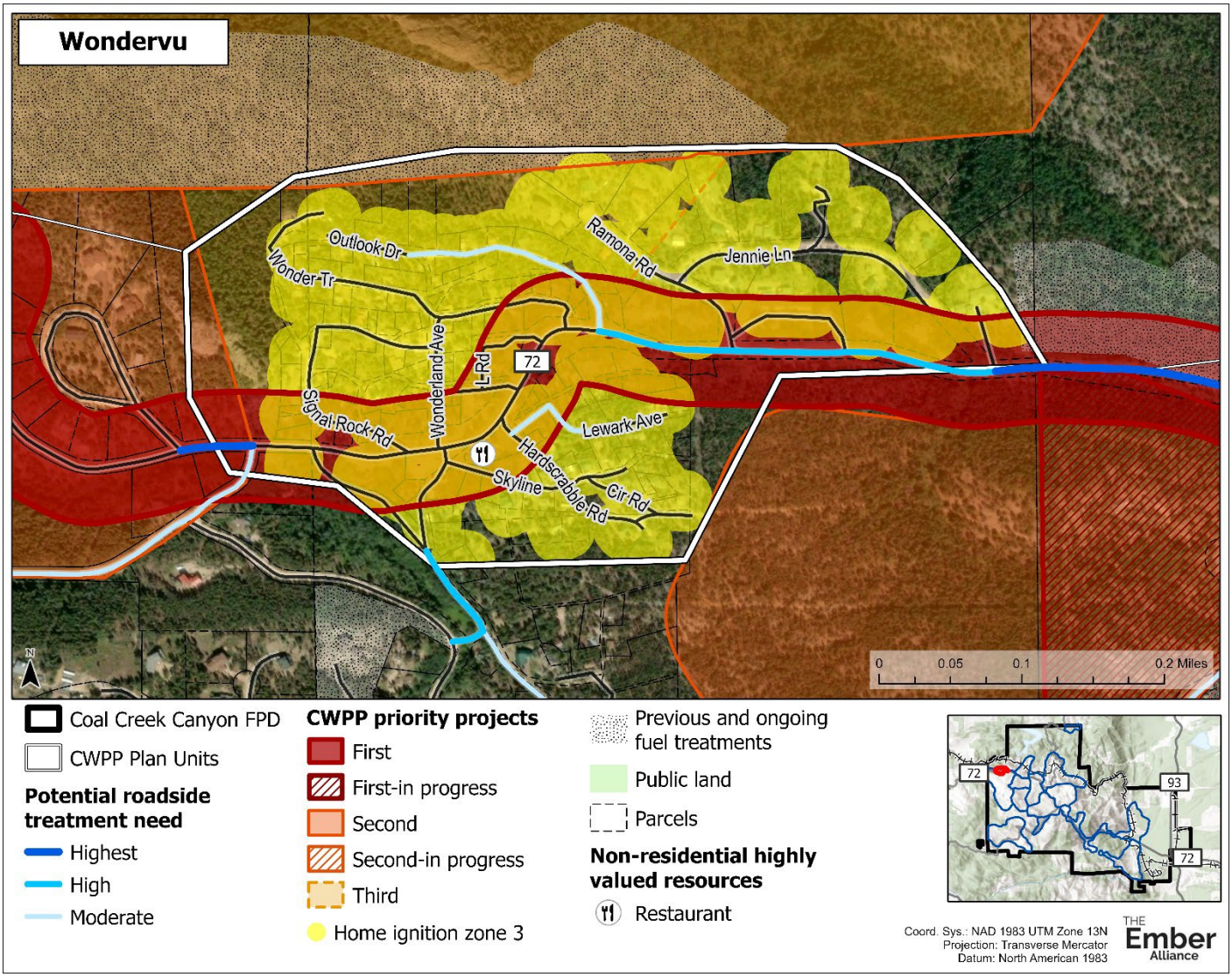


Figure 3.b.17. *HIZ, roadway, and landscape-scale priority projects recommended within the Wondervu plan unit.*

3.c. Home Ignition Zone 3 Recommendations by Vegetation Type

Local knowledge and professional expertise are needed to design effective, site-specific fuel treatments based on the best available science. Specific fuel treatment recommendations are dependent on forest type, tree density, fuel loads, terrain, land use, and management objectives. The location and purpose of treatments also matter. Treatments in large, forested areas can include the retention of individual trees and groups of trees in ponderosa pine ecosystems or patch cuts in lodgepole pine ecosystems. Evenly and widely spacing trees might be reasonable in zone 3, but this tree arrangement would not be appropriate for restoration-style fuel treatments.

Treatments in zone 3 (30-100 feet away from the home) can restore historical forest structure, but it is most important to focus on reducing wildfire risk to the home, creating safer conditions for fire fighters, and increasing the visibility of your home from the road for firefighters. Homeowners often enjoy the more open forest around their home because it lets in more light that encourages understory grasses and shrubs to grow and, in turn, can increase wildlife sightings near their home. Zone 3 often overlaps neighboring properties and requires residents to work together to address shared wildfire risk.

For all fuel treatments, it is important to address surface fuels. Forest management operations often increase surface fuel loads and can fail to achieve fire mitigation objectives if fuels created by the harvest activities (also known as slash) are not addressed (Agee and Skinner, 2005). Slash can include small trees, limbs, bark, and treetops. See **Approaches to Slash Management** for pros and cons of different slash management options.

Mitigating the impacts of tree removal on soil compaction and erosion is also important when treatments occur near streams and riparian ecosystems. The Colorado State Forest Service recommends streamside management zones of at least 50 feet (CSFS, 2023). Treatments should be monitored for colonization of invasive, weedy plants that might require control through integrated weed management. It's always a good idea to take pictures of treatments before and after to help evaluate effectiveness and monitor changes over time.

Here we provide general recommendations for treatments in zone 3 by vegetation types. Guidance for defensible space is summarized from the CSFS publication The Home Ignition Zone. **It is important to work with a forester that has experience and knowledge in creating defensible space so they can help you design an effective treatment specific to vegetation type, slope, and other conditions around your home.**

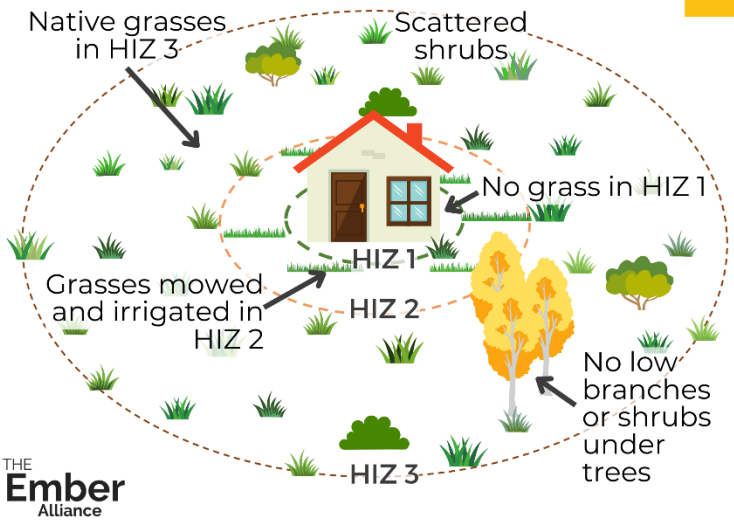
Grasslands

Species: Blue grama, little bluestem, prairie dropseed, buffalograss, sideoats grama, others

Typical elevation: 4,000-6,500 ft

Fire return interval: 2 to 20 years (frequent)

Fire severity: Low severity



Sources: CSFS Home Ignition Zone; Grassland Management in Boulder

Wildfires can spread rapidly across grasslands, and the management of grasslands is important for both fire resilience and ecological restoration.

Management in Home Ignition Zone 3

- Homeowners adjacent to grasslands should focus their efforts in HIZ 1 and 2.
- Mowing grass is not required in HIZ 3.
- Remove cheatgrass and smooth brome with herbicide, grazing, or prescribed burns, and seed with native species.
- Replace wooden fences with non-flammable materials to reduce the chance of fire spreading from grasses to fences to homes.
- Use goats, cows, or other livestock to manage grasses and/or woody plants.
- Where appropriate, conserve prairie dogs. Their activity creates bare ground that can slow the spread of fire.

Shrublands

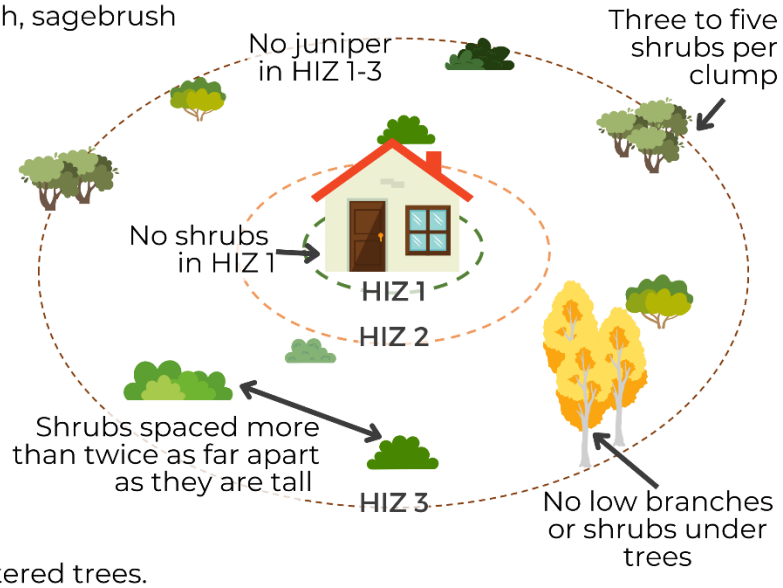
Species: Rocky mountain juniper, common juniper, Gambel oak, mountain mahogany, antelope bitterbrush, sagebrush

Typical elevation: 4,000-9,000 ft

Fire return interval: 2-30 years (frequent)

Fire severity: Low to moderate severity, depending on fuel continuity.

Shrubs that are close together and adjacent to homes are hazardous. In dry climates like Colorado, they can burn very hot and emit embers.



Management in Home Ignition Zone 3

- Remove shrubs under tree canopies.
- Remove limbs below 6-10 feet on scattered trees.
- Remove common junipers, which are highly flammable.
- Thin clumps of shrubs down to three to five shrubs/clump. Favor leaving large, old, Gambel oaks for biodiversity.
- Use mastication, mowing, herbicide, and prescribed fire for shrub removal, depending on the species and appropriate use of these management tools.
- Use goats, cows, or other livestock to manage grasses and/or woody plants.

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Source: CSFS Home Ignition Zone

Ponderosa pine mixed conifer

Species: Ponderosa pine, Douglas-fir, aspen, juniper, white fir, gamble oak

Typical elevation: 6,300-9,500 ft

Fire return interval: 7-50 years (frequent)

Fire severity: Low- to moderate-severity, with some smaller patches of stand-replacing fire where most or all trees die

Ponderosa pine mixed conifer forests are fire dependent. Historically, fire burned across the forest floor, controlling tree regeneration, removing lower limbs on mature trees, and creating large, open spaces between trees.

Human management activities (grazing, logging, fire suppression) have resulted in unnaturally dense forests. During extreme weather, high winds can easily spread fire between tree crowns, resulting in very large high-severity wildfires where most trees are killed. This is not always the case but is a trend that has occurred more frequently in this forest type in the last few decades.

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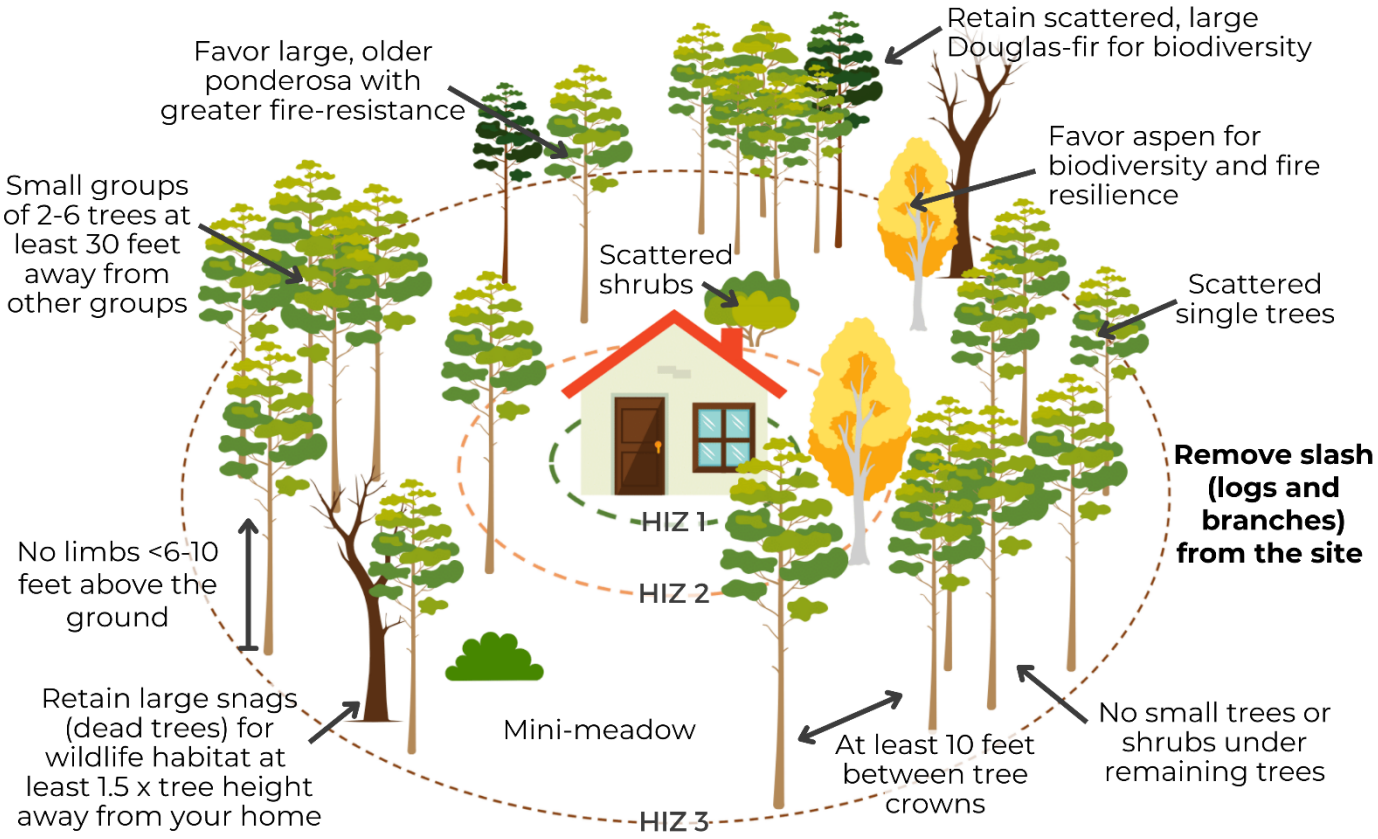
Management in Home Ignition Zone 3

To restore ecological conditions, increase fire resilience, and increase your home's ability to stand against wildfire, leave only 25-60 trees/acre in HIZ 3 (15-40 trees within 30 to 100 feet of your home) and create mini-meadows for grasses, wildflowers, and scattered shrubs.



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Sources: CSFS Home Ignition Zone; Battaglia et al. 2018. Forest Ecology & Management 422:147-160; Rocky Mountain Research Station GTR-310.

Douglas-fir mixed conifer

Species: Douglas-fir, ponderosa pine, lodgepole, aspen, white fir, occasional spruce, limber pine, gamble oak

Typical elevation: 6,000-9,500 ft

Fire return interval: 20 to >100 years (semi-frequent)

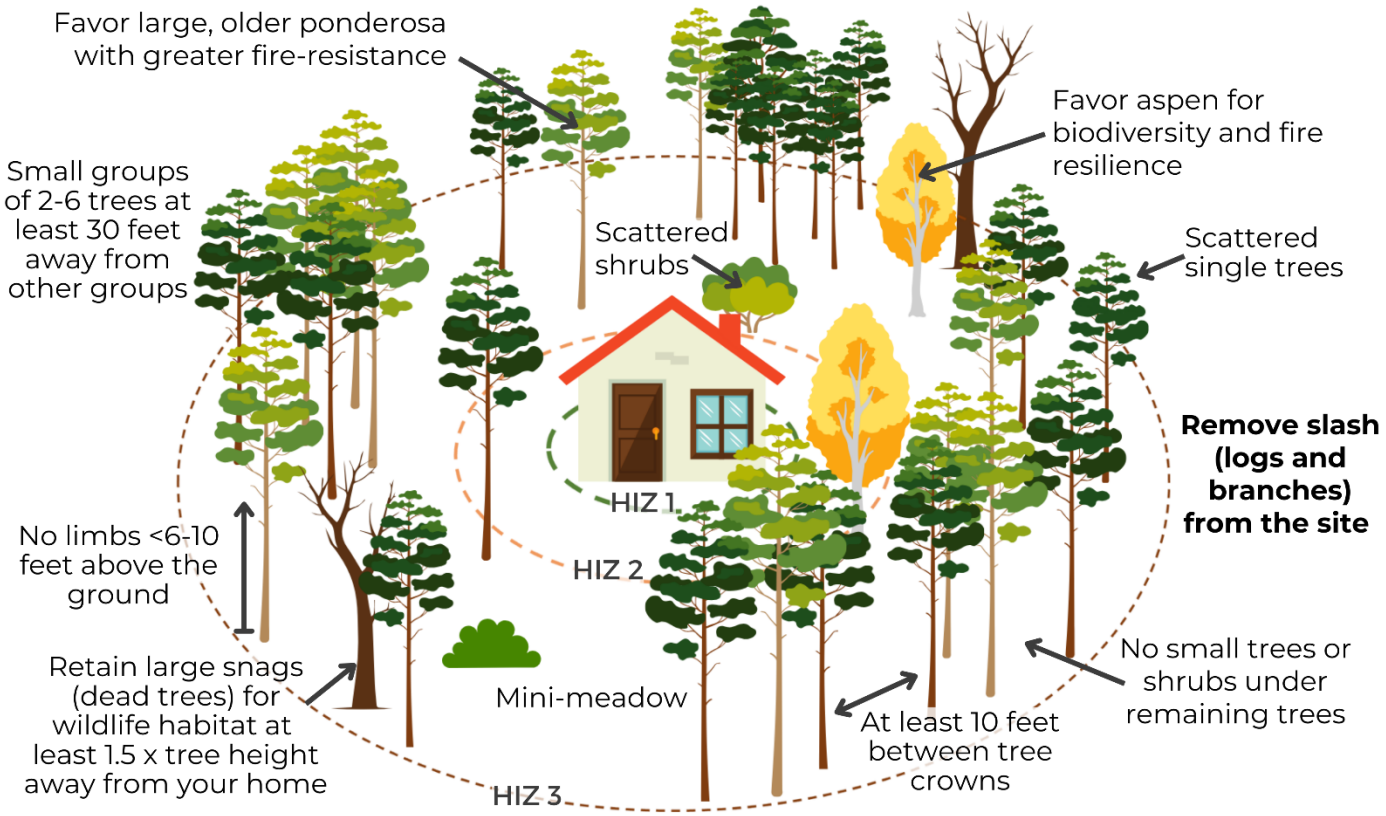
Fire severity: Moderate-severity with patches of stand-replacing fire where most or all trees die

Douglas-fir mixed conifer forests contain a diversity of tree species, many of which are not as fire tolerant as ponderosa pine. These forests also tend to be cooler and wetter, and as a result do not burn as frequently. When fire burns in these areas, patches of stand-replacing fire can be common. These forests are naturally denser than lower elevation forests, but human management activities (grazing, logging, fire suppression) have resulted in unnaturally dense forests that can fuel larger, more extreme wildfires.

COLORADO FOREST RESTORATION INSTITUTE

Management in Home Ignition Zone 3

To restore ecological conditions, increase fire resilience, and increase your home's ability to stand against wildfire, leave only 25-60 trees/acre in HIZ 3 (15-40 trees within 30 to 100 feet of your home) and create mini-meadows for grasses, wildflowers, and scattered shrubs.



THE Ember Alliance

Sources: CSFS Home Ignition Zone; Battaglia et al. 2018. Forest Ecology & Management 422:147-160; Rocky Mountain Research Station GTR-310.

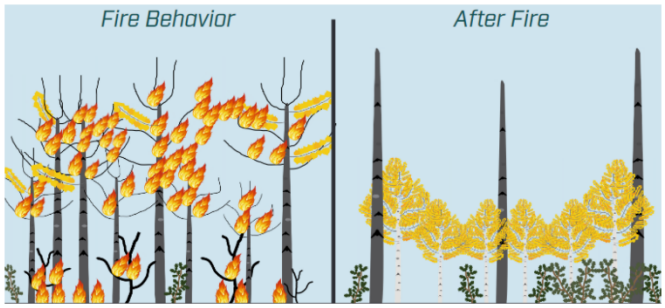
Aspen forests

Species: Aspen, occasional ponderosa pine, lodgepole pine, blue spruce, or other conifers

Typical elevation: Highly variable

Fire return interval: Highly variable

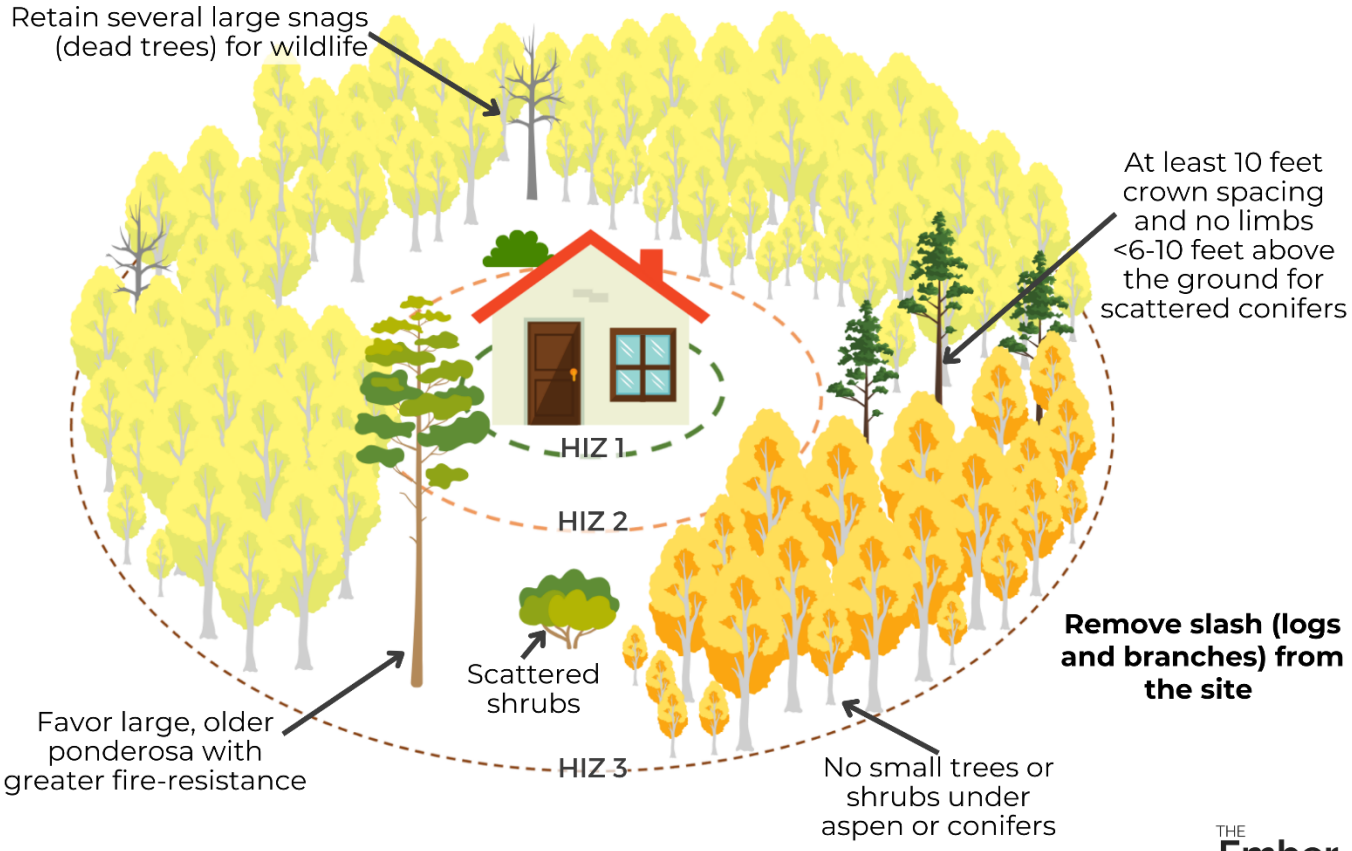
Fire severity: Slow and creeping or, during drought, stand-replacing fire where most or all trees die



Aspen trees are fairly fire resistant and fire resilient. These deciduous trees have high fuel moisture, no low branches, and smooth bark, making them less likely to ignite than conifer trees. Aspens are readily killed by fire, but they recover quickly via sprouting. Fires can create conditions where aspen stands expand because of the species' ability to sprout rather than needing to germinate from seed, and because this sun-loving species experiences reduced competition from conifer trees killed by fire.

Management in Home Ignition Zone 3

Aspen trees do not need to be removed from HIZ 3 due to their fire-resistant and fire-resilient nature. Instead, focus on removing limbs from conifer trees, shrubs growing under aspen and conifers, and slash (logs, branches, and other woody material).



Source: CSFS Home Ignition Zone.

Lodgepole pine

Species: Lodgepole pine dominated; occasional Douglas-fir, ponderosa pine, aspen, white fir, Engelmann spruce, blue spruce, limber pine, gamble oak

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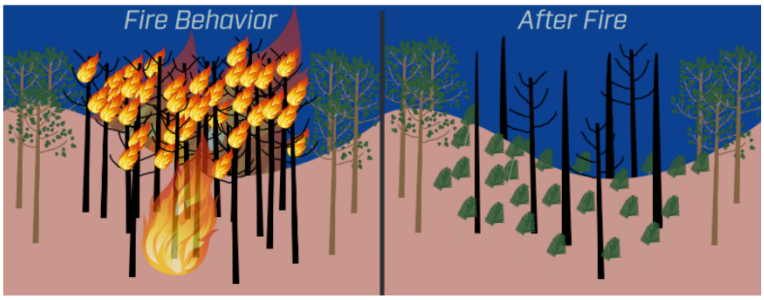
Typical elevation: 8,000-10,000 ft

Fire return interval: 75 to 300 years (infrequent)

Fire severity: Stand-replacing fire where most or all trees die

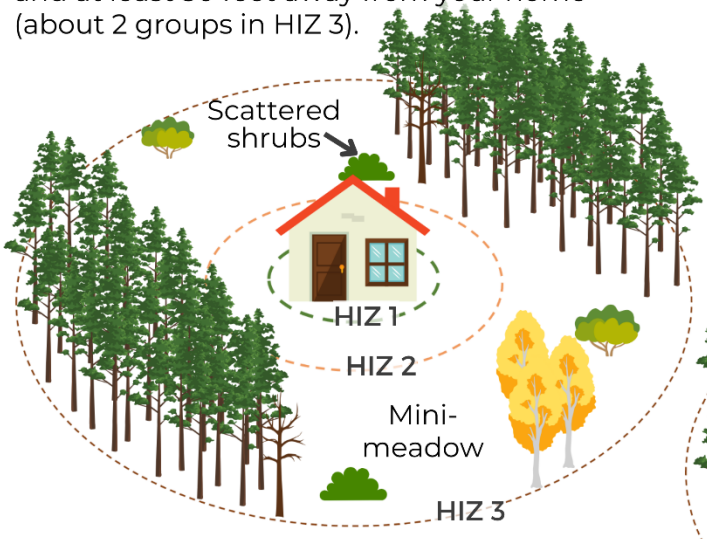


Lodgepole pine forests naturally grow densely, so fire spreads easily from tree crown to tree crown, resulting in patches where most trees are killed. Lodgepole pine also can have serotinous cones, which open and release seeds when heated by fire. These seeds then readily regenerate the new forest. More research is needed to understand forest recovery following the combination of drought, climate change, mountain pine beetle mortality, and recent wildfires.

Management in Home Ignition Zone 3

Lodgepole pine trees can blow over if too many neighboring trees are removed before they can adapt to the wind. There are two options for managing lodgepole pine in HIZ 3 to increase your home's chance of standing strong during a wildfire and to reduce windthrow:

Option 1: Leave groups of 30-50 trees at least 30-50 feet apart from other groups and at least 30 feet away from your home (about 2 groups in HIZ 3).



Option 2: Slowly thin the stand, no more than 30% of trees each time. Repeat to achieve at least 10-feet between tree crowns (no more than 80 trees/acre or 50 trees within HIZ 3, fewer for larger trees or on steep slopes). **This can take about 10 years to achieve, during which time, your home is still at risk.**

For both options 1 and 2:

- No limbs <6-10 feet above the ground
- No small trees or shrubs under remaining trees
- Very few to no trees in HIZ 2 and none in HIZ 1
- Favor aspen for biodiversity and fire resilience
- Retain several large snags (dead trees) for wildlife habitat at least 1.5 x tree height away from your home
- **Remove slash (logs and branches)**

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Sources: CSFS Home Ignition Zone; CSFS Lodgepole Management Guidelines.

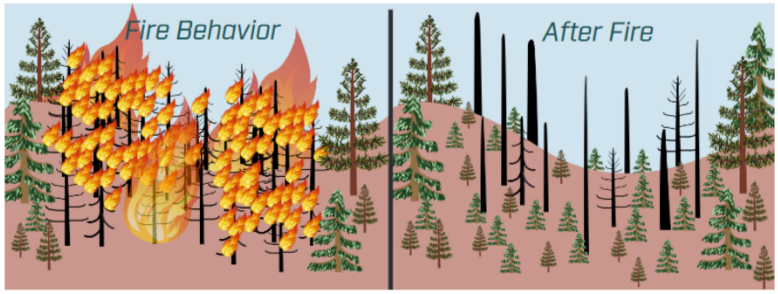
Subalpine forests

Species: Subalpine fir and Engelmann spruce; occasional blue spruce, aspen, and lodgepole, limber, and bristlecone pine

Typical elevation: 9,000-11,000 ft

Fire return interval: 100 to 600 years (infrequent)

Fire severity: Stand-replacing fire where most or all trees die



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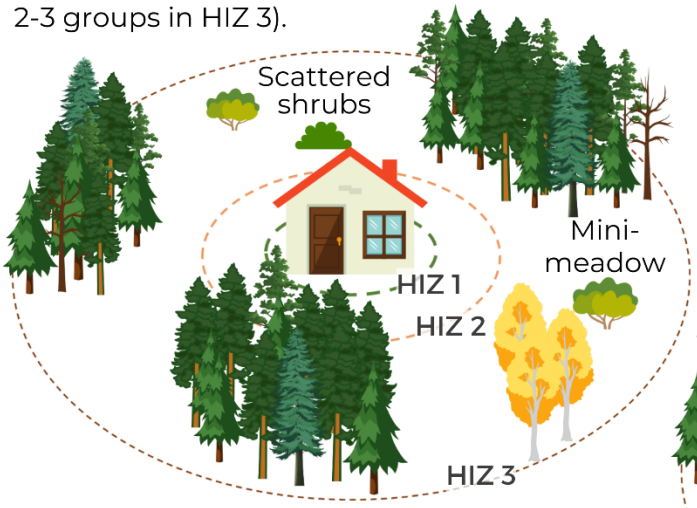
Subalpine forests are the wettest and densest forests in Colorado. When extended dry conditions occur in these forests, dead trees and other fuels that have accumulated over long periods of time dry out, creating conditions ripe for fire. Fires are infrequent, stand-replacing, and often synchronous across the region tied to widespread drought. More research is needed to understand forest recovery following the combination of drought, climate change, spruce beetle mortality, and recent wildfires.

Management in Home Ignition Zone 3

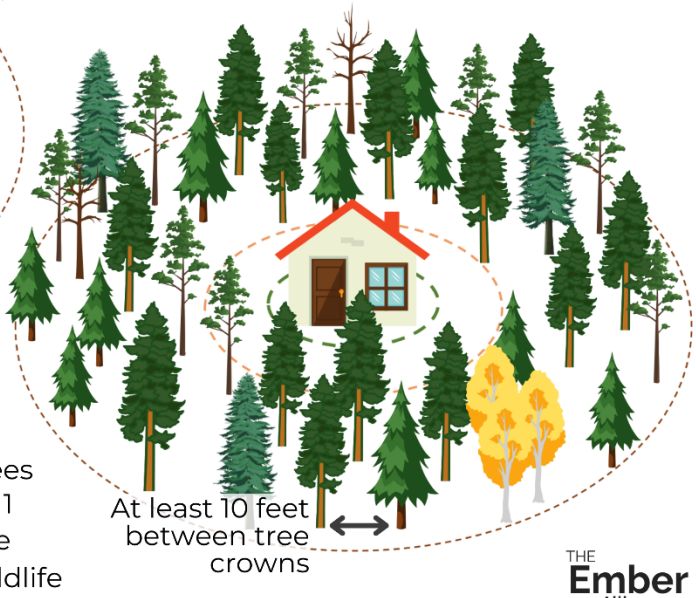
Spruce and fir trees can blow over if too many neighboring trees are removed before they can adapt to the wind. There are two options for managing spruce-fir in HIZ 3 to increase your home's chance of standing strong during a wildfire and to reduce windthrow:

Option 1: Leave groups of 15-30 trees at least 30-50 feet apart from other groups and at least 30 feet away from your home (about 2-3 groups in HIZ 3).



Option 2: Slowly thin the stand, no more than 30% of trees each time. Repeat to achieve at least 10-feet between tree crowns (no more than 80 trees/acre or 50 trees within HIZ 3, fewer for larger trees or on steep slopes).

This can take about 10 years to achieve, during which time, your home is still at risk.



For both options 1 and 2:

- No limbs <6-10 feet above the ground
- No small trees or shrubs under remaining trees
- Very few to no trees in HIZ 2 and none in HIZ 1
- Favor aspen for biodiversity and fire resilience
- Retain several large snags (dead trees) for wildlife habitat at least 1.5 x tree height away from your home
- **Remove slash (logs and branches)**

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Sources: CSFS Home Ignition Zone; CSFS Spruce Beetle Quick Guide FM 2014-1.

3.d. Recommendations for CCCFPD and Partner Organizations

Evacuation Planning and Capacity

Responsible Parties: Jefferson, Boulder, and Gilpin Counties are responsible for planning and managing evacuations in their jurisdictions.

There is a high likelihood of evacuation congestion and long evacuation times during a wildfire. Some neighborhoods have only one ingress/egress route, and some have roads that are narrow, winding, or difficult to navigate, especially through heavy smoke from a wildfire. Evacuation times for individual residents could exceed 3 hours and 30 minutes hours in some parts of CCCFPD due to the high density of homes and limited number of egress routes (see **Appendix B, Evacuation Modeling and Scenarios**). If residents of neighboring communities need to evacuate at the same time, these times can be even longer than what is modeled.

Residents of CCCFPD have participated in major evacuations during the 2013 floods, as well as many smaller-scale evacuations for wildfires such as the 2006 Plainview Fire and 2013 Lillis Lane Fire.

Many roads throughout the community are narrow and lined with dense vegetation that could create non-survivable conditions during wildfires. Under extreme fire weather conditions, 44% of roadways in CCCFPD could experience non-survivable conditions (**Figure 2.f.7**). **Mitigation actions along sections of road with high risk for non-survivable conditions during a wildfire can increase the chances of survival for residents stranded in their vehicles during and decrease the chance that roadways become impassable due to flames.**

Potentially Survivable Roadways	*Potentially Non-Survivable Roadways*
	

Some roads in CCCFPD have been well mitigated by removing tall trees and saplings, removing limbs on the remaining trees, and keeping grass mowed (left image). Other roads could experience potentially non-survivable conditions because they are lined by thick forests that have an abundance of ladder fuels (right image). Photo credit: The Ember Alliance.

Boulder County: BoCoAlert uses Everbridge for emergency notifications. CenturyLink/Lumen landlines and Comcast/Xfinity VOIP lines are automatically registered. Residents must register their cell phones and email addresses to receive additional notifications through the BOCO Alert website

Gilpin County: Gilpin County uses HyperReach for emergency alerts. Residents must register their cell phones and email addresses to receive additional notifications through the Hyper-reach website.

Jefferson County: JeffCom uses LookoutAlert for emergency alerts. Residential landlines are automatically registered unless their phone uses VoIP (voice-over internet protocol). Residents must register their cell phones and email addresses to receive additional notifications through the Lookout alert website.

everbridge™ hyper-reach the power of instant communication Lookout Alert EMERGENCY NOTIFICATIONS

Residents in CCCFPD should register for all three alert notifications.

Reliable technology to provide warnings and information about evacuations can help residents feel confident in their ability to evacuate during a wildfire. Each county manages their own emergency alert system, also known as reverse 911, to communicate evacuation orders to residents. HOAs, local mitigation organizations, and residents should actively extend awareness about the relevant alert system to neighbors that are unaware of the program.

Recommendations to improve evacuation preparedness:

- Conduct tree removal, cut low limbs, and mow grass along roadways to increase the likelihood of safe evacuation conditions during a wildfire. Prioritize the roads with the most traffic and congestion and work out to the less congested roads (**Figure 3.d.1**). See **Section 4.d** for recommended approaches.
- Coordinate with county Emergency Management departments to increase participation in their respective emergency alert systems. Fortunately, 88% of respondents to the CWPP survey indicated that they have signed up for at least one alert system, and many have signed up for alerts through multiple counties Communicate the importance of following evacuation orders; **failing to leave the community in a timely manner during a wildfire emergency can put first responders at risk.**
- Create a secondary egress route for the following communities/roads: Spruce Canyon Drive, Crescent Lake Road, Nadm Drive, Coal Creek Heights Drive, Skyline Road/Lyttle Dowdle Drive, Burke and Fischer Roads, Tunnel 19 Road, Blue Mountain Estates, Vonnie Claire Drive, Camp Eden, and Chute Road.
- Regularly test the county alert systems to ensure timely and accurate communication can occur.
- Encourage residents to leave with only one vehicle per household to reduce congestion.
- Encourage all households to develop family evacuation plans and to pack go-bags. Only 62% of respondents to the CWPP survey have evacuation plans for their family and only 48% have go-bags. Ready, Set, Go! is a resource to help with evacuation planning, and in-person workshops can help people start making their bag.
- 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.
- Make sure warnings and alerts can be understood by all residents, including those with English as a second language and with hearing impairments.
- Consider conducting district- or community-wide evacuation drills with the counties.

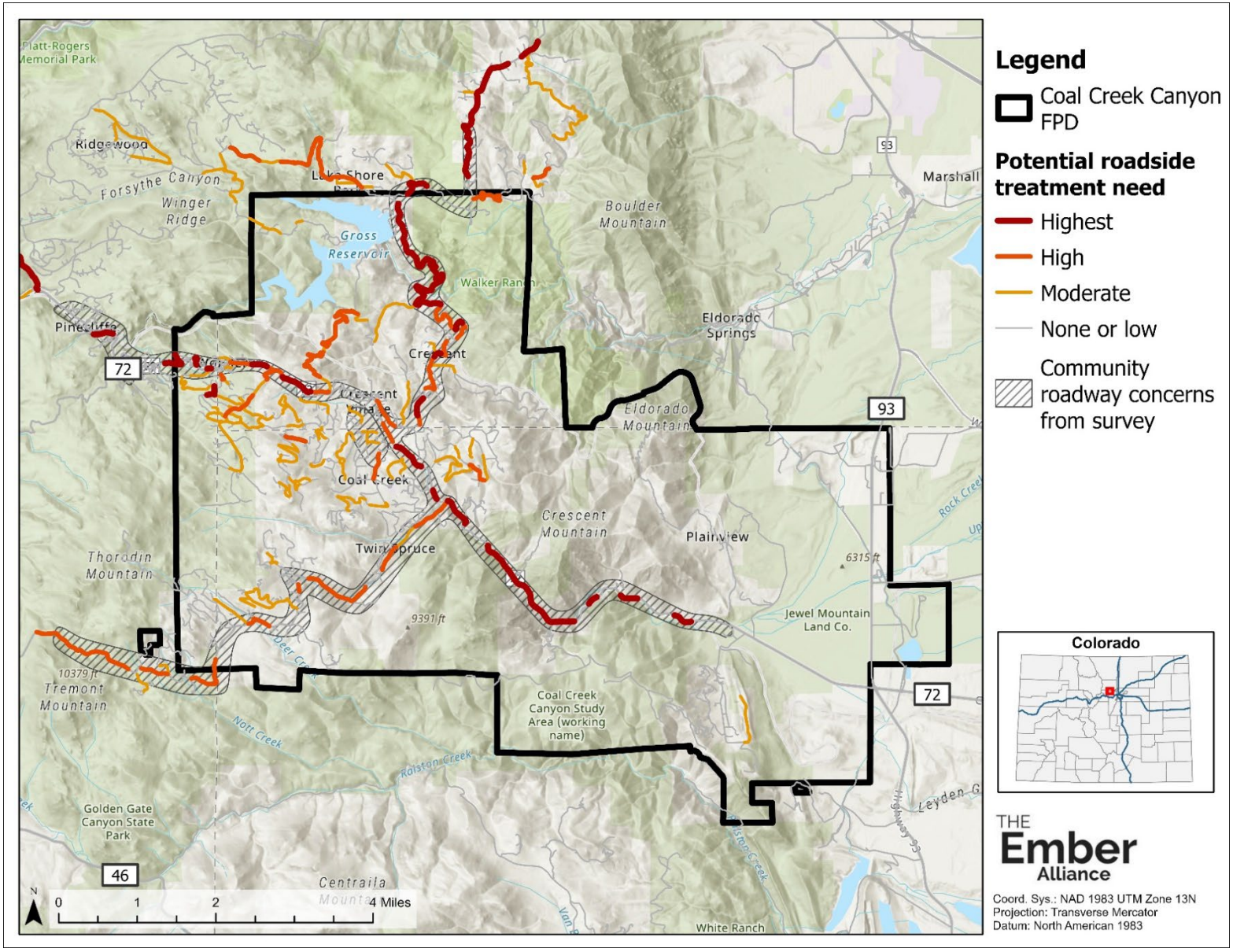


Figure 3.d.1. *Potential need for roadside fuel treatments based on the potential for wildfire to create non-survivable conditions along roadways and the potential for congestion during evacuations (methodology provided in* ***Appendix B****). Community members expressed concerns about many of the same roadways in the CWPP survey. See* ***Section 4.d*** *for recommended approaches to reduce wildfire risk along roadways. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

Accessibility and Navigability for Firefighters

Responsible Parties: Colorado Department of Transportation, Jefferson/Boulder/Gilpin County Road and Bridge Departments, Denver Water, Jefferson/Boulder County Open Space departments, and landowners with private roads on their property. Homeowners are responsible for address signage.

Two of the 15 plan units in CCCFPD (Burke and Wondervu) have roads that are inaccessible to some fire engines. There are many driveways throughout the district that are also inaccessible to fire engines during a wildfire. In just two of the 15 plan units (Miramonte and Plainview), most residents have noncombustible, clear, and reflective address signs and road signs. Wood, painted or stamped metal, and other nonreflective address and road signs may not be visible to firefighters at night or under heavy smoke. The following recommendations will increase the likelihood that emergency responders can locate and access all structures in CCCFPD:

- Road and right-of-way owners and managers should improve roadway access where feasible by widening road networks, adding a center lane on 2-lane roads, and/or creating turnarounds and pullovers to accommodate fire engines and two-way traffic during evacuation. Priority roads for improvement include Fisher Road and many of the roads in Wondervu.
- Road and right-of-way owners and managers should work with community groups and private landowners to remove trees from along roads to reduce the chance of non-survivable conditions occurring during wildfires. Priority locations for roadside fuel treatment include Coal Creek Canyon Road/Highway 72, Gross Dam Road, Flagstaff Road, Twin Spruce Road and Gap Road (**Figure 3.d.1**).
- CCCFPD and community groups should conduct outreach with residents to encourage them to 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 total horizontal clearance and 13.5 feet of vertical clearance to allow engines to safely access the roads (O'Connor, 2021).
- Responsible parties should work together to plan and execute roadway improvements and roadside fuel treatments. Widening roads and removing fuels along roadways can be time-consuming and expensive, but this work is vital for the safety of residents and first responders. Residents, community leaders, and partners can work together to share costs and apply for grants to facilitate this important work.

It would not be possible for a firefighting engine to enter this one-lane dirt road in CCCFPD if residents were also evacuating. Photo credit: The Ember Alliance.

Slash Management

Responsible Parties: Boulder/Jefferson/Gilpin Counties, CCCFPD, community fire mitigation groups, watershed organizations, and residents.

Residents in CCCFPD have experienced difficulties with slash management, like many other communities in Colorado. During the community engagement process for this CWPP, residents shared that access to inexpensive/easy means of slash disposal, such as curbside chipping, would be the most impactful action to enabling them to do more work to reduce wildfire risk on their property (**Figure 3.d.2**).

Boulder County hosts a free seasonal sort yard for slash in Nederland, but residents have shared that there are barriers to using it, such as the distance away from their homes and its limited hours of operation. Gilpin County hosts a free seasonal sort yard for slash in Blackhawk, but it is at least 15 miles away from CCCFPD residents. Jefferson County hosts a slash collection site at Blue Mountain Open Space annually, but some residents have expressed that the cost of using it is prohibitive, and the limited time frame it is open is inaccessible.

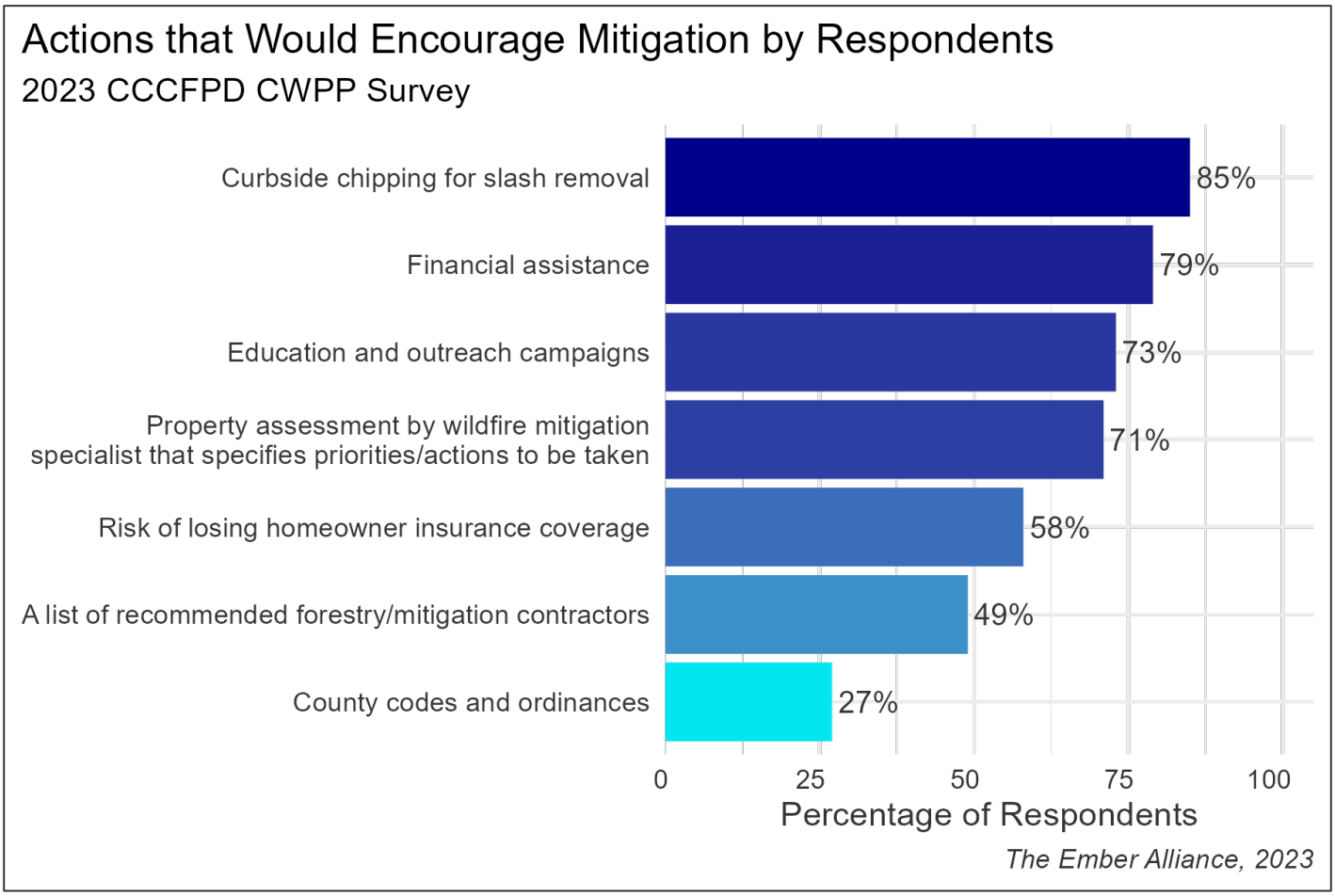


Figure 3.d.2. *Percentage of respondents that would be encouraged to take mitigation action based on the offered actions. Respondents to the CWPP survey indicated that slash removal, even more than financial assistance, would be the most impactful action in helping them complete more mitigation on their property. See* ***Appendix C*** *for a full summary of survey findings.*

Recommendations for slash management:

- Residents should dispose of slash via Boulder County's chipping program and Nederland Sort Yard.
- Jefferson County should consider making slash disposal events more frequent and free to residents and nearby neighbors.
- Gilpin County should consider permitting residents of neighboring counties that live near the border of the county to utilize the county slash collection site.
- Boulder Watershed Collective and CCCFPD should encourage and facilitate the participation of residents in the Colorado Division of Fire Prevention and Control's (DFPC's) certified burner program. This training and certification helps individuals become knowledgeable and capable of safely planning and conducting pile burns and provides some level of civil liability protection for certified burners.
- CCCFPD should partner with The Ember Alliance and local forestry and watershed organizations to form Pile Burn Cooperatives (PBCs) in areas of the district where pile burning is a viable slash management option. PBCs are groups of neighbors that get together to help burn slash piles, often with support from their local fire protection district. The Ember Alliance hosts workshops on pile building and burning to assist communities who are interested in forming PBC. Visit The Ember Alliance's website to learn more about PBCs in Colorado.

Homeowner and Short-Term Rental Certification

Responsible Parties: Boulder/Jefferson/Gilpin Counties

Residents in the WUI can benefit from a program clearly describing successful HIZ mitigation and staff who are able to help them identify where work needs to occur. Boulder County created a program called Wildfire Partners that does just this and uses it to license short-term rentals as well.

Short-term rentals are home or apartment rentals that are leased for 30 days or less at a time, usually called vacation rentals, Airbnb's, or VRBOs. Local governments have struggled to regulate short-term rentals; a study published in 2018 found that 20% of short-term rentals in the U.S. did not have smoke detectors and 58% didn't have fire extinguishers (Kennedy et al., 2018). Visitors are often unaware of the risks that come with their vacation location. Short term rentals without defensible space, clearly defined escape routes, or basic fire safety measures put visitors and neighbors at high risk in the event of a wildfire. Programs could require that short term rentals provide evacuation maps to renters with multiple ways out of the neighborhood, require renters to sign up for emergency alerts while they are visiting, share current fire ban information with renters before they visit, and close off outdoor fire pits when they are not allowed to be used.

Each county should implement rigorous short-term rental guidelines to protect the life safety of visitors as well as the properties of the homeowners in CCCFPD. An example of the licensing process is shown in **Figure 3.d.3**.

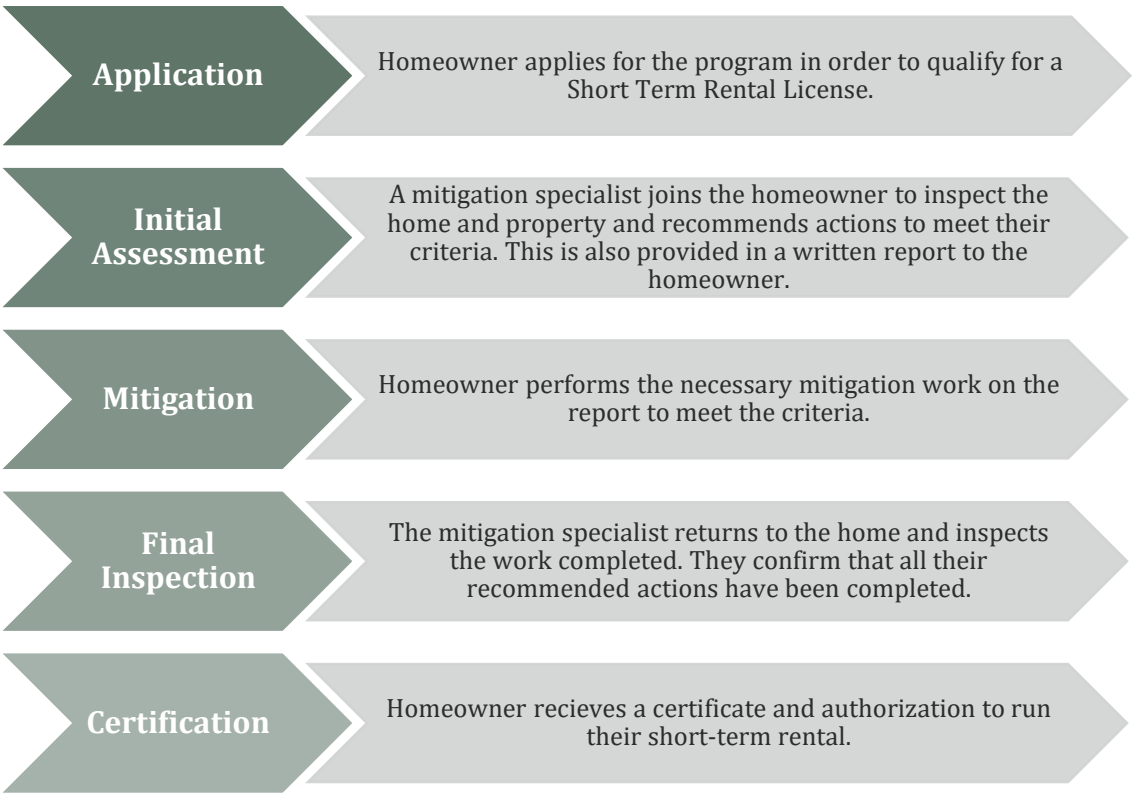


Figure 3.d.3. *Proposed short-term rental licensing process. Homes that are currently operating as short-term rentals could be granted a grace period to complete the mitigation to maintain their business as they complete required mitigation. Process adapted from Boulder County's Wildfire Partners Program.*

Preparing for Post-Fire Impacts

Responsible Parties: CCCFPD, Boulder Watershed Collective, CDOT, Jefferson County Road & Bridge, Boulder County Road & Bridge, Gilpin County Road & Bridge, Blue Mountain Water District

Proactive planning and activities to mitigate impacts of wildfires and post-fire sediment and debris flows are key components of becoming a fire-adapted community. Climate change makes immediate action even more imperative as the future is likely to include more frequent large, high-intensity wildfires and extreme rainfall events. See **Appendix B** for results of the CWPP post-fire sediment delivery analysis. Recommendations include:

CDOT spent $9.55 million in 2019 and 2020 to make permanent flood repairs along a 12-mile section of CO-72 in response to major flooding in 2013. Photo credits: CDOT.

- Fuels treatments in strategic locations can reduce wildfire severity and extent, decrease the likelihood that hydrophobic soils (soils that repel water) form, and reduce the loss of roots, vegetation, and plant litter that hold soil in place (B. M. Gannon et al., 2019; Jones et al., 2017a). Reduced fire severity can therefore reduce the potential for flooding and sediment transport in some cases. The analysis of post-fire sediment delivery presented in **Appendix B** was used to inform fuel treatment prioritization (see **Section 4.c**).
- Completion and regular revision of the Colorado Post-Fire Recovery Playbook by CCCFPD, CDOT, and Jefferson, Boulder, and Gilpin County Road & Bridge to prepare emergency managers to rapidly undertake post-fire emergency response and mitigation measures. Pre-planning can help emergency managers identify points of contact with organizations that need to be involved in post-fire recovery efforts. Pre-planning can also help managers understand tradeoffs of different mitigation approaches (e.g., applying straw mulch, applying seed mixes, and building water barriers) and determine which might be more appropriate in different areas given burn severity, soil texture, topography, values at risk, and available resources. See (Robichaud and Ashmun, 2013) for a scientific review of the relative effectiveness of different post-fire mitigation measures.
- Undertake low-tech, process-based restoration (LTPBR) to improve stream health. Rivers and stream channels that can dissipate flood waters and store sediment have high floodplain connectivity, contain features that can slow the velocity of water and sediment (e.g., boulders, beaver dams, and large pieces of wood), and are lined with abundant riparian vegetation. Building artificial beaver dams, building rock erosion control structures (also known as Zeedyk structures), and encouraging beaver activity in strategic locations can decrease the velocity of downstream flows and trap sediment. See this blog post from the National Forest Foundation for more information on LTPBR.
- Conserve and restore stream-side vegetation, like willows and cottonwoods, to reduce soil erosion, moderate floods, and potentially slow down the spread of wildfire due to elevated fuel moisture.

- Work with CDOT and Jefferson County Road & Bridge, Boulder County Road & Bridge, Gilpin County Road & Bridge to improve and maintain culverts, drainage features, and roadways in areas with elevated risk of post-fire sedimentation and debris flows. Proactive measures to improve infrastructure can reduce the potential for severe road damage in the future.
- Residents in areas with an elevated risk of post-fire sediment delivery are encouraged to take actions to protect their home, including (1) working with their insurance agents to determine the need for flood insurance and/or an earth movement, earthquake, and landslide rider to your homeowner's policy, (2) elevating and anchoring electrical panels, propane tanks, wiring, appliances, and heating systems, (3) securing important documents in waterproof deposit boxes, (4) ensuring sump pumps are working and have battery-operated backup power sources, (5) installing professionally engineered terraces or slope drains that could protect their home but without altering drainage patterns that could worsen conditions for their neighbors, and (6) consulting with a qualified forester to discuss pre-fire fuel treatments to limit sediment delivery damages from burn scars. Reducing fuel loading in areas of concern can reduce wildfire severity, decrease the likelihood that hydrophobic soils (soils that repel water) form, and reduce the loss of roots, vegetation, and plant litter that hold soil in place. Reduced fire severity can therefore reduce the potential for flooding and sediment transport in some cases. Visit the storymap "A dangerous path" from the Boulder Watershed Collective for more information on preparing for debris flows.

Outreach and Education

Responsible Parties: Coal Creek Canyon Collaborative (C4), CCC CWPP Community Outreach Committee, local community forestry and watershed groups, CCCFPD, CSFS, and Jefferson/Boulder/Gilpin Counties.

CCCFPD should continue to engage with community members using a variety of methods, including the CWPP website, community ambassadors, social media, and education materials for visitors. The following priority recommendations may fall to different entities or partners within and around CCCFPD.

Neighborhood Ambassador Program

Expanding and providing resources for the **Neighborhood Ambassador Program** could help residents better understand wildfire risks and spark coordinated action that effects positive change in CCCFPD. The neighborhood ambassador approach requires engaged volunteer ambassadors and a dedicated lead coordinator. See **Table 3.c.2** from the guide *Fire adapted communities neighborhood ambassador approach: Increasing preparedness through volunteers* for effective activities that neighborhood ambassadors can undertake (Wildfire Adapated Partnership, 2018).

***Table 3.d-1**. Potential activities for the neighborhood ambassador program. Table adapted from (Wildfire Adapated Partnership, 2018).*

Example activity	Ambassador responsibility	Coordinator responsibility
Educational programs about defensible space and home hardening	Gauge interest of neighbors and select topics. Find meeting location. Encourage neighbors to attend.	Arrange for specialists to make presentations. Advertise program through HOA newsletters, social media, etc.
Emergency planning	Organize an event for people to ask firefighters and law enforcement personnel about emergency planning and evacuation. Encourage residents to work with their neighbors to develop a plan for evacuation if a resident is not at home, school-aged children or pets might be	Provide information to residents about emergency planning and go-bags. Arrange for specialists to make presentations. Advertise program through HOA newsletters, social media, etc.

Example activity	Ambassador responsibility	Coordinator responsibility
	home alone, or residents have mobility impairments and need special assistance.	
Pile Burn Cooperative involvement	Work with CCCFPD to determine if slash pile burning is an appropriate method of slash management in your neighborhood or community. Gauge interest level among residents around pile burning.	Work with CCCFPD and partner organizations to plan pile build and burn workshops. Facilitate pile burn days among residents within your neighborhood or community.
Community chipping day	Secure HOA or neighborhood buy-in and request financial support. Select a date and organize event logistics. Encourage neighbors to attend.	Secure fuels module availability and grants or other financial support. Address liability and safety concerns. Advertise program through HOA newsletters, social media, etc.
Defensible-space walking tour	Identify homeowners with exemplary defensible space. Select a date and organize event logistics. Encourage neighbors to attend.	Arrange for fuel treatment specialists to attend and make presentations. Provide handouts and other educational material about defensible space. Advertise program through HOA newsletters, social media, etc.
Defensible space projects	Work with neighbors to identify high-priority project locations using insights from this CWPP. Secure HOA or neighborhood buy-in and request financial support. Select contractors and solicit bids. Oversee project completion.	Work with a certified forester for insights about effective treatment location and prescriptions, following guidelines in this CWPP. Identify potential contractors. Write scope of work for contract. Inspect project upon completion. Celebrate success through social media posts and newspaper articles.
Roadside fuel treatment projects	Work with neighbors to identify roads and driveways with potentially non-survivable conditions using insights from this CWPP. Secure HOA or neighborhood buy-in and request financial support. Select contractors and solicit bids. Oversee project completion.	Work with a certified forester for insights about effective treatment location and prescriptions, following guidelines in this CWPP. Identify potential contractors. Write scope of work for contract. Inspect project upon completion. Celebrate success through social media posts and newspaper articles.

Social Media

Social media is a powerful tool when used properly to connect with audiences. FEMA has a Wildfire and Outdoor Fire Safety Social Media Toolkit that is a great starting place for fire protection districts to begin gaining an audience with their constituents and sharing important fire safety information. Put Fire to Work highlights programs and organizations that successfully engage audiences around wildland fire and prescribed burning. CalFire's Ready for Wildfire campaign is active and collaboratively created to engage and encourage people to take action on wildfire preparedness.

Collaboration

Responsible Parties: Coal Creek Canyon Collaborative (C4), CCCFPD, Boulder Watershed Collective, and the CCCFPD CWPP Community Outreach Committee and CWPP Implementation Committee.

Collaboration with landowners, community members, local governments, business owners, and other partners is the best way to ensure recommendations from this plan translate to on-the-ground action. Some organizations may be able to offer incentives to homeowners, others have expertise and capacity to mitigate wildfire risk, and others have authority to enforce changes. A holistic approach to fire adaptation is only possible through compromise, mutual respect, and collaboration around shared goals.

Numerous partners were engaged in the development of this CWPP and offered input on the recommendations and priorities for CCCFPD. It is recommended that CCCFPD and partner organizations continue meetings with land management partners in the district to provide accountability on projects, continue to participate in cross-boundary mitigation programs such as the C4, Northern Colorado Fireshed Collaborative (NCFC), and Boulder County Fireshed, and support the community ambassador program's growth and maintenance.

3.e. Special Considerations for Vulnerable Populations

Social factors influence how impacted an individual or a community may be in the event of wildfire. So-called social vulnerability results from a lack of access to resources that can include infrastructure, social support, health, and financial means (Cutter et al., 2003). While CCCFPD at large may be well prepared for wildfire after engaging in this CWPP planning process, there is potential for some to fall through the cracks or struggle to engage in necessary mitigation and preparation work, which makes them more at risk in the event of a fire.

Poverty, racial and ethnic discrimination, age, and physical ability are frequently factors that are associated with social stratification and result in resource inequity (Crowley, 2020; Cutter et al., 2003; Davies et al., 2018; Emrich et al., 2020; Hewitt, 2013; Ojerio et al., 2008). Thus, it is important to consider how to ensure that all community members can participate in the wildfire preparedness actions outlined in this CWPP.

The vulnerable populations present in CCCFPD are people over the age of 65 (20%), people with disabilities (9%), and people of color (9%), primarily Hispanic people (5%). While these vulnerabilities have the highest incidence in the area, it is important to note that people from other vulnerable groups including families in poverty and folks living in mobile homes are present in small numbers and would benefit from community support for wildfire preparation. Language barrier is not likely a significant issue in the area currently (USFS, 2021a).

Pre-fire

Another major barrier is the ability to do the work recommended in this plan. People who may be impacted by this include those in lower income brackets or fixed incomes who don't have the resources to harden their homes, those who rent their homes and cannot make modifications without permission, and those with physical disabilities or impairments that keep them from doing the physical labor often involved in preparation and mitigation actions themselves. Mutual aid programs like Saws and Slaws or Axe and Snax bring community members together to complete mitigation work on behalf of the community by sharing the resources and skills they have available. For example, some may be able to perform physical labor, others can provide writing expertise to procure grants, while still others can offer meeting spaces and food.

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 and mutual aid 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.

During a Fire

During a fire, a major concern for elders is safe and expedient evacuation. Death tolls from historic wildfires are disproportionately comprised of people over 65 (Palaiologou et al., 2019). Many folks who lost their lives in the 2018 Camp Fire of Paradise, California were mobility limited and needed assistance evacuating. Others were isolated either physically or socially and are unaware of evacuation needs (Garner et al., 2020). Neighborhoods should identify members who may need additional help evacuating or receiving evacuation notice and ensure they have a plan to help those folks in an evacuation. Since cell service is limited in CCCFPD and evacuation orders may not be given door-to-door, it is especially important for neighbors who do receive emergency communications to pass them on to those who do not.

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 like FEMA 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 folks, and those who speak English as a second language or not at all.

While 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 who will need the most assistance after a fire ahead of time are better able to get those folks the help they need quickly.

3.f. Funding Opportunities

There are many funding opportunities from federal, state, and local agencies as well as non-profits to assist in forest health and wildfire mitigation projects. These funds can increase capacity but cannot cover all the costs of fire mitigation needed within the fire district. Residents and partners must put forth funds and time to complete this work.

Below is a non-comprehensive list of grants and funding opportunities available as of early 2024.

Opportunities from Local and State Agencies in Colorado

- The Colorado State Forest Service (CSFS) **Forest Restoration and Wildfire Risk Mitigation (FRWRM)** is a competitive grant program designed to assist with funding community-level actions across the entire state to: reduce the risk to people, property and infrastructure from wildfire in the wildland-urban interface; promote forest health and the utilization of woody material including for traditional forest products and biomass energy; and encourage forest restoration projects. Eligible applicants include local community groups, local government entities such as fire protection districts, public and private utilities, state agencies, and non-profit groups.
- The State of Colorado developed the **Colorado Strategic Wildfire Action Program (COSWAP)** grant program in 2021 to distribute over $17 million to fuels reduction, mitigation, education, and capacity building in the state.
- The Colorado State Forest Service offers the **Wildfire Mitigation Incentives for Local Government Grant Program** to match locally-raised funding for mitigation and management efforts.
- **Colorado Water Plan Grants** from the Colorado Water Conservation Board includes a category for watershed health & recreation that can support planning and action to protect critical drinking water, infrastructure, and overall watershed health from post-fire impacts.
- Colorado Water Conservation District also offers the **Wildfire Ready Watersheds** program that focuses on projects designed to mitigate post-fire watershed impacts.
- CSFS administers programs for landowner and community assistance, including the **Colorado Forest Ag Program** and **Colorado Tree Farm Program**.
- CSFS regularly updates their **Natural Resources Grants & Assistance Database** to help residents, agencies, and other partners find funding for natural resource projects.
- The Colorado Department of Revenue provides a **Wildfire Mitigation Measures Subtraction** and **State income tax credit for wildfire mitigation (HB22-1007)** whereby individuals, estates, and trusts may claim a subtraction on their Colorado income tax return or receive a state income tax credit for certain costs incurred in performing wildfire mitigation measures on property in the WUI.
- The **Jefferson Conservation District** and **Boulder Valley-Longmont Conservation District** helps landowners navigate forestry projects to promote forest health and complete wildfire mitigation projects.
- Boulder County offers their **Strategic Fuels Mitigation Grant Program** to support community partnerships and programs to help residents prepare for wildfires including projects on private lands.
- Residents in Boulder County can apply for financial incentives as part of the **Wildfire Mitigation Sales Tax Program**.

Funding from Federal Agencies

- **Community Wildfire Assistance Program** from the Bureau of Land Management supports activities such as hazardous fuels reduction, thinning, chipping, outreach, and education on non-federal lands.
- **Community Wildfire Defense Grants** (CWDG) are funded annually through the National Forest Service and help communities take action on implementation projects from their local CWPP.
- **Building Resilient Infrastructure and Communities (BRIC) grant program** supports states, local communities, Tribes, and territories as they undertake large-sale projects to reduce or eliminate risk and damage from future natural hazards. Homeowners, business operators, and non-profit organizations cannot apply directly to FEMA, but they can be included in sub-applications submitted by an eligible sub-applicant (local governments, Tribal governments, and state agencies).
- **Hazard Mitigation Assistance Grants Program (HMGP)** provides funding to state, local, Tribal, and territorial governments so they can rebuild in a way that reduces, or mitigates, future disaster losses in their communities. This grant funding is available after a presidentially declared disaster.
- **Environmental Quality Incentives Program (EQIP)** from the Natural Resources Conservation Service can support private landowners and Tribes conducting forest management, prescribed burning, or prescribed grazing to reduce fire risk.

Opportunities from Non-Governmental Organizations

- Coalitions and Collaboratives, Inc. manages the **Action, Implementation, and Mitigation Program (AIM)** to increase local capacity and support wildfire risk reduction activities in high-risk communities. AIM provides direct support to place-based wildfire mitigation organization with pass-through grant funding, on-site engagement, technical expertise, mentoring, and training on mitigation practices to help high-risk communities achieve their wildfire adaptation goals.
- **Stewardship Impact Grants** from Great Outdoors Colorado fund local agencies, tax districts, political subdivisions, and non-profit organizations for wildfire mitigation work that aligns with resource conservation or outdoor stewardship objectives.
- **Conservation Service Corps Grants** from Great Outdoors Colorado fund chainsaw crews to support local agencies, tax districts, political subdivisions, and non-profit with fuel mitigation projects.
- Fire Adapted Colorado (FACO) manages the **FACO Opportunity Fund**, which is a matching mini-grant program to support projects, build capacity, and address local needs with funding from the National Fire Adapted Communities Learning Network.

Capacity for Fire Protection Districts

- **Staffing for Adequate Fire and Emergency Response Grants (SAFER)** from FEMA directly fund fire departments and volunteer firefighter organizations to help increase their capacity.
- **Assistance to Firefighters Grants (AFG)** from FEMA help firefighters and other first responders obtain critical resources necessary for protecting the public and emergency personnel from fire and related hazards.
- **Fire Prevention & Safety (FP&S) Grants** from FEMA support projects that enhance the safety of the public and firefighters from fire and related hazards, such as carrying out fire prevention education and training, fire code enforcement, fire/arson investigation, firefighter safety and health programming, strategic national projects, prevention efforts, and research and development.

4. Landscape-Scale Implementation Recommendations

4.a. Fuel Treatments and Ecological Restoration

Objectives and Benefits

Fuel treatments are a land management tool for reducing wildfire hazard by decreasing the amount and altering the distribution of wildland fuels. 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, creating fuelbreaks, 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). Methods include tree thinning, pruning, pile burning, broadcast prescribed burning, patch cutting, 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).

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, changing climate conditions such as prolonged drought, and development in the WUI.

In some cases, fuel treatments can achieve both ecological objectives and wildfire risk reduction. For example, 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, evenly spaced trees could serve as an effective fuel treatment but would not achieve ecological objectives in other forest types. Mowing grasslands to reduce fuel load might reduce potential flame lengths but will not restore short-grass prairie ecosystems without also conducting regular prescribed burns and seeding with native species.

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.

Land management agencies and community groups in and around CCCFPD are actively reducing wildland fuels (see **Figure 2.g.1** for a map of previous fuel treatments). Based on responses to the CWPP survey, many residents in CCCFPD are supportive of fuel treatments and engaged in work to mitigate wildfire risk on their properties (**Figure 4.a.1**):

- 90% of respondants agree or strongly agree that large-scale tree removal is sometimes required to protect the community.
- 90% of respondants agree or strongly agree that trees should be removed along roads to enhance the safety of roads for evacuation.
- 47% of respondants have already cut trees or removed low limbs along their driveway to allow fire engine access.
- 61% of respondants are supportive or highly supportive of pile burning.
- 89% of respondants agree or strongly agree that broadcast prescribed burning by trained professionals is necessary to reduce wildfire risk.

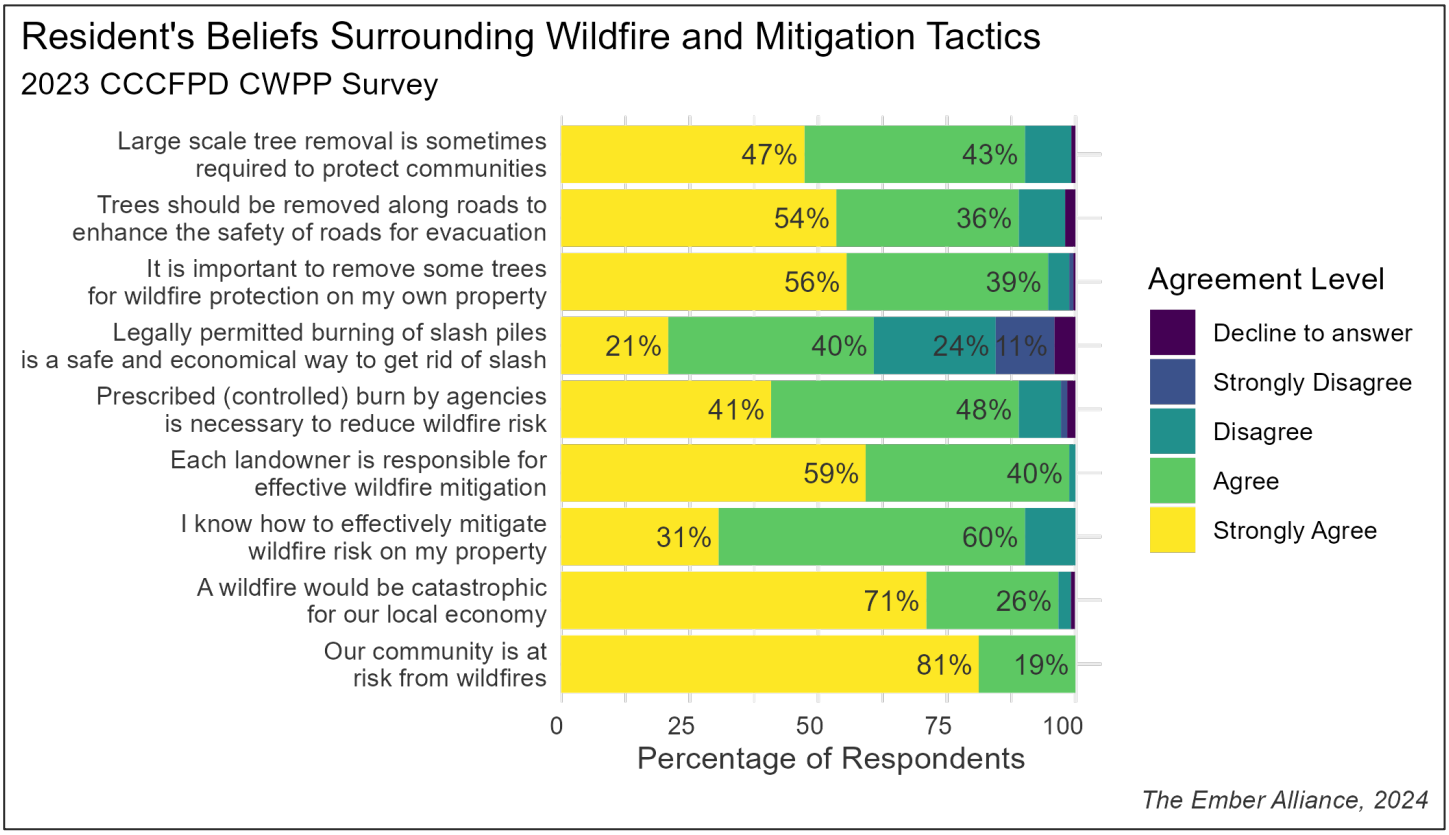


Figure 4.a.1. *CCCFPD survey responses on resident beliefs about wildfire risk, mitigation, and tactics. In general, this shows significant support for a variety of wildfire mitigation tactics.*

Treatment Types Covered in the CWPP

This CWPP covers fuel treatments in the home ignition zones 3, stand-level fuel treatments, and roadside fuel treatments, each with their own objectives and benefits.

Fuel Treatment Category	**Primary Objectives and Benefits**
Defensible space in home ignition zone 3 (30-100 feet away from the home) are addressed in ***Section 3.c*** *of this document. Zones 1 and 2 are addressed in* ***Section 3.a)***	Reduce surface fuels, reduce tree density, and increase the distance between surface and canopy fuels. Moderate fire behavior as it approaches structures and increase their chance of standing strong during a wildfire. Increase safety and access for wildland firefighters. Increase the visibility of structures from roadways to assist wildland firefighters with locating and accessing your home. Coordinate with partners when home ignition zone 3 overlaps neighboring properties to address shared wildfire risk. Linked defensible space creates safer conditions and better tactical opportunities for wildland firefighters. Defensible space projects that span ownership boundaries are better candidates for grant funding due to their strategic value.
Stand-level ecological restoration / fuel treatments	Reduce surface fuels, reduce tree density, and increase the distance between surface and canopy fuels. Restore ecological conditions to create more fire-resilient ecosystems.

Fuel Treatment Category	**Primary Objectives and Benefits**
	Reduce the likelihood of high-severity wildfires near communities. Create tactical opportunities for fire suppression, such as fuelbreaks.
Roadside fuel treatments	Dramatically reduce or eliminate surface and canopy fuels. Reduce the likelihood of non-survivable conditions along roadways during wildfires. Create tactical opportunities for fire suppression. Increase the visibility of structures from roadways to assist wildland firefighters.

Methods Used to Conduct Fuel Treatments and Restore Ecosystems

Mechanical Treatments

Trees can be removed manually or mechanically, with the most suitable method depending on slope, road access, cost, and potential damage to soil. Use of mechanical equipment is often infeasible on slopes greater than 35% (Hunter et al., 2007). Handcrews with chainsaws can operate on steeper slopes but can be less efficient than mechanical thinning. Sometimes the only option for tree removal on steep, inaccessible slopes is expensive helicopter logging.

Thinning operations often increase surface fuel loads and can fail to achieve fire mitigation objectives if fuels created by the harvest activities (also known as slash) are not addressed (Agee and Skinner, 2005). See **Approaches to Slash Management** for options to mitigate surface fuel loads created by fuel management.

A feller-buncher is a common piece of equipment used for mechanical treatments. Photo credit: Oregon Department of Forestry.

Broadcast Prescribed Burning

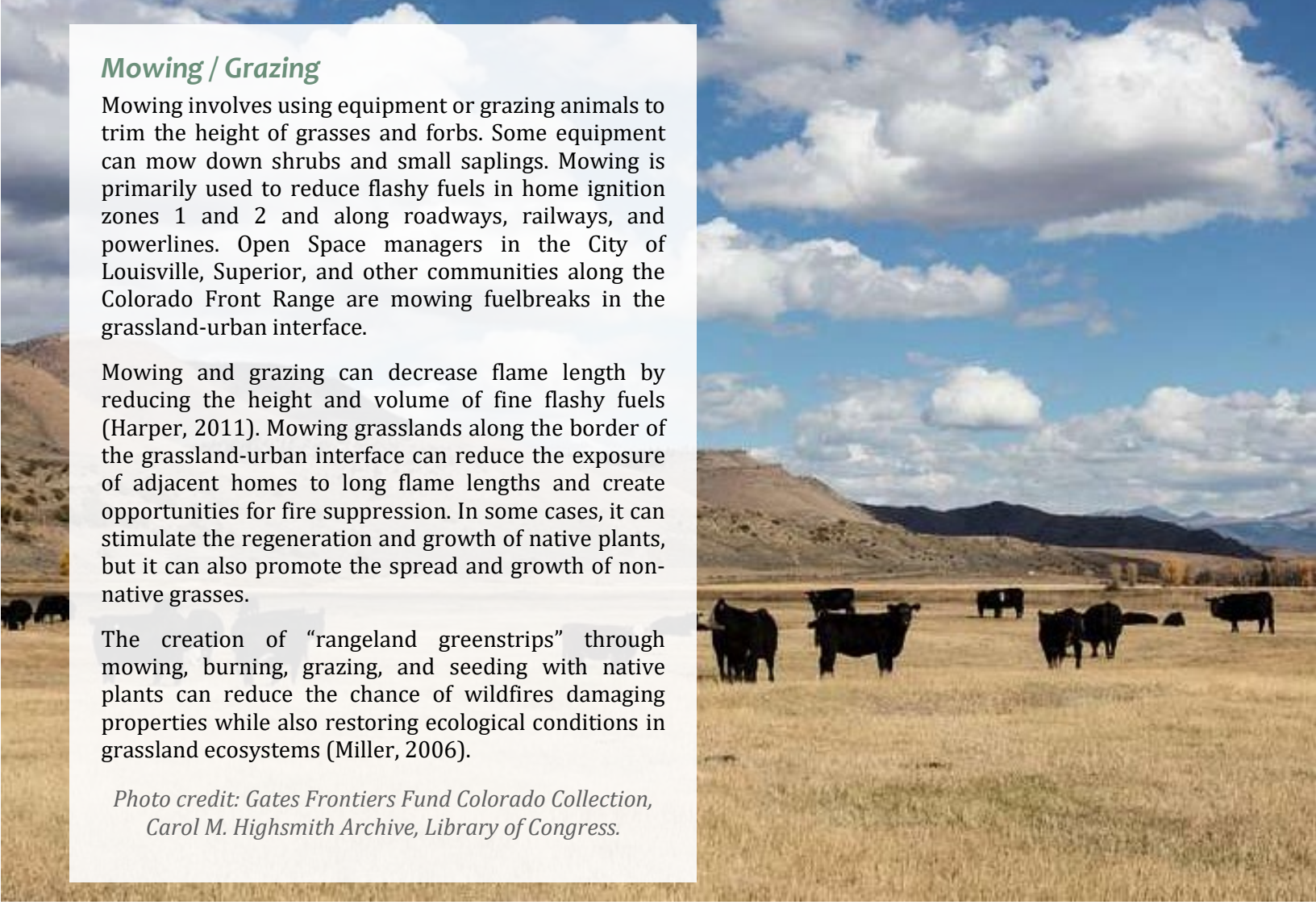
Broadcast prescribed burning (also called broadcast burning, prescribed fire, or controlled fire) is defined as wildland fire originating from a planned ignition in accordance with applicable laws, policies, and regulations to meet specific objectives. It is often the most effective method to mitigate wildfire risk and create healthy conditions in a variety of grassland, shrubland, and forest ecosystems (Paysen et al., 2000; Stephens et al., 2009). This method has unique impacts on vegetation, soils, and wildlife habitat that cannot be replicated by mechanical treatments alone (McIver et al., 2013). Prescribed burning mimics naturally occurring wildfire, can treat hundreds of acres at a time, removes surface fuel, and is relatively cost-effective (Hartsough et al., 2008; Hunter et al., 2007). Prescribed burns can reduce property damage during wildfires because they are so effective at reducing fuel loads (Loomis et al., 2019). Broadcast prescribed burning can be used following mechanical treatments to magnify treatment impacts. Thinning and burning treatments tend to achieve fuel reduction objectives and modify fire behavior to a greater extent than thinning alone (Fulé et al., 2012; Prichard et al., 2020). Regular spring burning can also help restore short-grass prairie ecosystems by controlling non-native grasses such as smooth brome (Willson and Stubbendieck, 1997). Many native grass species stay green into the summer, unlike cheatgrass and smooth brome, making them less receptive to wildfire (Miller, 2006).

Prescribed burning can remove surface and ladder fuels and restore ecological processes to frequent-fire ecosystems. Firefighters who plan and implement burns must hold rigorous certifications set by the National Wildfire Coordinating Group. Photo credit: The Ember Alliance.

Broadcast prescribed burning is challenging in the WUI due to diverse fuel types, proximity to homes, risk of visibility impairments on roads from smoke, health impacts of smoke, and political and social concerns. However, with proper planning and implementation, qualified firefighters can safely conduct prescribed burns, even in the WUI (Hunter et al., 2007). Life safety is always a top consideration when developing and conducting prescribed burns.

Broadcast burning is carefully regulated in Colorado by the Division of Fire Prevention and Control (DFPC), the Colorado Department of Public Health and Environment, local sheriff's offices, and fire departments as outlined in the *Colorado Prescribed Burning Act of 2013* and *2019 Colorado Prescribed Fire Planning and Implementation Policy Guide*. Firefighters who plan and conduct prescribed burns are highly qualified under national standards set forth by the National Wildfire Coordinating Group.

Less than 1% of prescribed burns escape containment lines, and most of these are rapidly suppressed (Weir et al., 2019). The wildland fire community soberly reviews prescribed burn escapes to produce lessons learned and make improvements (Dether, 2005).



Mowing / Grazing

Mowing involves using equipment or grazing animals to trim the height of grasses and forbs. Some equipment can mow down shrubs and small saplings. Mowing is primarily used to reduce flashy fuels in home ignition zones 1 and 2 and along roadways, railways, and powerlines. Open Space managers in the City of Louisville, Superior, and other communities along the Colorado Front Range are mowing fuelbreaks in the grassland-urban interface.

Mowing and grazing can decrease flame length by reducing the height and volume of fine flashy fuels (Harper, 2011). Mowing grasslands along the border of the grassland-urban interface can reduce the exposure of adjacent homes to long flame lengths and create opportunities for fire suppression. In some cases, it can stimulate the regeneration and growth of native plants, but it can also promote the spread and growth of non-native grasses.

The creation of "rangeland greenstrips" through mowing, burning, grazing, and seeding with native plants can reduce the chance of wildfires damaging properties while also restoring ecological conditions in grassland ecosystems (Miller, 2006).

Photo credit: Gates Frontiers Fund Colorado Collection, Carol M. Highsmith Archive, Library of Congress.

Fuel Treatment Effectiveness

The effectiveness of fuel treatments is influenced by a variety of factors, including the intensity, quality, and extent of treatments, location of treatments, maintenance of treatments, weather conditions and fire behavior, and actions of firefighters (**Figure 4.a.1**). Treatments that fail to remove enough trees or significantly reduce the amount of fuel on the ground can be ineffective during wildfires, as was observed during the 2010 Fourmile Fire that burned under extreme fire weather conditions (Graham et al., 2012). However, high-quality and strategically-placed fuel treatments can alter fire behavior and serve as effective tactical features for firefighters, as was observed during the 2020 Cameron Peak Fire in Larimer County (Avitt 2021) and the Golf Course Fire in 2018 (CSFS).

Fuel treatments are not intended to stop wildfires on their own. They are considered effective when they alter wildfire behavior by slowing the rate of spread, bringing the fire from the canopy to surface fuels, or reducing the intensity of the fire. These changes in behavior can provide critical time or space for resident egress, or can alter fire behavior enough to enable firefighters to engage the fire. The percentage of fuelbreaks that have effectively stopped actual wildfires is between 22-47% in forests (Gannon et al., 2023; Syphard et al., 2011) and 46-71% in sagebrush ecosystems (Weise et al., 2023). A review of fuel treatment effectiveness found that "a fuel treatment can only be as effective as the suppression that goes along with it"—less than 1% of wildfires are stopped by a fuelbreak alone and in insolation of suppression activities (McDaniel, 2023; page 3).

Fuel treatments are more effective under moderate fire weather conditions than extreme weather conditions, and most effective when firefighters are present to use the fuel treatment as a control feature (Gannon et al., 2023; Jain et al., 2021; Reinhardt et al., 2008; Syphard et al., 2011; Weise et al., 2023). Uncontrollable factors will always play a role in home loss during extreme wildfires, such as embercast from burning vegetation and structures.

Minute-to-minute shifts in wind directions, unexpected wind gusts, and extreme fire behavior and growth that overwhelm suppression efforts can result in home loss not explained by mitigation efforts prior to the fire.

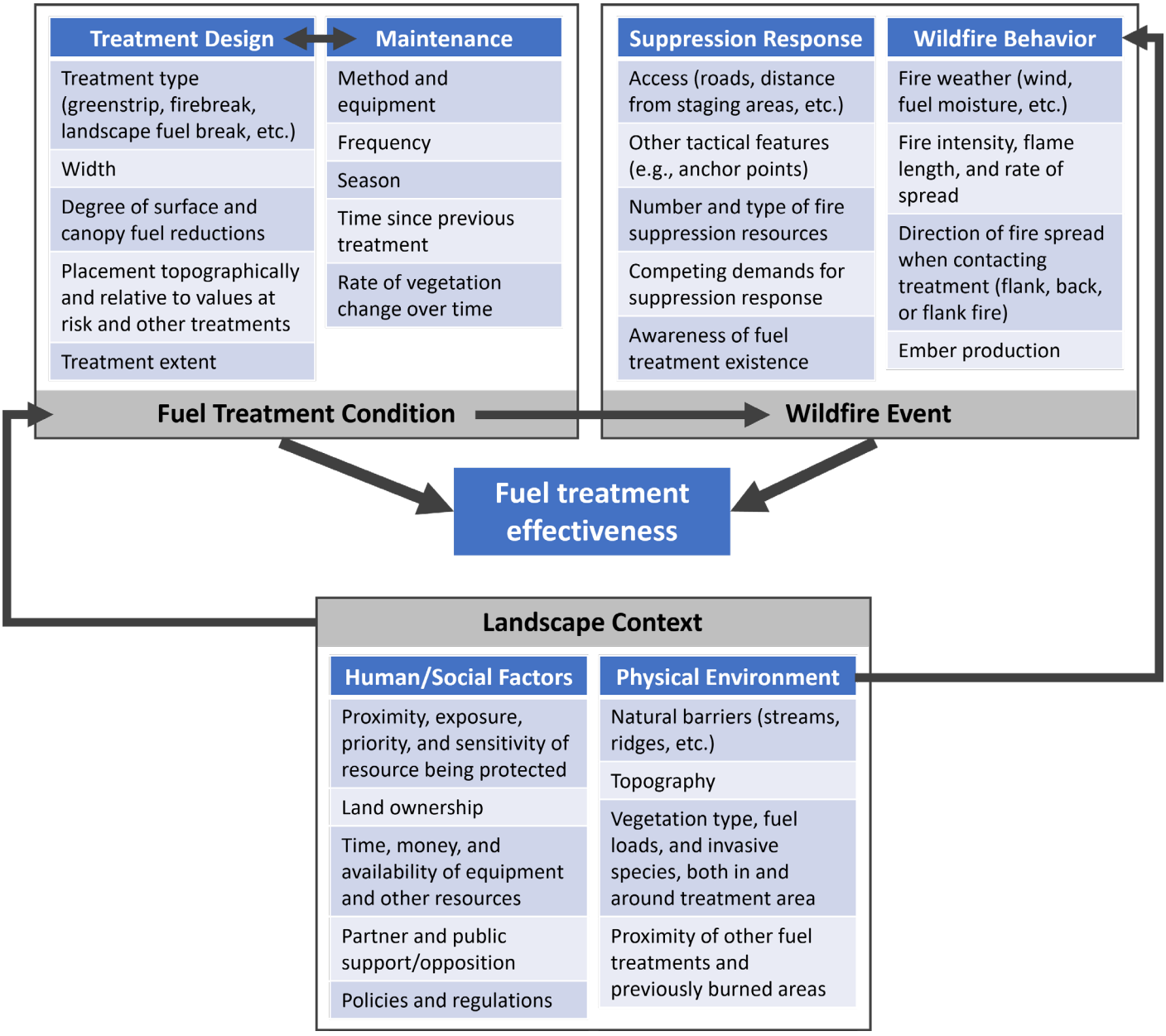


Figure 4.a.2. *The effectiveness of fuel treatments at altering wildfire behavior is influenced by numerous factors related to landscape context, fuel treatment specifications, and conditions during a wildfire event. Figure modified by The Ember Alliance based on (Jain et al., 2021; Trauernicht and Kunz, 2019)*

4.b. Recommendations for Roadside Fuel Treatments

Treatments along roadways require a dramatic reduction of fuels to create safer and survivable conditions. This includes removing most trees adjacent to the roadway, limbing remaining trees, and regularly mowing grass and shrubs (**Figure 4.b.1**). Treatments along roadways are often used as part of a shaded fuelbreak (Dennis, 2005).

The width of an effective roadside fuel treatment (distance to the left and right of a road) is dependent on slope. CSFS recommends that treatments extend 150 or more feet off the downhill side of the road and up 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 (**Table 4.b.1**) (Dennis, 2005). Important aspects of all roadside fuel treatments include:

- Clearing all limbs overhanging the road to create at least 13.5 feet of vertical clearance to facilitate engine access. See **Figure 3.a.4** for a depiction of how to measure limb height.
- Clearing all trees alongside the road to create at least 20 feet of horizontal clearance to facilitate engine access.
- Removing trees to create at least 10 feet of crown spacing between remaining trees or clumps within the roadside treatment zone specified in **Table 4.b.1** in order to reduce the intensity of wildfire if a fire were to approach the road. See **Figure 3.a.4** for how to measure crown spacing.
- Removing all dead or dying trees that could fall across the road and block traffic.
- Removing shrubs under trees and conifer regeneration in order to reduce the chance of wildfires transitioning from the surface into treetops.
- Mowing tall grasses adjacent to the road to reduce the intensity of wildfire if a fire were to approach the road.
- Remove slash from the site following fuel treatments. Slash left behind can burn with high intensity during a wildfire and make conditions unsafe for residents and firefighters.

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 this community. Roadside treatments must dramatically reduce fuel loads to effectively reduce the risk of non-survivable conditions developing along evacuation routes during wildfires.

Table 4.b.1. *Minimum fuel treatment width uphill and downhill from roads depends on the slope along the roadway[1]. Recommendations from the Colorado State Forest Service (Dennis, 2005).*

Percent slope (%)	Downhill distance (feet)	Uphill distance (feet)	Total fuel treatment width (feet)
0	150	150	300
10	165	140	305
20	180	130	310
30	195	120	315
40	210	110	320
50	225	100	325
60	240	100	340

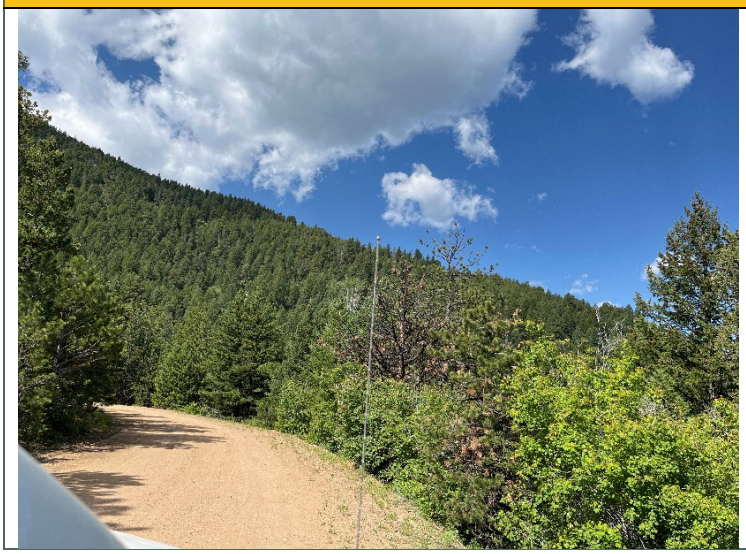
[1]Measurements are from the toe of the road fill for downhill distances and above the road cut for uphill distances. Distances are measured parallel to flat ground, not along the slope.

Figure 4.b.1. *Effective roadside fuel treatments remove enough trees to result in widely spaced crowns, remove ladder fuels, and reduce surface fuels. Photos: David Cawrse/USDA.*

Table 4.b.2*. Examples of conditions occurring along roadways in CCCFPD and suggestions for improvement.*

Roadway example	Suggestions for improvement
	• In general, this roadway is not in need of improvement. • Mow tall grasses adjacent to the road to reduce the intensity of wildfire if a fire were to approach the road.

Roadway example	Suggestions for improvement
	• Remove trees so there is at least 20 feet of horizontal clearance for engine access. • Create a shaded fuelbreak along the road. Aspen can be retained but trim the branches that are hanging into the roadway. • Create regular pullouts and turnaround locations for engines.
	• Fix the powerlines so they are a minimum of 13.5 feet off the road for an engine to drive under. • Create pull-offs and turnarounds large enough for an engine. • Remove conifer trees that are clumped together on the uphill side of the road to create at least a 10-foot spacing.
	• Remove trees so there is at least 20 feet of horizontal clearance for engine access. • Create a shaded fuelbreak along the road. • Trim limbs that are hanging into or over the roadway.

Roadway example	Suggestions for improvement
	• Remove trees so there is at least 20 feet of horizontal clearance for engine access. • Create a shaded fuelbreak along the road. • Remove some of the trees on the inside of the turns and switchbacks to improve visibility.

4.c. Priority Project Areas for CCCFPD

Altering potential wildfire behavior and restoring ecological conditions requires a landscape-scale approach to treatments across ownership boundaries. We located and prioritized project areas for roadside fuel treatments, ecological restoration, and/or stand-level fuel treatments within and around CCCFPD to be implemented in the next 5 years (**Figure 4.c.1**). 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.

Project areas were identified through partner collaboration. These decisions were made by representatives from CCCFPD, Boulder Watershed Collective, Blue Mountain Forest Stewardship Initiative, Crescent Park Community Fire Protection Association, Arvada Water, Timberline Fire Protection District, Mountain View Fire Protection District, Colorado State Forest Service, US Forest Service, Saws and Slaws, United Power, Jefferson County Open Space, CSU Extension Offices, Colorado Department of Transportation, and the Coal Creek Canyon Collaborative (C4). Partners gathered at the Coal Creek Canyon Improvement Association Hall in November 2023 and compared maps that showed modeled wildfire behavior, burn probability, post-fire sediment delivery, roadway congestion and safety, infrastructure and values at risk of wildfire, land ownership, ember cast, and past fires and fuel treatments. In groups, the partners delineated potential project areas and collaboratively identified the highest priorities. In December 2023 and January 2024, the Core Team refined these project areas, created goals, and decided on leaders and timelines (see **Appendix B** for methodology).

At the time of the initial prioritization meeting, there were no potential operational delineations (PODs, a pre-identified network of high-quality potential wildfire control locations) that covered CCCFPD, however they were created collaboratively shortly after and have been incorporated into the priority project areas. The POD boundaries align with the Core Team priority areas.

The section below describes the current conditions in each CWPP project area, treatment objectives and benefits, potential treatment types, project leads, and relative importance. The relative importance and feasibility of treatments is reflected in their timeline—partners aim to conduct treatments for immediate action in the next 1-2 years, short-term treatments are targeted for the next 3-4 years, and mid-term projects for the for the next 5-10 years. Mid-term projects will require more coordination, funding, and other enabling conditions before implementation can begin.

The CWPP implementation plan for stand-level and roadside treatments focuses on high-priority locations, 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. CCCFPD, local organizations, residents, and land managers should reevaluate fire risks and reprioritize treatment units as conditions change over time.

Project IDs and names referenced in Figure 4.c.1:

A: Pinecliffe

B: Black Gulch Fuel Reduction

C: Camp Eden & Upper Twin Spruce Link

D: Mt Thorodin Communication Tower Protection

E: Rudi Lane

F: Copperdale Lane, Ridge Road, and Coal Creek Heights Drive

G: Coal Creek Heights & Hilltop Link

H: Twin Spruce/Gap Rd Roadside Fuel Reduction

I: South District

J: Deer Creek Forest Health

K: Indian Peak Circle & Hwy 72 Switchbacks

L: Eastside of Wondervu

M: Northside of Camp Eden

N: Coal Creek Canyon Fire Department Station 2 and communication tower

O: Copperdale

P: Forsythe Project Expansion

Q: South Gross Reservoir Forest Health

R: Central Corridor Rail Line Ignition Reduction

S: Highway 72 Roadside Fuel Reduction

T: Miramonte Road

U: East Gross Dam Forest Health

V: Gross Hydro Plant

W: Forsythe project maintenance

X: County Road 68J Roadside Fuel Reduction

Y: Gross Dam Rd/Flagstaff Rd Roadside Fuel Reduction

Z: Meyer's Homestead Trailhead

AA: Gross Reservoir weather station & Denver Water Offices

AB: Crescent Meadows/Walker Ranch Loop

AC: Tunnel 19 Area

AD: Whispering Pines Church

AE: Crescent Lake Road

AF: Crescent Park

AG: Business District

AH: Complete Fire Station HIZ work

AI: Central Canyon South

AJ: Crescent Mountain

AK: Plainview Road

AL: Secondary Communication Infrastructure Protection

AM: Communication tower on Old Post Office Building

AN: Communication tower on Plainview Dr

AO: Blue Mountain Water District Infrastructure Protection

AP: Electric substations (TAP204087 and Plainview)

AQ: Communication tower at 11726 Hwy 93

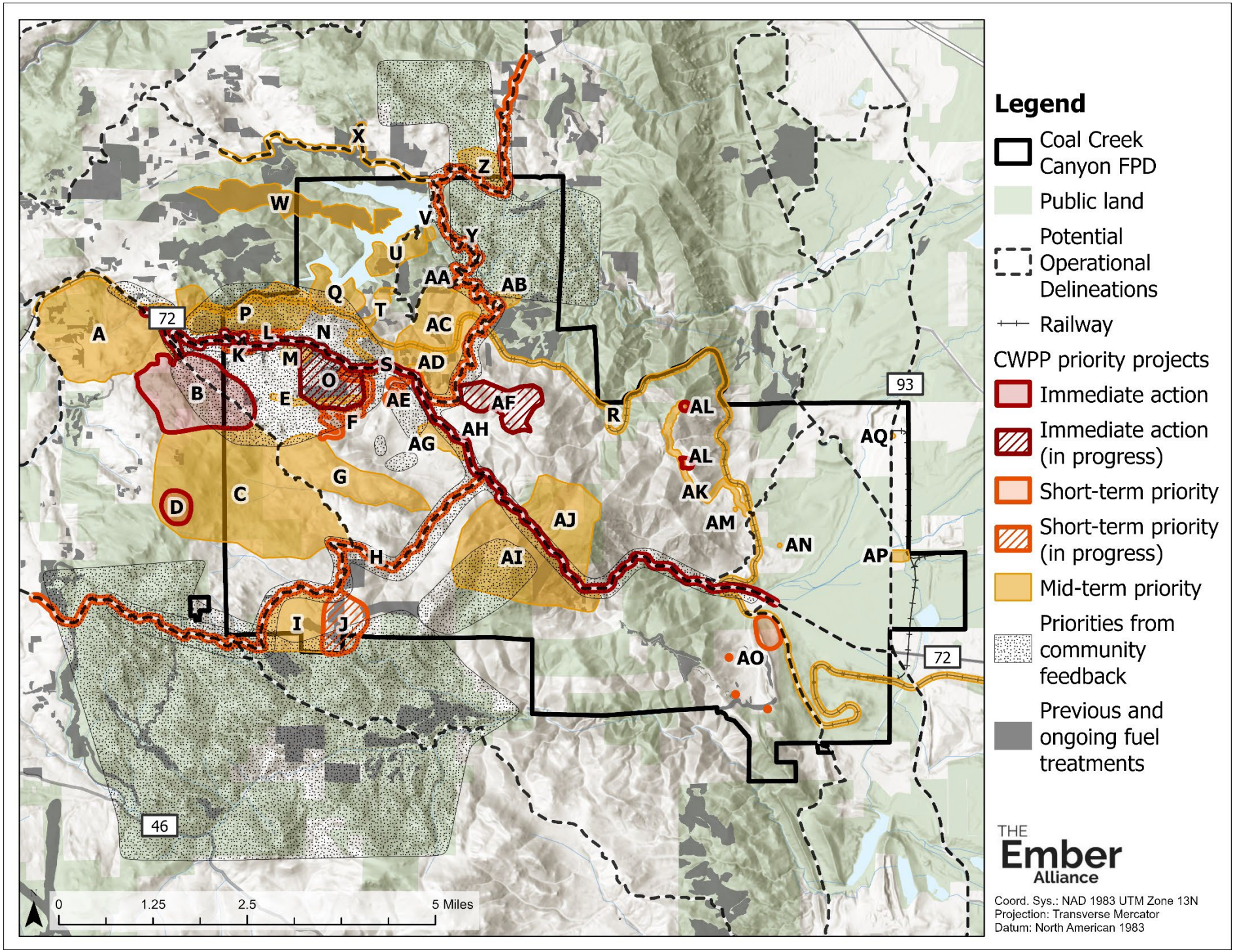


Figure 4.c.1. *Priority project areas for implementation in the next 5 years to reduce the impact of wildfire in CCCFPD, create strategic opportunities for wildland firefighters, create safer conditions for evacuations, and restore ecological conditions. See the previous page for project names. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

Photo: Google Maps

Highway 72 Roadside Fuel Reduction

Highway 72 (Coal Creek Canyon Road) runs northwest to southeast through the entire district, following Coal Creek and serving as the primary access and evacuation route for residents in the canyon. The highway is owned by the State of Colorado and maintained by CDOT. It follows the bottom of Coal Creek Canyon and is surrounded by vegetation from the beginning of the canyon in the east through the edge of the district in the west.

There is a healthy ponderosa pine woodland between the intersection on Highway 72 and 93 to the mouth of the canyon that is not in need of roadside treatment. From the mouth of the canyon west, there are varying species and densities of trees, from spread out ponderosa to dense lodgepole pine and wet mixed conifer. The sides of the canyon also vary from fairly flat near the road to vertical rock faces. This project will need to include traffic management for at least the first phase, where work is happening along the road.

Treatment objectives:

- The primary objective of this project is to create safer evacuation conditions for residents by decreasing the amount of vegetation along at least the 12.3 highlighted miles of Highway 72.
- The second objective of this project is to improve forest health and aesthetics along Highway 72 by removing the significant amount of standing dead trees that line Highway 72.
- The third objective is to initiate the management of Highway 72 as a POD boundary.

Treatment type:

- The first phase of this project will involve CDOT using their equipment (mulching head) to mulch all flammable vegetation, including all standing dead trees, within 20 feet of the edge of Highway 72 or up to their right-of-way.
- The second phase of this project is more complicated and involves treating beyond 20 feet of the edge of the roadway to create a shaded fuelbreak in accordance with CSFS guidelines. This will require partners working together and with private landowners to get treatments done on private land, beyond the boundary of the right-of-way, where necessary. This will likely be a combination of mechanical and hand thinning with a variety of slash management techniques, depending on access and ownership.

Priority: Immediate priority, begin work within 2024.

Lead and support organizations: Colorado Department of Transportation will lead the first phase of the project. CDOT will work with BWC, CSFS, BVLCD, and JCOS to work through the second phase of the project.

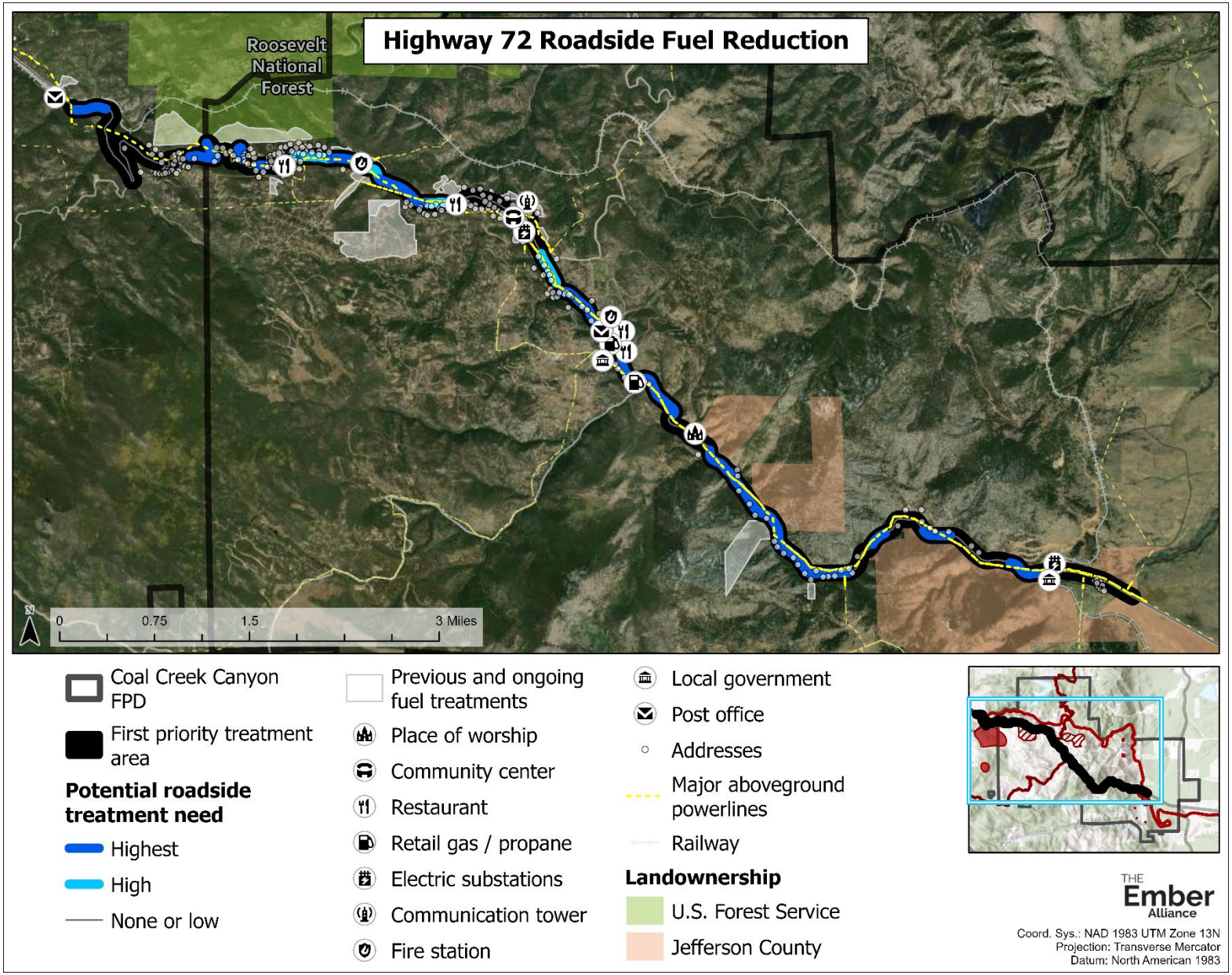


Figure 4.c.2. *Map of the Highway 72 Roadside Fuel Reduction project. The black area along the road is designated as a priority project in this CWPP, and the blue areas highlight where, within the project area, roadside treatment may have a higher impact on resident safety. This map only shows addresses, highly valued resources, landownership, and previous fuel treatments within 0.1 miles (528 ft) from the roadside.*

Gross Dam Road / Flagstaff Road Roadside Fuel Reduction

Gross Dam Road, which meets up with Flagstaff Road near the northern border of CCCFPD, crosses mostly private lands from where it intersects with Highway 72 until the railroad crossing, where it crosses through mostly public land in Eldorado Canyon State Park, Gross Reservoir, and Walker Ranch. It serves as an evacuation route for residents who live off Gross Dam Road, and as an alternate evacuation route for canyon residents that need to evacuate to the north when other routes are inaccessible.

The road is surrounded by varying densities of ponderosa pine and mixed conifer forests. The land around the roads varies from flat to steep enough to require some switchbacks. The highlighted 6.4 miles of Gross Dam Road are unpaved, and the highlighted 3.4 miles of Flagstaff Road are paved.

Treatment objectives:

- The primary objective of this project is to create safer evacuation conditions for residents by decreasing the amount of vegetation along Gross Dam Road and Flagstaff Road.
- The second objective is to initiate the management of Gross Dam Road and Flagstaff Road as a POD boundary.
- The third objective is to improve forest health where applicable along the roadway.
- The fourth objective is to build trust and relationships with private landowners that have land within the shaded fuelbreak area by treating on public lands first, demonstrating the aesthetics and effectiveness of the fuelbreaks, then proceeding to work with private landowners.

Treatment type:

- Initial treatment is likely to include mechanical thinning at first, and hand thinning where necessary. Treatment should follow CSFS fuelbreak guidelines as much as possible.
- Slash management should be fairly easy with the project occurring along the road, so chipping, slash removal, and pile burning are all feasible options in this area.

Priority: Short-term priority, begin work in 2025-2026.

Lead and support organizations: Denver Water Vegetation Management is responsible for Gross Dam Road management from its intersection with Flagstaff Road and where it crosses the railroad tracks. Jefferson County and Boulder County Road and Bridge Departments are responsible for road maintenance on the rest of the road right-of-way in their respective counties. Boulder County Open Space, Colorado Parks and Wildlife, Colorado State Forest Service, Boulder Watershed Collective, and the local Community Ambassador Program will support the lead organizations where they have management authority or where it is necessary to work with private landowners.

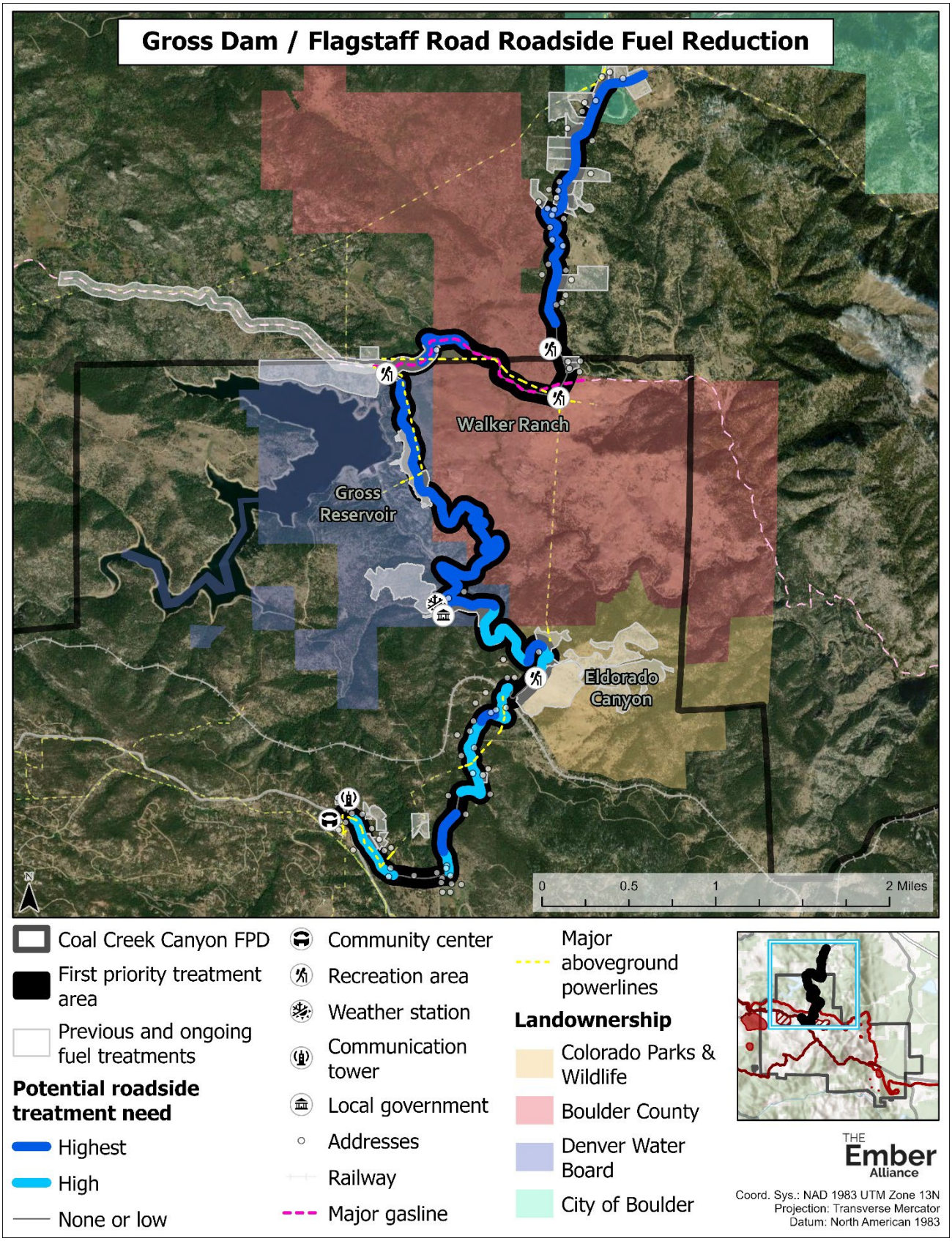


Figure 4.c.3. *Map of the Gross Dam / Flagstaff Road Roadside Fuel Reduction project. The black area along the road is designated as a priority project in this CWPP, and the blue areas highlight where, within the project area, roadside treatment may have a higher impact on resident safety. This map only shows addresses, highly valued resources, landownership, and previous fuel treatments within 0.1 miles (528 ft) from the roadside.*

Twin Spruce Road / Gap Road Roadside Fuel Reduction

Twin Spruce Road runs 2.7 miles from Highway 72 southwest and ends at Nadm Drive, where it turns into Gap Road. Gap Road continues southwest through the north end of Golden Gate Canyon State Park. The road is paved until it enters the state park. This project includes at least 6.3 miles of Gap Road.

Twin Spruce Road is surrounded by varying densities of mixed conifer and ponderosa pine, and as it turns into Gap Road, the vegetation is primarily lodgepole pine.

Treatment objectives:

- The primary objective of this project is to create safer evacuation conditions for residents by decreasing the amount of vegetation along Upper Twin Spruce Road and Gap Road.
- The second objective is to initiate the management of Twin Spruce and Gap Roads as a POD boundary.
- The third objective is to improve forest health where applicable along the roadway.
- The fourth objective is to build trust and relationships with private landowners that have land within the shaded fuelbreak area by treating fuels on public lands first, demonstrating the aesthetics and effectiveness of the fuelbreaks, then proceeding to work with private landowners.

Treatment type:

- Initial treatment is likely to include mechanical thinning at first, and hand thinning where necessary. Treatment should follow CSFS fuelbreak guidelines as much as possible.
- Slash management should be fairly easy with the project occurring along the road, so chipping, slash removal, and pile burning are all feasible options in this area.

Priority: Short-term priority, begin work in 2025-2026

Lead and support organizations: Jefferson County Road and Bridge is primarily responsible for management of the roads here, within their designated right-of-way. Colorado Parks and Wildlife is primarily responsible for management of the roads within their state parks. Colorado State Forest Service, Boulder Watershed Collective, and the local Community Ambassador Program will support working with private landowners where needed outside of the right-of-way to create an effective fuelbreak.

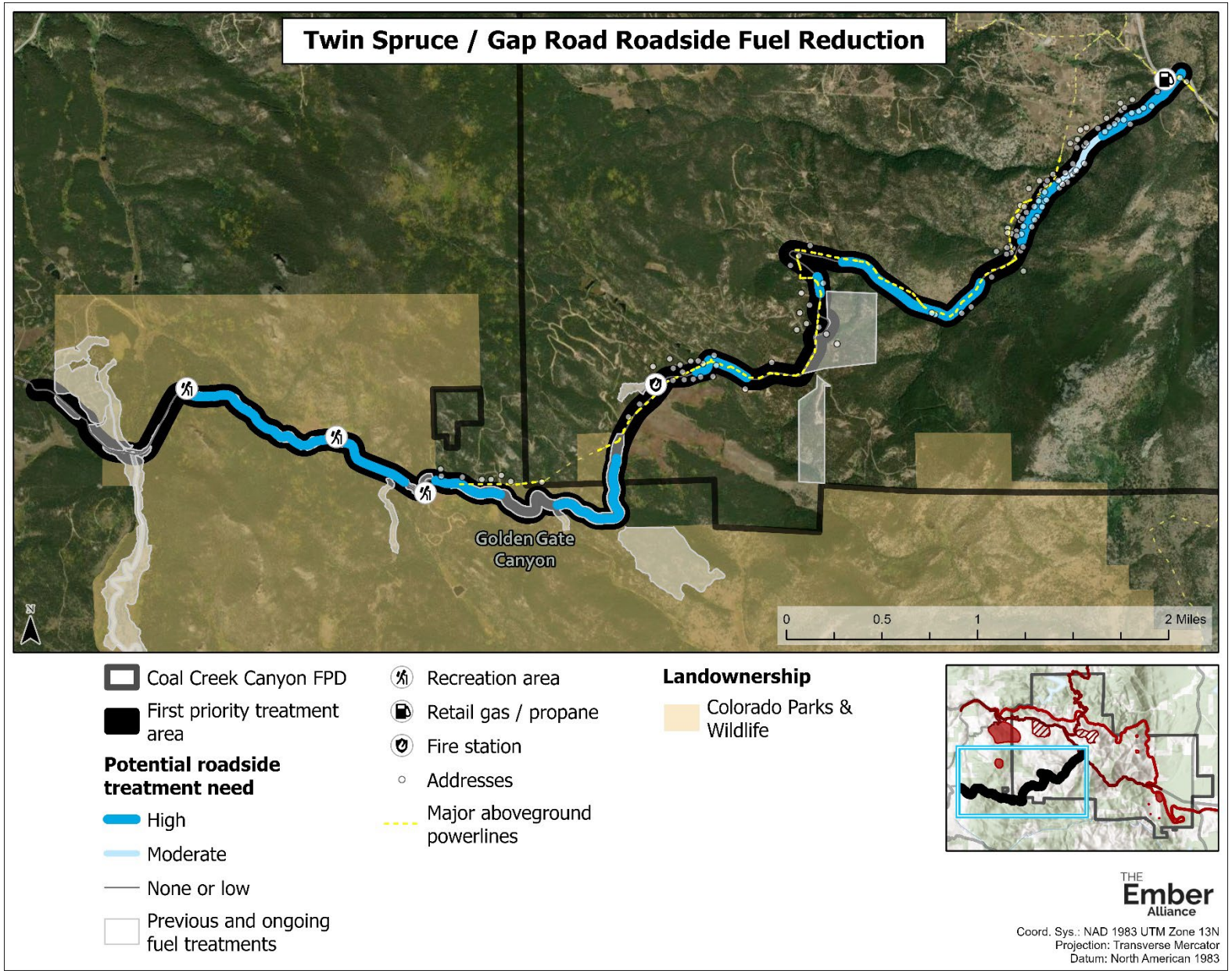


Figure 4.c.4. *Map of the Twin Spruce / Gap Road Roadside Fuel Reduction project. The black area along the road is designated as a priority project in this CWPP, and the blue areas highlight where, within the project area, roadside treatment may have a higher impact on resident safety. This map only shows addresses, highly valued resources, landownership, and previous fuel treatments within 0.1 miles (528 ft) from the roadside.*

Black Gulch Fuel Reduction

Black Gulch is a largely undeveloped valley in Gilpin County, on the western edge of CCCFPD. The area is mostly privately owned, with lots ranging from less than a quarter of an acre to 80 acres. The project map covers just over 750 acres. Treatment does not need to occur over that entire area, but the more that is treated, the more effective this project will be. This treatment will be most effective when combined with treatment along Highway 72 and with home hardening and defensible space around the homes that are near this project.

The valley is densely forested, especially on the northeast aspect. Lodgepole and mixed conifer dominate the northeast aspect, while the southwest aspect has some ponderosa pine stands. The terrain is moderately steep.

Treatment objectives:

- The primary objective of this project is landscape-scale fuels reduction to decrease the intensity and size of a potential wildfire as it approaches the most densely populated area of the district.
- The second objective is to improve the forest health in this area by improving forest structure (horizontal and vertical distribution of layers in a forest including trees, shrubs and ground cover) and composition (all vegetation species found in a forest) to within a historical range of variability. Historical range of variability refers to the conditions of a natural system before settlement.
- The third objective is to initiate the management of Black Gulch Road as a POD boundary.

Treatment type:

- In ponderosa pine and mixed conifer stands, reducing the number of trees, decreasing overall density, favoring large trees, and removing a significant amount of understory growth is recommended. This will likely require mechanical thinning work. Pile burning is likely to be the most effective slash management tool. Reference the General Technical Report 373 (GTR-373) for details.
- In lodgepole stands, patch cuts that mimic stand-replacing fires are recommended to restore the disturbance regime of the forest while safely accomplishing the objectives. Aspen should be retained and encouraged. The entire hillside should not be cut in one treatment, but in smaller, staged treatments to promote a **Mosaic Landscape**.
- If feasible, consider prescribed burning on the southwest aspects. An assessment for the Northern Colorado Fireshed suggests that values at risk, including forest health and the WUI, could experience benefits from the judicious use of prescribed burning (Rhea et al., 2022).

Priority: Immediate priority, begin work within 2024

Lead and support organizations: The USFS owns much of the western portion of the project area, and the rest is privately owned. Organizations including the Boulder Watershed Collective, Boulder Valley-Longmont Conservation District, CSFS, and Saws and Slaws will need to work together to build relationships with landowners, get grants and project funding, and complete the work on the private lands.

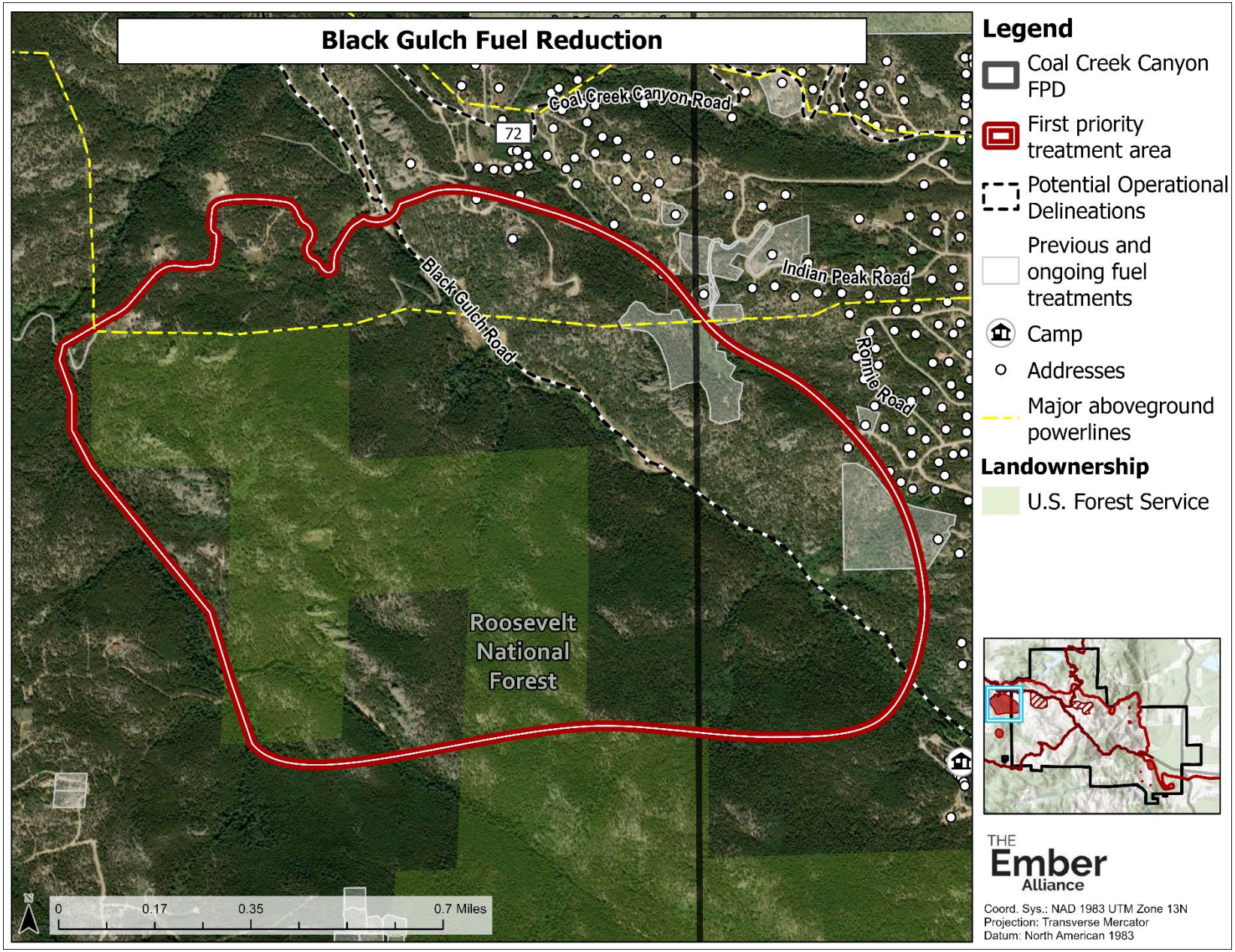


Figure 4.c.5. *Map of the area identified for fuels treatment in the Black Gulch Fuel Reduction project. This map shows a generalized area for fuels treatment, not all the land within the project boundary needs to be treated.*


Photo: Boulder County Sherrif's Office

Mount Thorodin Communication Tower Protection

The Mount Thorodin Communications Tower (officially known as ATC Thorodin – 90369) lies at the top of Starr Peak, near Mount Thorodin. This building, which resides in Gilpin County and is operated by American Tower, hosts the primary (and frequently the only) emergency communications tower for all CCCFPD, and many of the surrounding fire districts. It houses cell towers that residents rely on to receive emergency notifications and has early fire detection cameras for the fire districts and counties. It is surrounded by USFS land and accessible to authorized personnel by a rough road.

At 10,500 feet above sea level, it is surrounded by subalpine tree species such as spruce, fir, and lodgepole. The project boundary encompasses 76 acres, but not all that area needs treatment – only what is strategic enough to ensure that the communications towner and equipment used to operate it is adequately protected.

Treatment objectives:

- The primary objective of this project is to create a high-quality defensible space around the base of the tower structure.
- The second objective is to reduce fuels beyond the defensible space to further reduce the risk of wildfire affecting the structure and thus responder communications during the event.

Treatment type:

- The structure should have defensible space and structure hardening that meets or exceeds the guidelines set out in the CSFS HIZ Guide. Because the structure is atop a mountain, zone 3 should extend beyond 100 feet to account for slope.
- Vegetation beyond the HIZ should be removed, thinned, or limbed where possible to decrease the severity of wildfire approaching the structure, especially to the west. Piles should be burned on site.
- Along the roadway, vegetation should be removed on either side of the road to create a total of 20 feet of horizontal clearance to increase responder safety when accessing or defending the structure.

Priority: Immediate priority, begin work within 2024

Lead and support organizations: CCCFPD will work with the USFS, American Tower, Boulder County, Gilpin County, and private landowners to initiate this project. They may also work with other tower users, including Mountain Broadband, MRIC, or other parties that may be affected by this project.

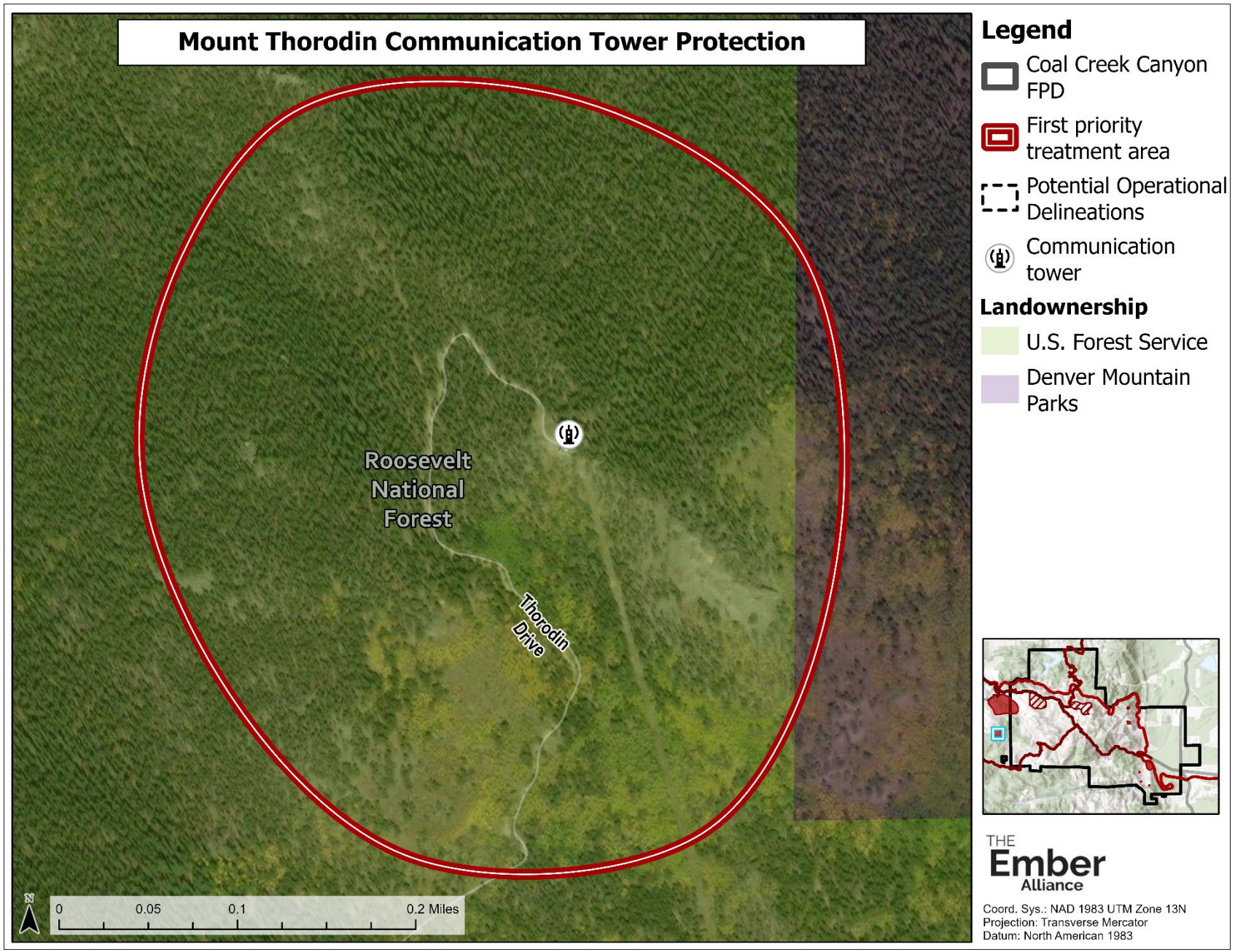


Figure 4.c.6*. Map of the area delineated for treatment in the Mount Thorodin Communication Tower Protection project.*


Photo: Netoe

Secondary Communication Infrastructure Protection

This project encompasses two communications tower sites: one atop Eldorado Mountain and another that sits along the road leading to the top of Eldorado Mountain. The project encompasses approximately 10 acres of land, but not all that area is necessary to treat in order to accomplish the objectives outlined.

The vegetation in this area is primarily ponderosa pine and dry mixed conifer. These towers are on privately owned land. These towers serve both Coal Creek Canyon as well as other parts of Boulder County.

Treatment objectives:

- The primary objective of this project is to create high-quality defensible space around the base of all communication tower structures to reduce the risk of wildfire affecting the structure and thus responder communications during an incident.

Treatment type:

- The structures should have defensible space and structure hardening that meets or exceeds the guidelines set out in the CSFS HIZ Guide. The structures that are on top of Eldorado Mountain should extend zone 3 beyond 100 feet to account for slope.
- Along the roadway, vegetation should be removed on either side of the road to increase responder safety when accessing or defending the structures.

Priority: Mid-term priority, begin work before 2029.

Lead and support organizations: CCCFPD will initiate conversations with the partners that own and manage the structures and land, such as iHeartMedia and cell providers that have towers here.

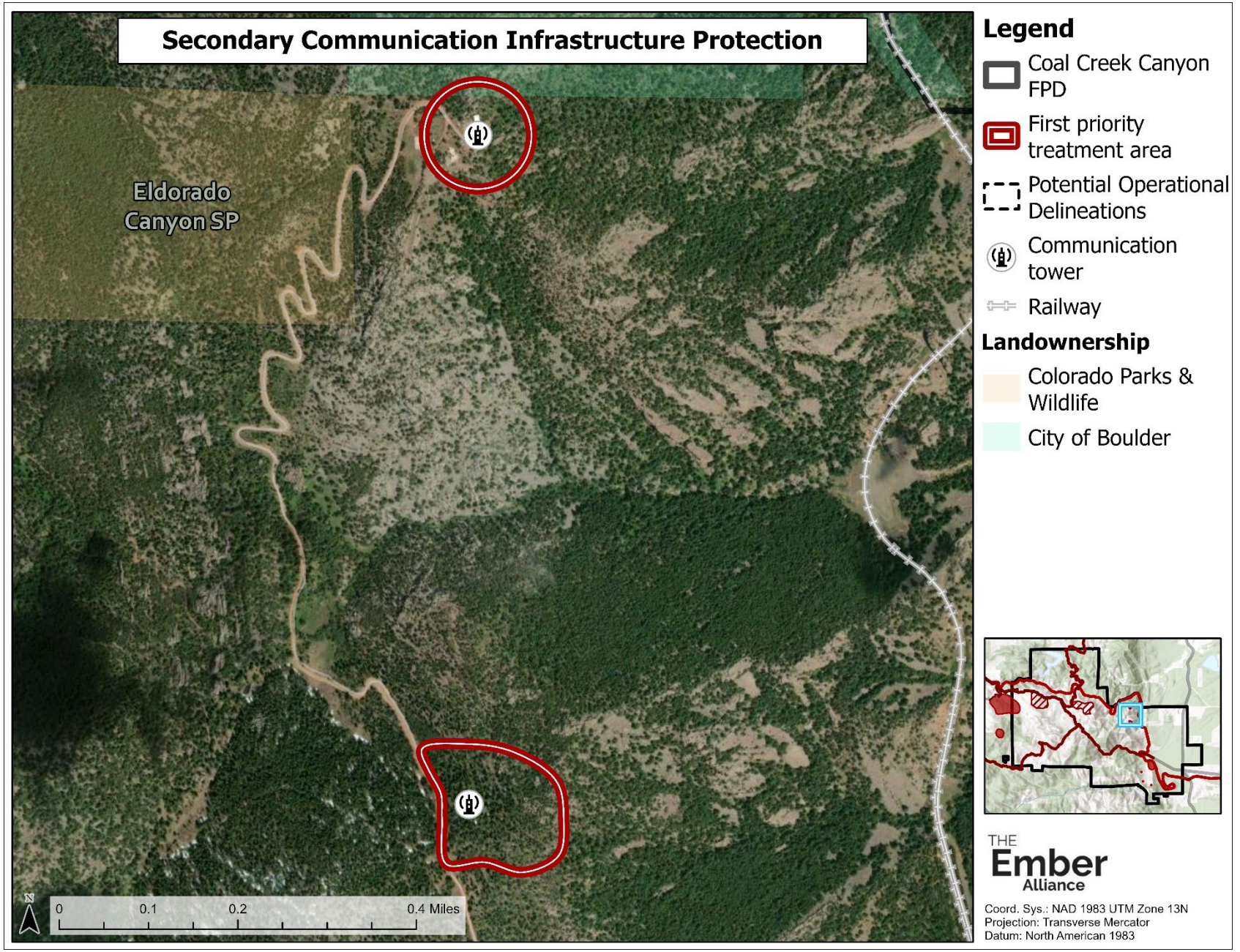


Figure 4.c.7. *Map of the areas outlined for treatment in the Secondary Communications Infrastructure Protection project.*

Blue Mountain Water District Infrastructure Protection

Blue Mountain Water District is a local utility organization that serves Blue Mountain Estates and is a water source for firefighters when responding both inside and outside the neighborhood. The map shows approximately 60 acres in this project, but treatment does not need to occur in that entire area. In addition, defensible space treatments are recommended around isolated water tanks and pumps.

This area is dominated by ponderosa pine and other dry mixed conifer species that are growing denser than they did before settlement. The structures are on rolling foothills, with a steep slope to the west.

Treatment objectives:

- The primary objective is to reinforce and protect the water district's infrastructure against wildfire.

Treatment type:

- The structures should have defensible space and structure hardening that meets or exceeds the guidelines set out in the CSFS HIZ Guide.
- Vegetation beyond the HIZ should be removed, thinned, or limbed where possible to decrease the severity of approaching wildfires, especially to the west. Reference the General Technical Report 373 (GTR-373) for details.
- If feasible, consider prescribed burning in parts of this project area. An assessment for the Northern Colorado Fireshed suggests that values at risk, including forest health and the WUI, could experience benefits from the judicious use of prescribed burning (Rhea et al., 2022).
- Along roadways, vegetation should be removed on either side of the road to increase responder safety in the area.

Priority: Short-term priority, begin work in 2025-2026

Lead and support organizations: Blue Mountain Forest Stewardship Initiative will lead this project, with support from the water district, CSFS, Jefferson County Open Sace, and CCCFPD.

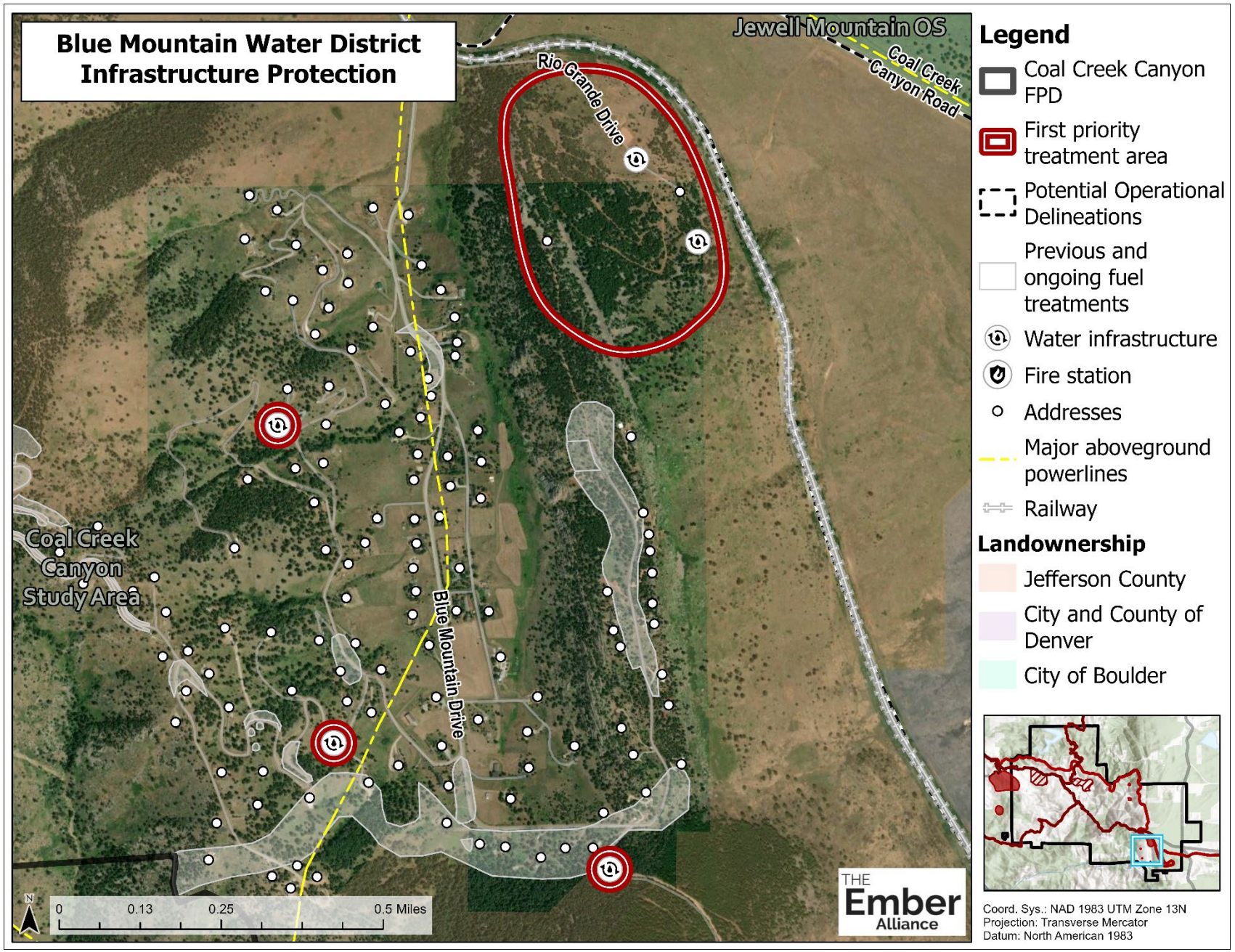


Figure 4.c.8. *Map of the area identified for structure protection and fuels treatment in the Blue Mountain Water District Infrastructure Protection project.*

Photo: Jerry Huddleston

Central Corridor Rail Line Ignition Reduction

The Central Corridor Rail Line runs east and west through the CCCFPD, crossing roads and going through tunnels. It passes through the entire spectrum of vegetation within CCCFPD. This line is owned by Union Pacific.

Treatment objectives:

- The primary objective is to reduce the risk of railroad sparks and embers igniting nearby vegetation, leading to large wildfires.

Treatment type:

- The treatment for this project includes decreasing the amount of vegetation near the railroad along the 31.8 miles through the district. Due to the variety of ecosystems that the railroad traverses, this may need to be accomplished through multiple methods, including mechanical thinning, hand thinning, mulching, goat herds, or prescribed fire.
- If feasible, consider prescribed burning in the eastern parts of this project area. An assessment for the Northern Colorado Fireshed suggests that values at risk, including forest health and the WUI, could experience benefits from the judicious use of prescribed burning (Rhea et al., 2022).

Priority: Mid-term priority, begin work before 2029.

Lead and support organizations: The USFS and Blue Mountain Forest Stewardship Initiative will initiate conversations with Union Pacific and build the relationship necessary to commence work. Other partners will likely need to be involved with this project at some point, including the CSFS, CCCFPD, and the counties.

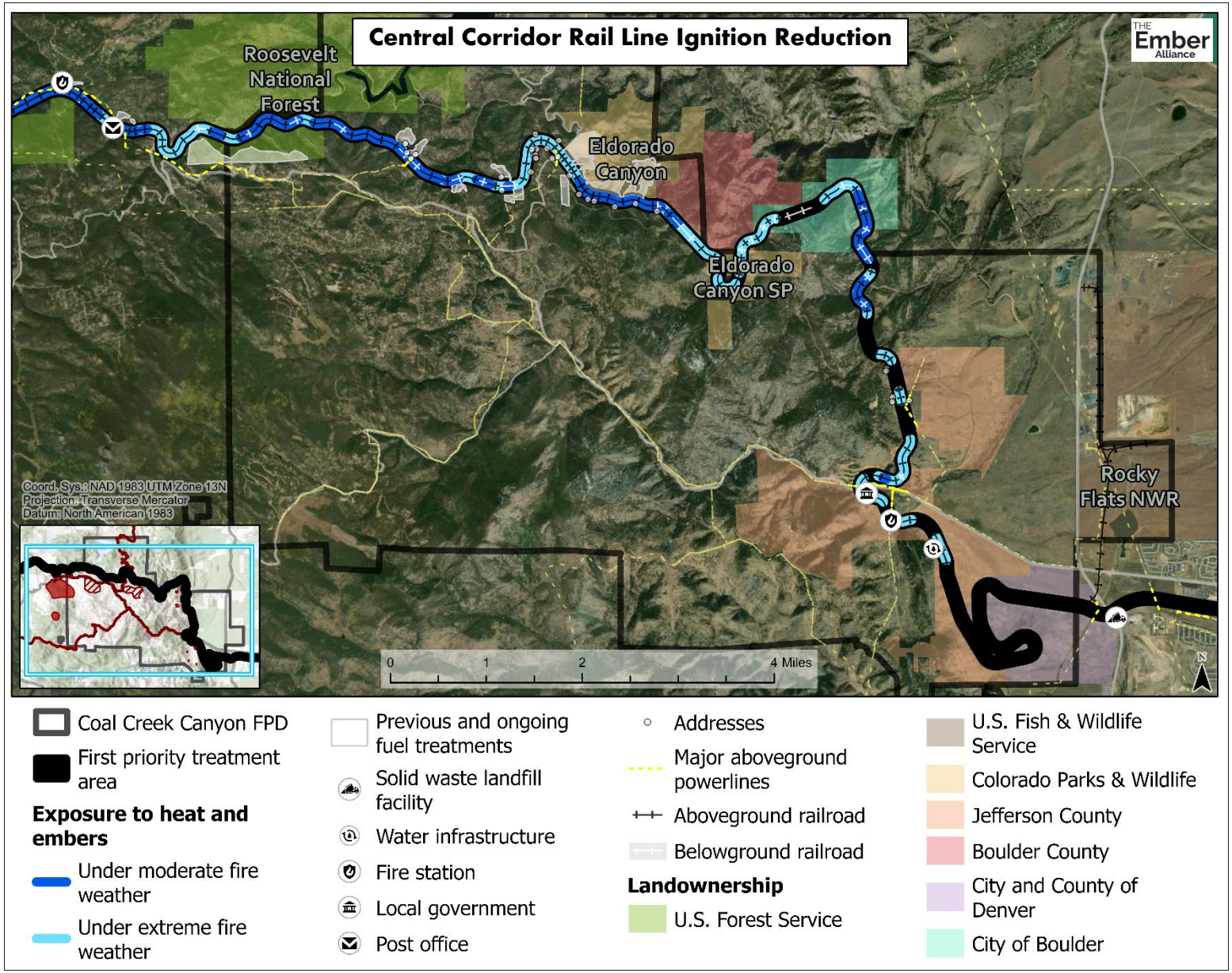


Figure 4.c.9. *Map of the Central Corridor Rail Line Ignition Reduction project. The black area along the railroad is designated as a priority project in this CWPP, and the blue areas highlight where, within the project area, the railroad is exposed to radiant heat and embers. This map only shows addresses, highly valued resources, landownership, and previous fuel treatments within 0.1 miles (528 ft) from the tracks.*

Other CWPP Projects

Many projects were created throughout the CWPP process, and not all are able to be top priority projects. These projects are still important to the community and meet the goals of reducing wildfire risk for CCCFPD. If opportunities arise to pursue these projects, residents and partner organizations should pursue them alongside the priority projects listed above, and when the priority projects are underway or complete, these projects can serve as next steps, or a starting place for the CCCFPD's next CWPP update.

Objectives and treatment types will vary widely for each of these projects and are generally outlined in **Table 5.c.1**. Please consult your local CSFS forester, CSU Extension representative, community ambassador, or forestry professional to further define appropriate objectives, scope, and methods for each project.

Priority: Second and third priority, compared to the above-listed projects.

Project Names:

- Complete Fire Station HIZ work (project ID on map: AH)
- Copperdale (project ID on map: O)
- Crescent Park (project ID on map: AF)
- Rudi Lane (project ID on map: E)
- Coal Creek Canyon Fire Department Station 2 and communication tower (project ID on map: N)
- Miramonte Road (project ID on map: T)
- Gross Hydro Plant (project ID on map: V)
- County Road 68J Roadside Fuel Reduction (project ID on map: X)
- Gross Reservoir weather station & Denver Water Offices (project ID on map: AA)
- Whispering Pines Church (project ID on map: AD)
- Plainview Road (project ID on map: AK)
- Communication tower on Old Post Office Building (project ID on map: AM)
- Communication tower on Plainview Dr (project ID on map: AN)

- Electric substations (TAP204087 and Plainview) (project ID on map: AP)
- Communication tower at 11726 Hwy 93 (project ID on map: AQ)
- Pinecliffe (project ID on map: A)
- Camp Eden & Upper Twin Spruce Link (project ID on map: C)
- Coal Creek Heights & Hilltop Link (project ID on map: G)
- South District (project ID on map: I)
- Northside of Camp Eden (project ID on map: M)
- Forsythe Project Expansion (project ID on map: P)
- South Gross Reservoir Forest Health (project ID on map: Q)
- East Gross Dam Forest Health (project ID on map: U)
- Forsythe project maintenance (project ID on map: W)
- Meyer's Homestead Trailhead (project ID on map: Z)
- Crescent Meadows/Walker Ranch Loop (project ID on map: AB)
- Tunnel 19 Area (project ID on map: AC)
- Business District (project ID on map: AG)
- Central Canyon South (project ID on map: AI)
- Crescent Mountain (project ID on map: AJ)
- Copperdale Lane, Ridge Road, and Coal Creek Heights Drive (project ID on map: F)
- Crescent Lake Road (project ID on map: AE)
- Deer Creek Forest Health (project ID on map: J)
- Indian Peak Circle & Hwy 72 Switchbacks (project ID on map: K)
- Eastside of Wondervu (project ID on map: L)

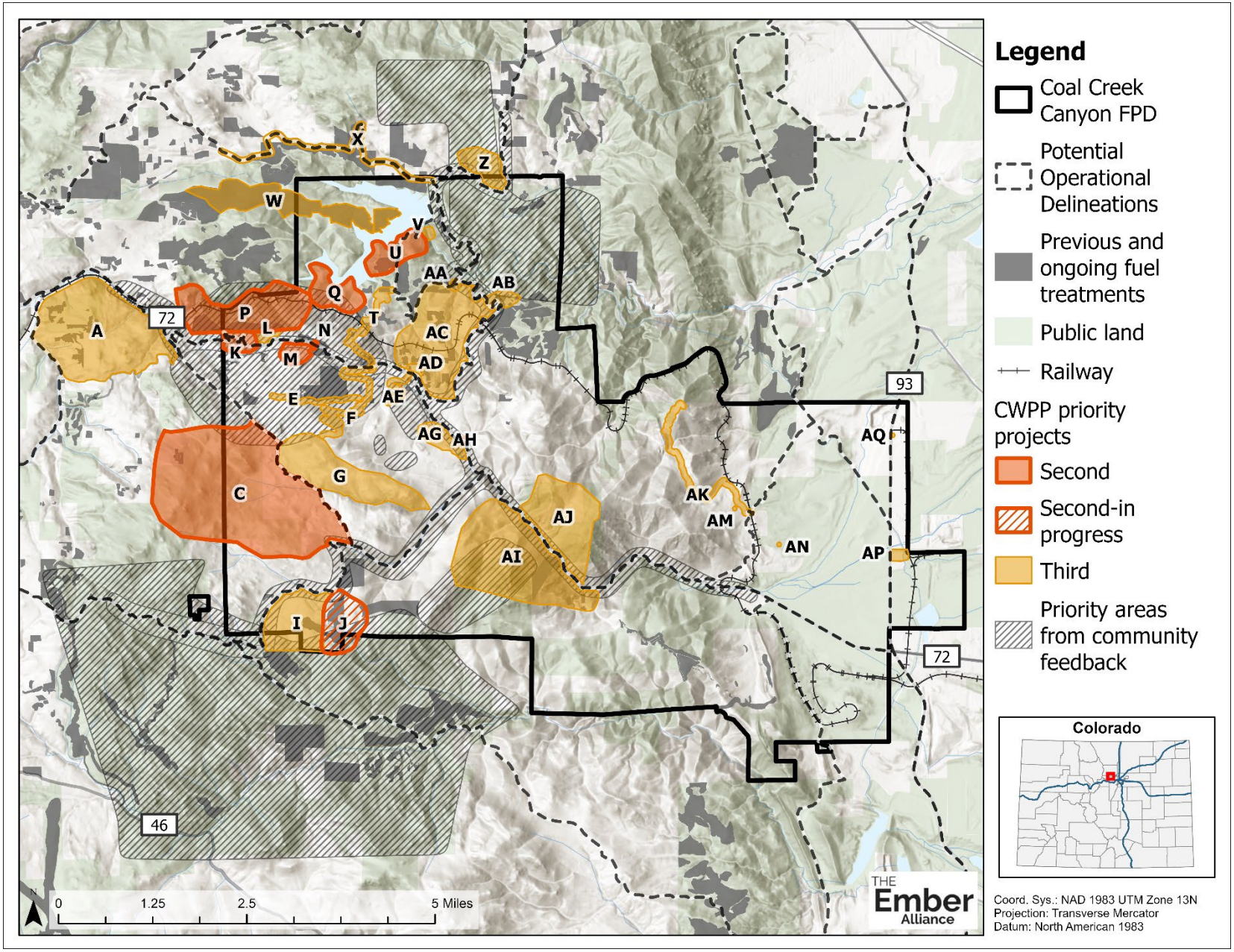


Figure 4.c.10*. Map of the second and third priority projects. These projects are important to reducing wildfire risk in the community, but they are not as urgent to complete as the first priority projects listed above.*

4.d. Logistics of Fuel Treatments

Roles and Responsibilities

Landowners are responsible for fuel mitigation on their own lands, including along their private driveways. Residents must initiate and follow through on this work, but that does not mean they must do it alone. For assistance in planning and implementing fuel treatments, contact the Colorado State Forest Service (CSFS), Boulder Wildfire Partners, Boulder Valley–Longmont Conservation District (BVLCD), and Jefferson Conservation District (JCD), or other wildfire mitigation specialists. CCCFPD and their partner organizations can also reach out to volunteer organizations like Saws and Slaws or Team Rubicon for support implementing hazardous fuel reduction. Cooperation from private property owners is necessary for effective roadside fuel treatments; roadway and utility easements are rarely wide enough to satisfy the minimum of 150 feet treatment depth on each side of roads.

Tree cutting with a chainsaw and other forestry equipment should be done by experienced and certified individuals. CSFS provides guidance for how to select a contractor for forest management, and the CSFS Golden Field Office provides a list of local forest agriculture contractors on their website.

Numerous organizations are taking responsibility to manage the land they administer and mitigate wildfire risk (**Figure 2.g.1**). The US Forest Service (USFS) regularly conducts prescribed burns and tree removal on the Roosevelt National Forest, Jefferson County Open Space has an active forest management program, Colorado Parks & Wildlife (CPW) works with CSFS to treat Eldorado Canyon State Park, Golden Gate Canyon State Park, and Ralston Creek State Wildlife Area, and the Denver Water Board has supported fuel treatments around Gross Reservoir. Miramonte and Blue Mountain Estates and several private landowners across CCCFPD have conducted fuels reduction projects on their land.

The responsibility for conducting roadside fuel treatments depends on the location of the road. Landowners are responsible for treatments along their private driveways. HOAs and improvement associations can treat roads they manage. CCCFPD is currently coordinating with the Colorado Department of Transportation to conduct roadside mitigation along Coal Creek Canyon Road/Highway 72. CCCFPD and partner organizations can work with Road and Bridge Departments in Boulder, Jefferson, and Gilpin County to address roadside hazards along county roads, and CCCFPD and partner organizations can coordinate with the USFS to treat fuels along roadways on National Forest land. Other communities have successfully worked with utility companies to treat fuels in utility rights-of-way. As part of the **Central Corridor Rail Line Ignition Reduction** project for this CWPP, the USFS and BMFSI will initiate conversations with Union Pacific and build the relationship necessary to commence work along the railroad tracks.

Treatment Costs

The cost of fuel treatment depends on management objectives, treatment specifications, slope, accessibility, and treatment method (e.g., mechanical thinning, hand thinning, or prescribed burning). Costs of $2,500 to $10,000 per acre are not uncommon along the Colorado Front Range where there is little biomass or timber industry to provide financial return (B. M. Gannon et al., 2019). Follow-up treatments are generally less expensive than the initial entry and help maintain the efficacy of the original treatment investment.

Since fuel treatments are expensive, it is important to conduct strategic, well-designed, landscape-scale treatments to increase the likelihood that fuel treatments modify fire behavior, save lives, and restore ecosystems. Fuel treatments can reduce property damages by making wildfires less damaging and easier to control; this is especially true for prescribed burning, which is often cheaper and more effective at altering forest fuel loads than mechanical thinning alone (Fulé et al., 2012; Loomis et al., 2019; Prichard et al., 2020). Proactive management of forests can also reduce the cost of rehabilitating watersheds when wildfires are followed by large rainstorms and result in massive erosion (Jones et al., 2017b). Fuel treatments can also reduce suppression costs due to the increased efficiency of firefighting (Loomis et al., 2019).

Longevity of Fuel Treatment Benefits

Benefits of fuel treatments are not permanent and decrease overtime, with treatment "lifespan" depending on forest type, topography, rates of seedling regeneration (which is often influenced by precipitation), and the number of trees removed during treatments. Many forests require more than one phase of treatment to reduce fuels and restore ecosystem structure. Some areas might require mechanical tree removal followed by prescribed burning, and then a maintenance treatment with tree removal and/or prescribed burning 10 to 20 years later. With a single pulse of tree regeneration, the risk of torching returns to near pre-treatment levels within 10 to 35 years in ponderosa pine forests in Colorado (Tinkham et al., 2016).

Approaches to Slash Management

Forest management operations often initially increase surface fuel loads by leaving slash in the project area, which can fail to achieve fire mitigation objectives if fuels created by the harvest activities (also known as slash) are not addressed (Agee and Skinner, 2005). Slash can include small trees, limbs, bark, and treetops. Slash management is a critical step in the forest management process. It is unwise, ineffective, and even dangerous to conduct poor-quality fuel treatments that fail to reduce canopy fuels, result in increased surface fuel loads, and do not receive maintenance treatments. Such treatments can lead to a false sense of security among residents and fire suppression personnel (Dennis, 2005), and they divert limited funds away from more effective, strategic projects.

Leaving untreated slash within roadside fuel treatments is particularly counterproductive. The risk of active crown fire might be lower after a thinning operation, but untreated slash in fuel treatments can burn at high intensities and endanger the lives of residents stuck on roadways during a wildfire. Slash is easier and cheaper to manage along roadways due to access, and roads can serve as highly effective holding features for controlled burning of grass in the spring and fall, and pile burning in the winter.

Methods for managing slash come with different benefits and challenges (**Table 4.e.1**). For example, lop-and-scatter and mastication do not remove surface fuels from the site, they only rearrange them. It can take a decade or more for slash to decompose to a point where it no longer poses a significant fire hazard. Broadcast prescribed burning is most effective at removing surface fuels, but requires extensive planning and expertise to conduct properly, and may not be appropriate until slash is removed or piled and burned.

Slash removal in this part of Colorado is quite difficult due to limited biomass and timber industries. Recommendations to improve slash management options for CCCFPD are provided in **Section 3.c** of this CWPP.

Broadcast Prescribed Burning

Broadcast prescribed burning is often the most effective method to reduce surface, ladder, and canopy fuel loads. Broadcast burning can be safely and successfully conducted with proper planning and implementation by qualified firefighters. Broadcast burning is regulated in Colorado by the Division of Fire Prevention and Control (DFPC), Department of Public Health and Environment, local sheriff's offices, and fire departments as outlined in the *2019 Colorado Prescribed Fire Planning and Implementation Policy Guide.*

Prescribed burning is a common tool used to restore ecosystem processes and reduce fuel loads. Photo credit: The Ember Alliance.

Challenges with broadcast burning can include public concerns about risk from flames, embers, and smoke. There are often limited opportunities to conduct burns under appropriate fire weather conditions, and firefighters are often on wildfire assignments and unavailable to conduct burns.

Pile Burning

Pile burning can be the best and sometimes only option for slash removal in steep, inaccessible areas, and incomplete slash management can leave an area just as at risk as an unmitigated area. Pile burning is different from broadcast burning; the overall complexity of pile burn operations is lower because fire activity is limited to discrete piles, and piles can be burned when snow covers the ground.

Pile burning can be a safe and effective method to consume slash created by thinning operations Photo credit: The Ember Alliance.

Burning piles can produce embers, but the risk of these embers igniting spot fires or structures is low. Piles are typically burned on days with snowpack, high fuel moisture, and low to moderate wind speeds. Embers from burn piles travel shorter distances than embers from passive and active crown fires because the burning material is closer to the ground (Evans and Wright, 2017).

Challenges with pile burning can include public concerns about risk from flames, embers, and smoke. There are often limited opportunities to conduct pile burns because of requirements for snowpack and atmospheric ventilation. Intense heat from pile burning can sterilize soils and result in slow recovery of plants. Mitigation measures, such as raking the burnt soil and seeding with native plants, are sometimes warranted after pile burning if the soil was completely sterilized by extreme heat or if invasive species are prevalent in the area (Miller, 2015).

It is critical to properly construct piles either by hand or with machines and to burn them as soon as conditions allow (see the 2015 *Colorado pile construction guide* from the DFPC and CSFS for guidance). Unburnt slash piles can become a hazard during wildfires, especially if loose logs catch fire and roll down slopes. Burning older piles is less effective and does not consume as much material because piles become compact and lose fine fuels over time (Wright et al., 2019).

Individuals must apply for smoke permits from the Colorado Department of Public Health and Environment to burn piles, and apply for open burn permits and/or smoke management from their County. Pursuant to Colorado House Bill 22-1132 (Darcy's Last Call Act), individuals must contact their local fire department before burning. Visit the following websites for details on burn permits and regulations in each County intersecting CCCFPD:

- Boulder County website on burn permits.
- Gilpin County website on open burn regulations and permits.
- Jefferson County website on open burning.

DFPC administers a certified burner program that provides civil liability protection to individuals planning and leading burns if smoke or flames cause damage. The burn must have been properly planned, approved, and executed to receive liability protection. The rigorous certification program requires individuals to complete 32-hours of training, pass an exam, lead at least three pile burns, complete a task book, and comply with all legal requirements for pile burning in Colorado.

Community Slash Piles

Community slash piles allow residents to immediately reduce fuel loads on their property, and they eliminate the need for residents to burn or chip their own material. However, it can be challenging for residents to haul material from their properties to the slash pile. Providing a program that will pick up the slash material and bring it to the slash disposal site will also reduce barriers for residents to complete mitigation work thoroughly.

The success of community slash piles is dependent on consistent management of the pile. If large slash piles are left in the community, they can pose a fire risk. Community slash piles also come with a cost for management and maintenance, but the cost is spread across all residents and therefore lower than if individual residents were to create and burn their own slash piles.

Boulder County hosts a free seasonal sort of yard for slash in Nederland, Gilpin County hosts a free seasonal sort yard for slash in Blackhawk, and Jefferson County has a fee-based seasonal slash collection site at Blue Mountain Open Space annually. The distance and cost for these sort yards are prohibitive for some residents in CCCFPD, which is why we recommend that CCC community work with local agencies and organizations to create a closer, free slash collection site.

Lop-and-Scatter

Lopping involves cutting limbs, branches, treetops, smaller-diameter trees, or other woody plant residue into shorter lengths. Scattering involves spreading slash so it lies evenly and close to the ground. The lop-and-scatter approach reduces the height of slash relative to untreated slash, therefore increasing the distance between surface and canopy fuels (but not as effectively as broadcast prescribed burning or pile burning).

Lop-and-scatter can contribute to more intense fire behavior by not addressing increased surface fuel loads created by thinning (Agee and Skinner, 2005; Hunter et al., 2007). **Lop-and-scatter should not be utilized in ZONES 1, 2, or 3 or along roadways** because this method does not remove surface fuels from the site, it just rearranges them. Lop-and-scatter is better suited to areas with low slash accumulations and for stand-scale fuel treatment areas far away from homes.

Mastication or Chipping

Mastication involves using specialized machines like a tow-behind chipper or a hydro-ax to grind up standing saplings and shrubs and cut slash into medium-sized chips. Chipping involves processing slash through a mechanical chipper to break material into small chips or shreds. Mastication and chipping can reduce fire intensity and rates of spread by increasing the distance between surface and canopy fuels and suppressing the regrowth of grasses (Kreye et al., 2014).

However, unless material is hauled away after treatment, fuels are just rearranged, not reduced. Smoldering fires in masticated and chipped fuels can be difficult to suppress, produce abundant smoke, kill tree roots, and lead to spot fires if high winds reignite masticated fuels and blow them across containment lines (Kreye et al., 2014). Additionally, fuels left behind in mastication and chipping treatments are deeper and more compact than natural fuels (Kreye et al., 2014). Thus, they can impede plant regeneration, particularly when the depth of masticated and chipped fuels exceeds 4 inches (Jain et al., 2018). For detailed information on chipping and mastication, refer to CFRI's Mulching Knowledge Summary.

Neighborhood chipping programs are cost-effective ways for communities to gain access to chippers without individuals paying for the unit and service each time they need it. Many communities create chipping programs where a chipper can be brought to anyone's property and chip the material there for them to spread across their land again. CCCFPD and partner organizations should continue to host their chipping events and programs for residents as a cost-effective slash management option, and expand them as the need arises.

Hauling Material Offsite

Cut trees can be loaded on trucks and removed completely from the site, thereby immediately reducing fuel loads on the site. The destinations of removed trees are mills to be turned into boards or firewood, yard waste disposal sites to be composted and turned into garden soil or mulch, or the landfill.

Hauling material offsite can be expensive and labor intensive. There is a limited biomass and timber industry in Colorado, so material often costs more to transport than it is worth. Needles, bark, and small branches are often left behind, which means surface fuel loads can be greater after treatment than before. Hauling material outside the community can also spread insects like mountain pine beetles, ips beetles, and emerald ash borer.

Utilizing Material for Firewood

Wood leftover from thinning operations can be used as firewood. Firewood needs to be "seasoned" before use, which involves splitting the wood into usable logs and drying it for 6-18 months. Homeowners can often manage preparing firewood themselves, so it can be an alternative way to manage some material from mitigation work. Utilizing material for firewood can relocate surface fuels from one site to another, but it increases fuel loads near a home until burned. **Firewood must be stored at least 30 feet and uphill of structures; otherwise, it can create hazardous conditions during a wildfire.**

If firewood is used locally, it reduces the chances of introducing non-native insects and diseases to the ecosystem that cause outbreaks and damage forest health. Transporting firewood outside the community is not recommended if there are insects like mountain pine beetles, ips beetles, and emerald ash borer in the area.

Table 4.d-1. Many methods are available to remove slash created by forest thinning, each with their own benefits and challenges.

Method	Removes surface fuel from site	Restores ecosystem functions	Retains nutrients on the site	Expertise required to conduct	Effort to conduct	Relative cost / acre	Total time to plan and conduct
Broadcast prescribed burning	✓	✓	✓	Very high	Very high	$$$	Months to years
Pile burning on site	✓		✓	Moderate	Moderate to high	$$	Weeks to months
Air curtain burner	✓			High	Moderate	$$$$	Weeks to months
Community slash pile	✓			Low to moderate	Moderate	$$	Ongoing
Lop-and-scatter			✓	Low to moderate	Moderate	$ - $$	Weeks to months
Mastication or chipping	(✓)		✓	High	Moderate to high	$$$	Weeks to months
Hauling material away	✓			Low to moderate	High	$$ - $$$	Weeks to months
Utilizing material for firewood	(✓)			Low	Low to moderate	$	Days to weeks

Note: Mastication and chipping only remove surface fuel from the site if material is hauled away after treatment. Utilizing material for firewood can relocate surface fuels from one site to another but increase fuel loads near a home until burned.

5. Implementation Plan and the Future of the CWPP

Below are strategic actions for residents, CCCFPD, the CWPP Implementation Committee, and other community groups, public land managers, county, state, and federal agencies, and non-profit conservation groups to accomplish immediately or in the mid- or long-term (see definitions below). Some activities have low financial cost but require a fundamental shift in attitudes and behavior to prioritize wildfire risk mitigation. Other actions are more substantial and require commitment and collaboration across the community to pool resources, apply for grants, and make incremental steps toward meaningful change. Many of these recommendations are aspirational and will require expanded capacity and funding, as well as patience and hard work from community members and leaders to make lasting changes.

5.a. Implementation Phases

Immediate action	• Partners should start working on this project within 2024. • Has the highest potential for immediate return-on-investment. • Can be funded within the current capacity of CCCFPD and partner organizations with some supplemental funding from grants available in the next 12-18 months. • Can occur with little to no expansion of the current CCCFPD staff and partner organizations. • Can capitalize on current relationships with emergency response partners, land management agencies, and non-profit organizations.
Short-term priority	• Partners should start working on this project by 2026. • Requires moderate expansion of financial and implementation capacity of CCCFPD and partner organizations. • Requires new cooperative relationships with emergency response partners, land management agencies, and non-profit organizations. • Requires greater level of coordination among partners. • Requires greater level of community discussion and decision making.
Mid-term Priority	• Partners should start working on this project by 2029. • Requires multi-year planning and funding. • Requires extensive grant funding. • Requires substantial expansion of financial and implementation capacity of CCCFPD and partner organizations. • Requires substantial coordination among partners. • Requires substantial community discussion and decision making.
Long-term Projects	• Partners are not expected to start on this project within five years of the signing of this CWPP, unless opportunities come. • These projects are potentially good fits for this community but may not be as impactful as other listed priorities. • These projects are potential starting places for the next CWPP Update Action Plan.

5.b. Implementation Activities and Responsibilities

Table 5.b.1. *Each of the 97 recommended actions in this CWPP, listed with their goals, responsible parties, and relative priority. Many of these are seen elsewhere throughout the document and are compiled here for tracking purposes. Purple highlight indicates that action on this recommendation is in progress.*

Recommendation	Goals	Responsibility	Priority
Fire Adapted Communities			
Home Hardening	See **Section 3.a**	Residents	Immediate Action
Mitigating Home Ignition Zone 1	See **Section 3.a**	Residents	Immediate Action
Mitigating Home Ignition Zone 2	See **Section 3.a**	Residents	Immediate Action
Sign up for emergency notification through your county	Consider signing up for notifications from neighboring counties if you live near the border of your county.	Residents	Immediate Action
Engage in annual maintenance of your home ignition zone	See **Section 3.a**	Residents	Immediate Action
Develop a family evacuation plan and go-bags	Plans should include considerations of pets and livestock if applicable. Cooperate with neighbors to develop plans for evacuating children who may be home alone or residents with mobility impairments or other special needs.	Residents	Immediate Action
Provide Evacuation Safety Education	Provide education on evacuation, including how routes could change depending on where a fire is burning. Include go-bag workshop. Include preparation for smoke (wildfire and prescribed burn). Include county emergency notification systems and how cross-county notification works	CCCFPD, CWPP Outreach Team	Immediate Action
Increase Cell Service coverage	This is in progress - a new cell tower on Station 1 is being added. More towers for additional coverage are needed. Explore installing solar power sources to reduce the need for backup generators.	TBD	Immediate Action
Complete Fire Station HIZ work (project ID on map: AH)	Reduce the risk of ignition to all four CCCFPD stations, demonstrate high-quality HIZ work for the community.	CCCFPD	Immediate Action
Highway 72 Roadside Fuel Reduction (project ID on map: S)	Protection of evacuation routes by A) Mulching within 20 ft from the edge of the road with CDOT's mulching head. B) shaded fuelbreak beyond the 20-foot	Led by CDOT within Hwy 72 ROW, partners	Immediate Action

Recommendation	Goals	Responsibility	Priority
	clearing, following CSFS standards and/or best management practices. See **Highway 72 Roadside Fuel Reduction** for details.	include BWC, CSFS, BVLCD, JCOS	
Mount Thorodin Communication Tower Protection (project ID on map: D)	Protect the main Communications tower used by CCCFPD, and the broadband equipment. Create defensible space around the towers, harden generator or other infrastructure at the base of the towers. See **Mount Thorodin Communication Tower Protection** for details.	Led by CCCFPD, partners include USFS, American Tower, Mountain Broadband, MRIC, Boulder County	Immediate Action
Identify Slash Solutions for CCC	Investigate Jeffco assistance in establishing a slash depot in Coal Creek Canyon. Investigate a possible alliance with Biochar Now to provide a temporary mobile biochar unit for slash disposal.	Led by BMFSI and similar organizations, with support from JCOS, JCD, Biochar Now	Immediate Action
Form Coal Creek Canyon CWPP Implementation Committee	Coordinate collaborative action to accomplish CWPP Action Plan items. Keep action items relevant to the organizations involved, help problem-solve when roadblocks arise, and prepare for the update in ~5 years. Coordinate with County CWPPs Implementation Committees where possible.	CCCFPD, C4 group, CWPP Outreach Committee, BWC, BMFSI and similar organizations, Boulder County and Jefferson County and Gilpin County, CSFS, CDOT	Immediate Action
Develop Community Ambassador Program	Support Plan Unit Community Ambassadors. Seek further training for them through Fire Adapted Colorado (FACO). Utilize the CoalCreekCwpp.org website to coordinate CWPP implementation by plan unit groups. Have CAs coordinate evacuation support networks.	Led by CWPP Implementation Committee with CWPP Outreach Team and CCCFPD	Immediate Action
Hire a CCCFPD Mitigation Coordinator and/or Crew	CCCFPD can provide a resource for community members in any county to support homeowner mitigation, egress route improvement, and community action. CCCFPD can participate in ongoing discussions about a local or regional mitigation team operated by the county or other FPD partners.	CCCFPD working with partners in neighboring districts and the county.	Immediate Action
Build education program about sufficient insurance	Home - United Policyholders (uphelp.org)	CWPP Outreach Team	Immediate Action
Build Post-Fire Recovery Planning Homeowner Resource	Post-Fire Playbook | Department of Public Health & Environment (colorado.gov)	CWPP Outreach Team	Immediate Action

Recommendation	Goals	Responsibility	Priority
Update County Building Codes	Require more HIZ mitigation / home hardening for new homes and remodels. Require future development of utilities to have underground powerlines, or other protected power sources.	Counties	Immediate Action
Identify Alternative Emergency Alerts	Figure out how to get evac alerts to people when the power is out or cell service is down. Evaluate sirens as an evacuation notification system. Consider a CB or HAM radio network.	Counties OEM	Short-term Priority
Mitigating Home Ignition Zone 3	See **Section 3.a**	Residents	Short-term Priority
Form or join local mitigation groups	Join local mitigation groups, or work with neighbors to create one for your plan unit. Reach out to your Community Ambassador to see how you can engage.	Residents	Short-term Priority
Create secondary egress/fire access routes	See Plan Unit Recommendations to see if you live in a community that needs an alternative egress route.	Residents	Short-term Priority
Become Wildfire Partner Certified	Boulder County Residents can participate in this program to get personalized assessments, action plans, and certifications.	Residents	Short-term Priority
Conduct a community evacuation drill for residents	Highest effort of the grouping of actions.	CCCFPD, CWPP Outreach Team	Short-term Priority
Gross Dam Rd / Flagstaff Rd Roadside Fuel Reduction (project ID on map: Y)	Protection of evacuation routes through shaded fuelbreaks out to CSFS recommendations or best management practices. Need to get authorization from County Road and bridge departments, then work will need to be completed by other entities. Start with public lands to show success and gain momentum. See **Gross Dam Road / Flagstaff Road Roadside Fuel Reduction** for details.	Led by BoCo Road and Bridge, Denver Water Vegetation Management, partners include BCOS, CPW, CSFS, BWC, Community Ambassador Program	Short-term Priority
Twin Spruce / Gap Rd Roadside Fuel Reduction (project ID on map: H)	Protection of evacuation routes via shaded fuelbreaks out to CSFS recommendations or best management practices. Need to get authorization from County road and bridge departments, then work will need to be completed by other entities See **Twin Spruce Road / Gap Road Roadside Fuel Reduction** for details.	Led by Jeffco Road and Bridge, partners include CSFS, BWC, BMFSI and similar organizations, Community Ambassador Program	Short-term Priority
Blue Mountain Water District Infrastructure Protection (project ID on map: AO)	Protect the water district infrastructure by structure hardening and defensible space around the buildings and access roads. See **Blue Mountain Water District Infrastructure Protection** for details.	Led by BMFSI, partners include BMWD, CCCFPD and CSFS	Short-term Priority
Develop Financial Aid Program	Financial aid to residents for mitigation - especially for home hardening.	CWPP Implementation Committee, BWC	Short-term Priority

Recommendation	Goals	Responsibility	Priority
Develop Jeffco & CCC Relationship Building	Will strengthen alliance with Jeffco Open Space, Jefferson Conservation District, Jeffco Sheriff's Office Fire Management Officer, Jeffco CSFS district office, County Commissioners, etc. Will discuss CCC slash depot needs. Support Jeffco launching a program like Wildfire Partners.	Led by C4 and BMFSI and similar organizations, with support from the CWPP Implementation Committee	Short-term Priority
Improve HOA Regulations	CCCFPD works with HOAs and neighborhood groups to create HOA regulations on HIZ safety.	CCCFPD Fire Marshal	Short-term Priority
Improve Roadway Visibility	Install reflective road guardrail markers that you could see in smoke.	CDOT, Jefferson County Road and Bridge and Boulder County Road and Bridge	Short-term Priority
Copperdale Lane, Ridge Road, and Coal Creek Heights Drive (project ID on map: F)	Roadside fuel treatments to create safer evacuation conditions for residents.	CWPP Implementation Committee, Community Ambassadors	Short-term Priority
Crescent Lake Road (project ID on map: AE)	Roadside fuel treatments to create safer evacuation conditions for residents.	Crescent Lake HOA	Short-term Priority
Develop Emergency Notification Alternatives	If you live in an area without cell service or internet, connect with neighbors and develop and communication system that can support emergency notifications within your tools. This may look like neighbors knocking on each other's doors, or a HAM radio network.	Residents, CWPP Outreach Committee	Mid-term Priority
Conduct HIZ Tours	Organize community-wide home hardening and defensible space tours to demonstrate effective mitigation practices.	Residents	Mid-term Priority
Provide Animal and Livestock Evacuation Info	Education on where residents can get information on animal evacuations.	CWPP Outreach Team	Mid-term Priority
Secondary Communication Infrastructure Protection	Protect the communications towers through defensible space around the towers, harden generator or other infrastructure at the base of the towers.	Led by CCCFPD, partners include Clear Channel Communications, local cell providers	Mid-term Priority
Central Corridor Rail Line Ignition Reduction (project ID on map: R)	Develop relationship with railroad, understand Union Pacific's concerns and goals for wildfire mitigation. Then propose further treatment beyond what the railroad has currently treated. Shaded fuelbreak or clearing, especially to the upslope side of the railroad. See **Central Corridor Rail Line Ignition Reduction** for details.	Led by USFS and BMFSI, partners include CSFS and CCCFPD	Mid-term Priority

Recommendation	Goals	Responsibility	Priority
County Roadway Mitigation	Coordinate annual mowing of county road right of way. Work with Plan Unit Community Ambassadors to identify and mitigate fire danger from fuels along roadways.	Led by BMFSI, with partners including Jeffco Road & Bridge, Plan Unit CAs	Mid-term Priority
Evacuation route fire mitigation	Coordinate road maintenance and mitigation priorities.	Residents, CWPP Implementation Committee, BMFSI and similar organizations, CCC Community Ambassadors, CWPP Outreach Team, CDOT, Jeffco R&B, BoCo R&B	Mid-term Priority
Revamp C4 into coordination team	Increase cross-county coordination for mitigation, response, and evacuation notifications.	CWPP Implementation Committee and C4	Mid-term Priority
Develop program for HIZ Assessments for Jeffco/Gilpin Residents	Identify and/or develop resources for conducting HIZ assessments for Jeffco and Gilpin residents. Support Jeffco and Gilpin to launch a program similar to Wildfire Partner. Explore CCCFPD joining Wildfire Prepared. Explore training a team of volunteer HIZ assessors.	Led by BMFSI and similar organizations, with partners including CSFS, JCOS, Gilpin CSU Exchange, CCCFPD	Mid-term Priority
Form a local CERT Team	FEMA Community Emergency Response Team, especially to assist with evacuation.	CWPP Implementation Committee	Mid-term Priority
Improve HOA Regulations	Serve on HOA working teams and speak with HOA leadership to support community-wide action around wildfire mitigation and advocate for HOA regulations that align with the CSFS The Home Ignition Zone guide.	Residents	Mid-term Priority
Rudi Lane (project ID on map: E)	Roadside fuel treatments to create safer evacuation conditions for residents.	CWPP Implementation Committee, Community Ambassadors	Mid-term Priority
Coal Creek Canyon Fire Department Station 2 and communication tower (project ID on map: N)	Create high-quality defensible space around the fire station and communication tower.	CCCFPD, CWPP Implementation Committee	Mid-term Priority
Miramonte Road (project ID on map: T)	Roadside fuel treatments to create safer evacuation conditions for residents and link together previous fuel treatments.	Miramonte, JCD	Mid-term Priority
Gross Hydro Plant (project ID on map: V)	Create high-quality defensible space around the powerplant and electric substation.	Denver Water	Mid-term Priority

Recommendation	Goals	Responsibility	Priority
County Road 68J Roadside Fuel Reduction (project ID on map: X)	Roadside fuel treatments to create safer evacuation conditions for residents, strengthen the POD boundary, and link together previous fuel treatments.	CWPP Implementation Committee, Community Ambassadors	Mid-term Priority
Gross Reservoir weather station & Denver Water Offices (project ID on map: AA)	Create high-quality defensible space around the Gross Reservoir weather station and Denver Water Offices.	Denver Water	Mid-term Priority
Whispering Pines Church (project ID on map: AD)	Create high-quality defensible space around the church and link together existing fuel treatments.	TBD	Mid-term Priority
Plainview Road (project ID on map: AK)	Roadside fuel treatment to create safer access to secondary communication towers.	TBD	Mid-term Priority
Secondary Communication Infrastructure Protection (project ID on map: AL)	Create high-quality defensible space around the main communication tower used by Coal Creek Canyon Fire Protection District. Create safer conditions along the road to the tower. See **Secondary Communication Infrastructure Protection** for details.	CCCFPD, companies that own/manage the structures, surrounding landowners	Immediate Action
Communication tower on Old Post Office Building (project ID on map: AM)	Create high-quality defensible space around the secondary communication tower.	TBD	Mid-term Priority
Communication tower on Plainview Dr (project ID on map: AN)	Create high-quality defensible space around the secondary communication tower.	TBD	Mid-term Priority
Electric substations (TAP204087 and Plainview) (project ID on map: AP)	Create high-quality defensible space around the electric substations.	TBD	Mid-term Priority
Communication tower at 11726 Hwy 93 (project ID on map: AQ)	Create high-quality defensible space around the secondary communication tower.	TBD	Mid-term Priority
Build visitor education on wildfire and camping safety	Address illegal camping on private land and campfire ignitions .	CWPP Outreach Team	Long-term Project

Recommendation	Goals	Responsibility	Priority
Resilient Landscapes			
Black Gulch Fuel Reduction (project ID on map: B)	Landscape fuels reduction to reduce intensity and severity of fire via shaded fuelbreaks along the lower elevations of the area, and forest restoration and significant fuel reduction, following GRT-373 recommendations. See **Black Gulch Fuel Reduction** for details.	Led by the CWPP Implementation Committee, partners include BWC, BVLCD, CSFS, USFS, Axe and Snax	Immediate Action
Fund Resources for Private Lands & Infrastructure	Develop more opportunities for private foundation funding, particularly around wildfire resilience.	Led by BWC, with support from Conservation Districts, CSFS, Wildfire Partners, Boulder County Strategic Fuels Mitigation Grant Program (SFMG), Saws and Slaws, and Residents	Immediate Action
Copperdale (project ID on map: O)	Stand-scale fuel reduction and defensible space to reduce potential fire severity and increase the chance that homes stand strong against wildfire.	BWC	Immediate Action
Crescent Park (project ID on map: AF)	Stand-scale fuel reduction and defensible space to reduce potential fire severity and increase the chance that homes stand strong against wildfire.	BWC	Immediate Action
Deer Creek Forest Health (project ID on map: J)	Stand-scale forest restoration and fuel reduction to reduce potential fire severity and improve forest health.	Boulder Valley Longmont Conservation District	Short-term Priority
Indian Peak Circle & Hwy 72 Switchbacks (project ID on map: K)	Stand-scale fuel reduction to reduce potential fire severity, reinforce the POD boundary, and link together existing treatments.	private landowner	Short-term Priority
Eastside of Wondervu (project ID on map: L)	Defensible space to reduce potential fire severity, increase the chance of homes to stand strong against wildfire, and strengthen the POD boundary.	TBD	Short-term Priority
Mitigate along United Power infrastructure	Treat fuels along transmission lines.	Led by United Power	Short-term Priority
Get Certified for Pile Burning	Participate in the Colorado Certified Burner Program to learn proper burning methods.	Residents, DFPC, The Ember Alliance	Mid-term Priority

Recommendation	Goals	Responsibility	Priority
Form a local Pile Burn Cooperative	Work with neighbors and local organizations to form a Pile Burn Cooperative. Working collectively to build and burn slash piles is safer, more efficient, and provides a valuable opportunity to share knowledge and resources.	Residents, CWPP Outreach Committee	Mid-term Priority
Explore Grazing as a Mitigation Tool	Work with JCOS to initiate a grasslands fire mitigation grazing program for JCOS land in CCCFPD. BCPOS and JCOS are working on ramping up grazing on open space in a targeted and intentional manner to meet fire and ecological goals. JCOS is working on a grassing health plan similar to the forest health plan.	Led by the CWPP Implementation Committee, with support from BMFSI and similar organizations and JCOS	Mid-term Priority
Identify potential mud slide/debris flow areas	Debris Flow maps produced by the Colorado Geological Survey for Boulder and Jefferson County.	Boulder Watershed Collective	Mid-term Priority
Develop Weed Management Plan	To address fuel loads and post-fire recovery, build a weed management plan.	CWPP Implementation Committee, BVLCD, JCD	Mid-term Priority
Pinecliffe (project ID on map: A)	Stand-scale fuel reduction to reduce potential fire severity, strengthen the POD boundary, and reinforce the benefits of previous fuel treatments.	TBD	Mid-term Priority
Camp Eden & Upper Twin Spruce Link (project ID on map: C)	Stand-scale fuel reduction to reduce potential fire severity and post-fire sediment delivery, restore forest conditions, and strengthen the POD boundary. Reduce the potential for ignitions from the new DMP property to result in large wildfires.	USFS and DMP	Mid-term Priority
Coal Creek Heights & Hilltop Link (project ID on map: G)	Stand-scale fuel reduction and defensible space to reduce potential fire severity and increase the chance that homes stand strong against wildfire.	TBD	Mid-term Priority
South District (project ID on map: I)	Stand-scale fuel reduction to reduce potential fire severity and strengthen the POD boundary.	TBD	Mid-term Priority
Northside of Camp Eden (project ID on map: M)	Stand-scale fuel reduction to reduce potential fire severity, strengthen the POD boundary, and reinforce the benefits of previous fuel treatments.	TBD	Mid-term Priority
Forsythe Project Expansion (project ID on map: P)	Stand-scale forest restoration and fuel reduction to reduce potential fire severity and sediment delivery, restore forest ecosystems by establishing a regular fire return interval, and reinforce the benefits of previous fuel treatments.	USFS	Mid-term Priority
South Gross Reservoir Forest Health (project ID on map: Q)	Stand-scale fuel reduction to reduce potential fire severity and post-fire sediment delivery.	Denver Water	Mid-term Priority

Recommendation	Goals	Responsibility	Priority
East Gross Dam Forest Health (project ID on map: U)	Stand-scale fuel reduction to reduce potential fire severity, reinforce the POD boundary, and link together existing treatments.	Denver Water	Mid-term Priority
Forsythe project maintenance (project ID on map: W)	Maintain existing fuel treatment effectiveness and restore forest ecosystems by establishing a regular fire return interval. Thinning and prescriptive burning.	USFS	Mid-term Priority
Meyer's Homestead Trailhead (project ID on map: Z)	Stand-scale fuel reduction to reduce potential fire severity, strengthen the POD boundary, improve conditions for the emergency helicopter landing zone, and create safer conditions at the Meyer's Homestead Trailhead.	TBD	Mid-term Priority
Crescent Meadows / Walker Ranch Loop (project ID on map: AB)	Stand-scale fuel reduction to reduce potential fire severity, strengthen the POD boundary, and reinforce the benefits of previous fuel treatments.	Boulder County Parks & Open Space	Mid-term Priority
Tunnel 19 Area (project ID on map: AC)	Stand-scale fuel reduction to reduce potential fire severity and post-fire sediment, link together existing treatments, and strengthen POD boundaries.	TBD	Mid-term Priority
Business District (project ID on map: AG)	Stand-scale fuel reduction and defensible space to reduce potential fire severity, increase the chance that homes stand strong against wildfire, and strengthen the POD boundary.	CWPP Implementation Committee, Community Ambassadors	Mid-term Priority
Central Canyon South (project ID on map: AI)	Stand-scale fuel reduction to reduce potential fire severity and post-fire sediment delivery and strengthen the POD boundary.	TBD	Mid-term Priority
Crescent Mountain (project ID on map: AJ)	Stand-scale fuel reduction to reduce potential fire severity and post-fire sedimentation.	TBD	Mid-term Priority
Build Undeveloped Land Mitigation Regulations	Create wildfire mitigation policy for properties without structures.	Counties	Long-term Project
Safe & Effective Fire Response			
Install visible, reflective address and street signs	Install visible, reflective address and street signs. These can be obtained from CCCFPD. Contact County for Street Signs.	Residents	Immediate Action
Install Community Cisterns	See Plan Unit Recommendations to see if you live in a community that needs additional cistern capacity. Crescent Park, Coal Creek Heights and Upper Twin Spruce are top priority areas for the CCCFPD that need cisterns.	Residents, CCCFPD	Immediate Action
Increase FPD Response Resources	Ensure that CCCFPD has enough resources to respond to the fires anticipated in the coming 10 years.	CCCFPD	Immediate Action
Build outreach communication plan for community	Multiple outreach methods, website, focus groups, CWPP storymap. Increase fire danger comms. Include fire ecology education. Include specific effort for absentee	CWPP Outreach Team	Immediate Action

Recommendation	Goals	Responsibility	Priority
	landowners and home-bound landowners. Encourage CCCFPD participation in events.		
Complete Mitigation for Communication Infrastructure at Fire Stations	Create high-quality defensible space around the communication infrastructures at Station 1 and Station 2.	CCCFPD	Short-term Priority
Improve driveway access for firefighters	See **Section 3.a**	Residents	Short-term Priority
Improve Gate Access	Ensure each locked gate within CCCFPD can be opened by CCCFPD during emergencies. CCCFPD has locks on many of the gates around the community.	CCCFPD	Short-term Priority
Develop consistent wildfire communication plans	Require better coordination between emergency alerts from Gilpin, Boulder, and Jefferson. Work with partners that share similar mitigation and active wildfire information to ensure that they are sharing the same information and using the same language and resources. Encourage Gilpin County to allow non-residents to sign up for emergency notification systems.	Mutual Aid networks, CCCFPD and County Sherrif's Offices	Short-term Priority
Obtain county-maintained 24/7 Fire Duty Officers	Boulder and Jeffco have them. Gilpin doesn't have one.	Counties	Short-term Priority
Designate Shelter-In-Place/Safety Zones within the Canyon	Identify and maintain some select shelter-in-place zones within the district.	CCCFPD	Mid-term Priority

5.c. CWPP as a Living Document

CWPPs are a guide and a plan for action. They should be revisited and reviewed annually, at minimum, by CCCFPD and the CWPP Implementation Committee. Check off goals as they are accomplished and celebrate treatments, outreach events, new partnerships, and other accomplishments. Keep track of the work that happens between updates, take pictures, and collect implementation ideas for the next update.

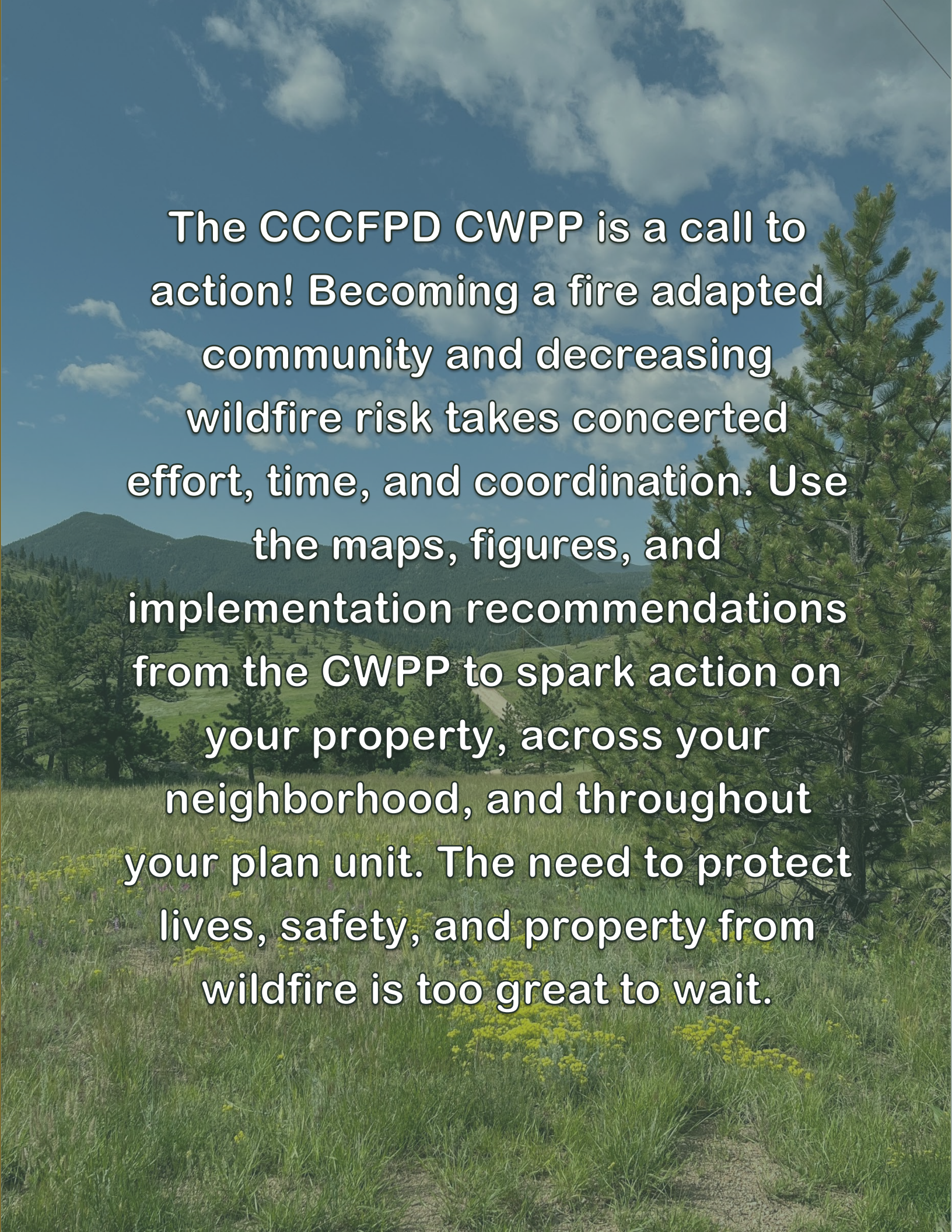
The CSFS requires CWPPs to be updated on a regular basis. It is recommended to update them every 5 years, at minimum. CWPPs greater than 10 years old are outdated and can exclude communities from successfully applying for competitive funding opportunities.

The update to this plan can either be a preface to this document or a new document that integrates with this one. The update to this plan must include:

- A description of progress made since the CWPP was created.
- A description of demographic changes in the community and other important infrastructure changes.
- 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 by CSFS involves:

- Reviewing the existing CWPP.
- Engaging partners that have a vested interest in the plan.
- Hosting collaborative meetings.
- Documenting completed projects and demographic and landscape changes.
- Developing updated wildfire risk reduction priorities.
- Updating maps (priority project areas and fuel treatment history maps should be updated during each CWPP update. Risk assessments and other maps should be updated if they no longer accurately represent the risk in the area, or when they are more than 10 years old).
- Distributing updated drafts to key partners for review and input prior to final approval.
- Finalizing with Core Team signatures and submitting to CSFS State Office.


The CCCFPD CWPP is a call to action! Becoming a fire adapted community and decreasing wildfire risk takes concerted effort, time, and coordination. Use the maps, figures, and implementation recommendations from the CWPP to spark action on your property, across your neighborhood, and throughout your plan unit. The need to protect lives, safety, and property from wildfire is too great to wait.

6. Glossary

20-foot wind speed: The rate of sustained wind over a 10-minute period at 20 feet above the dominant vegetation. The wind adjustment factor to convert surface winds to 20-foot wind speeds depends on the type and density of surface fuels slowing down windspeeds closer to the ground (NWCG, 2021).

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).

ArcCASPER: An intelligent capacity-aware evacuation routing algorithm used in the geospatial information system mapping program ArcMap to model evacuation times and congestion based on roadway capacity, road speed, number of cars evacuating per address, and the relationship between roadways congestion and reduction in travel speed (Shahabi and Wilson, 2014).

Basal area: Cross sectional area of a tree measured at breast height (4.5 feet above the ground). Used as a method of measuring the density of a forest stand in units such as ft^2/acre (USFS, 2021b).

Broadcast prescribed burning (aka, prescribed burn, 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 fuels: The stratum of fuels containing the crowns of the tallest vegetation (living or dead), usually above 20 feet (NWCG, 2018b).

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: Chains are commonly used in forestry and fire management as a measure of distance. 1 chain is equivalent to 66 feet. Chains were used for measurements in the initial public land survey of the U.S. 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 structural ignitability throughout the at-risk community. A CWPP may address issues such as wildfire response, hazard mitigation, community preparedness, and structure protection (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 along 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 up slope 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): 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. It is encouraged that residents develop defensible space so that during a wildfire their home can stand alone without relying upon limited firefighter resources due to the great reduction in hazards they have

undertaken. The Colorado State Forest Service defines three zones of defensible space: zone 1 (HIZ 1) as 0 to 5 feet from the home, zone 2 (HIZ 2) as 5 to 30 feet from the home, and zone 3 (HIZ 3) as 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 by physically separating the burning from unburned fuel (NWCG, 2018b).

Draws: Topographic features created by a small, natural watercourse cutting into unconsolidated materials. Draws generally have a broader floor and more gently sloping sides than a ravine or gulch (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: Small, hot, and carbonaceous particles. The term "firebrand" is also used to connote a small, hot, and carbonaceous particle that is airborne and carried for some distance in an airstream (Johnston, 2018).

Ember cast: The process of embers/firebrands/flaming sparks being transported downwind beyond the main fire and starting new spot fires and/or igniting structures. Short-range ember cast is when embers are carried by surface winds and long-range ember cast is when embers are carried high into the convection column and fall out downwind beyond the main fire. The number of embers reaching an area decreases exponentially with distance traveled, and the likelihood of structure ignition increases with the number of embers landing on receptive fuels (Caton et al., 2016). The distance used to differentiate short-range and long-range ember cast varies among sources. NWCG (2018b) classifies short-range ember cast as embers that travel less than 0.25 miles and long-range ember cast as embers that travel more than 0.25 miles, whereas Beverly et al., (2010) use a threshold of 0.06 miles. We use the Beverly et al., (2010) definition in this CWPP.

Fire adapted community (FAC): 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 FAC; there are many strategic actions and tools that 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, non-governmental organizations, etc. Fire adaptation is an ongoing process of collaborative action to identify risk, mitigate it, and maintain the work overtime.

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: 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. 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 kills). Moderate-severity or intermediate fire severity falls between these two extremes (Agee, 1996). Specific cutoffs for fire severity classifications differ among researchers. For example, Sheriff 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).

FireFamilyPlus: A software application that provides summaries of fire weather, fire danger, and climatology for one or more weather stations extracted from the National Interagency Fire Management Integrated Database (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).

FlamMap: A fire analysis desktop application that can simulate potential fire behavior and spread under constant environmental conditions (weather and fuel moisture) (Finney, 2006). FlamMap is one of the most common models used by land managers to assist with fuel treatment prioritization, and it is often used by fire behavior analysts during wildfire incidents.

Fuel model: A stylized set of fuel bed characteristics used as input for a variety of wildfire modeling applications to predict fire behavior (Scott and Burgan, 2005).

Fuel reduction: 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 man-made change in fuel characteristics that affects fire behavior so that fires burning into them can be more readily controlled. Fuelbreaks differ from firebreaks due to the continued presence of vegetation and organic soil. 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 1000-hour fuels. One-hour fuels are dead vegetation less than 0.25 inch in diameter (e.g., dead grass), ten-hour fuels are dead vegetation 0.25 inch to 1 inch in diameter (e.g., leaf litter and pine needles), one hundred-hour fuels are dead vegetation 1 inch to 3 inches in diameter (e.g., fine branches), and one thousand-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 become wetter as relative humidity in the air changes (NWCG, 2018b).

Handcrews: A number of individuals that have been organized and trained and are supervised principally for operational assignments on an incident (NWCG, 2018b).

Handline: Fireline constructed with hand tools (NWCG, 2018b).

Hazards: Any real or potential condition that can cause injury, illness, or death of personnel, or damage to, or loss of 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 in conjunction with creating defensible space increases the chance that a home will stand strong during a wildfire.

Home ignition zone (HIZ): The characteristics of a home and its immediate surroundings within 100 feet of structures. Conditions in the HIZ principally 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 (IRPG): 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 some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high-intensity fire and to utilize natural or constructed firebreaks or fuelbreaks and favorable breaks in the topography. The intervening fuel is usually backfired; but occasionally the main fire is allowed to burn to the line, depending on conditions (NWCG, 2018b).

Insurance Services Office (ISO) rating: ISO ratings are provided to fire departments and insurance companies to reflect how prepared a community is for fires in terms of local fire department capacity, water supply, and other factors (see more information online at https://www.isomitigation.com/ppc/fsrs/).

Ladder fuels: Fuels that provide vertical continuity between strata, 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).

LANDFIRE: A national program spearheaded by the U.S. Department of the Interior and the U.S. Department of Agriculture to provide spatial products characterizing vegetation, fuels, fire regimes, and disturbances across the entire United States. LANDFIRE products serve as standardized inputs for fire behavior modeling. More information about the program is available online at https://www.landfire.gov/.

Lop-and-scatter: Cutting (lopping) branches, tops, and unwanted boles into shorter lengths and spreading that debris evenly over the ground such that resultant logging debris will lie close to the ground (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 that are implemented to reduce or eliminate (mitigate) risks to persons, property, or natural resources. These actions can be undertaken before and during a wildfire. Actions before a fire include fuel treatments, vegetation modification in the home ignition zone, and structural changes to increase the chance a structure will stand strong during a wildfire (aka, home hardening). Mitigation actions during a wildfire include mechanical and physical tasks, specific fire applications, and limited suppression actions, such as constructing firelines and creating "black lines" through the use of controlled burnouts 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. It 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 Department of the Interior to coordinate programs of the participating agencies to avoid wasteful duplication and to provide a means of constructively working together. NWCG provides a formalized system and agreed upon standards of training, equipment, aircraft, suppression priorities, and other operational areas. More information about NWCG is available online at https://www.nwcg.gov/.

Noncombustible building materials: Material 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).

Non-survivable road: Portions of roads adjacent to areas with predicted flame lengths greater than 8 feet under severe fire weather conditions. Potentially non-survivable 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 lower chance of surviving radiant heat from fires of this intensity. Non-survivable conditions are more common along roads that are lined with thick forests, particularly with trees that have limbs all the way to the ground and/or abundant saplings and seedlings.

Overstory: 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, but 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).

Potential operational delineations (PODs): PODs are topographic areas bounded by features suitable for fire control (e.g., ridgetops and roads) that can be used for proactive wildfire decision making and tactical operations during wildfire events. PODs can serve as management units for proactive ecological restoration and wildfire risk mitigation, as well as for cross-boundary and collaborative land and fire management planning (Thompson et al., 2022).

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 fuel's 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: Topographic feature created by streams cutting into unconsolidated materials. They are narrow, steep-sided, and commonly V-shaped. Ravines are steeper than draws (NRCS, 2017).

Remote Automatic Weather Stations (RAWS): A weather station that transmits weather observations via satellite to the Wildland Fire Management Information system (NWCG, 2018b).

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, generally a divide or pass between the heads of streams flowing in opposite directions. The presence of a saddle funnels airflow and increases windspeed, thereby exacerbating fire behavior (NRCS, 2017).

Safety zones: An area cleared of flammable materials used by firefighters for escape in the event the line is outflanked or spot fires outside the control line render the line unsafe. In firing operations, crews progress so as to maintain a safety zone close at hand, allowing the fuels inside the control line to be consumed before going

ahead. Safety zones may also be constructed as integral parts of fuelbreaks; they are greatly enlarged areas that can be used with relative safety by firefighters without the use of a fire shelter (NWCG, 2018b).

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).

Smoldering combustion: The combined processes of dehydration, pyrolysis, solid oxidation, and scattered flaming combustion and glowing combustion, which occur after the flaming combustion phase of a fire; often characterized by large amounts of smoke consisting mainly of tars (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: Behavior of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire (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 from an active wildland fire (NWCG, 2018b).

Structure triage: The process of inspecting and classifying structures according to their defensibility or non-defensibility, based on fire behavior, location, construction, and adjacent fuels. Structure triage involves a rapid assessment of a dwelling and its immediate surroundings to determine its potential to escape damage by an approaching wildland fire. Triage factors include the fuels and vegetation in the yard and adjacent to the structure, roof environment, decking and siding materials, prevailing winds, topography, etc. (NWCG, 2018b). There are four categories used during structure triage: (1) defensible – prep and hold, (2) defensible – stand alone, (3) non-defensible – prep and leave, and (4) non-defensible – rescue drive-by. The most important feature differentiating defensible and non-defensible structures is the presence of an adequate safety zone for firefighters (NWCG 2018a). Firefighters conduct structure triage and identify defensible homes during wildfire incidents. Categorization of homes is not pre-determined; triage decisions depend on fire behavior and wind speed due to their influence on the size of safety zones needed to keep firefighters safer.

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).

Task book: A document listing the performance requirements (competencies and behaviors) for a position in a format that allows for the evaluation of individual (trainee) performance to determine if an individual is qualified in the position. Successful performance of tasks, as observed and recorded by a qualified evaluator, will result in a recommendation to the trainee's home unit that the individual be certified in the position (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).

Values at risk: 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 supply, 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): Sometimes called Wildland-Urban Interface and Intermix. 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). For the purpose of this CWPP, the WUI boundary includes all of the developed areas of CCCFPD (the plan units) and the surrounding landscape that could transmit wildland fire into the developed areas and important evacuation routes (**Figure 2.c.2**). Strategic wildfire mitigation across the WUI can increase the safety of residents and wildland firefighters and reduce the chances of home loss.

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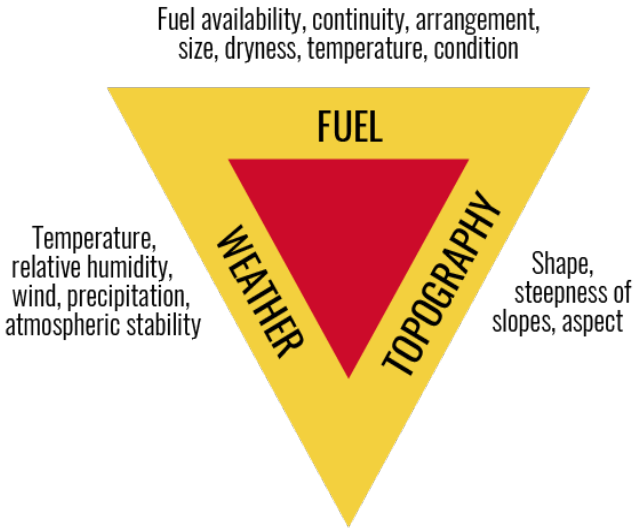
Appendix A. Introduction to Wildfire Behavior and Terminology

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, and they are the variables that wildland firefighters pay attention to when assessing potential wildfire behavior during an incident (NWCG, 2019).



Interactions between fuels, weather, and topography dictate fire behavior. Source: California State University.

Fuels

Fuels include live vegetation such as trees, shrubs, shrubs, and grasses, dead vegetation like pine needles and cured grass, and materials like 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[3]. 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 surface 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 long flame lengths 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," and 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 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).

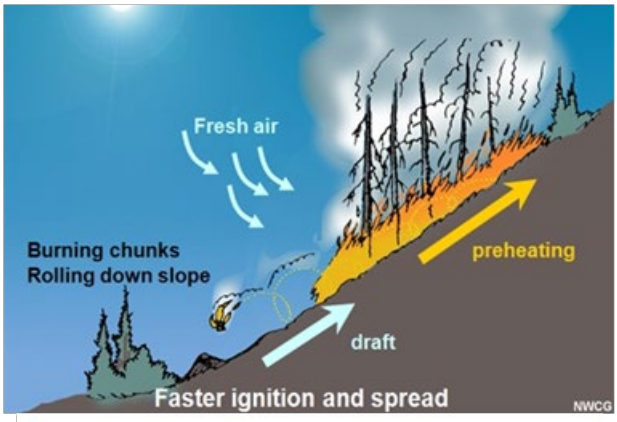
[3] Radiant heat transfer occurs by short-wavelength energy traveling through air. Radiant heat is what you feel when sitting in front of a fire. Radiant heat preheats and dries fuels adjacent to a wildfire, which initiates combustion by lowering the fuel's ignition temperature. Convective heat transfer 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.

Topography

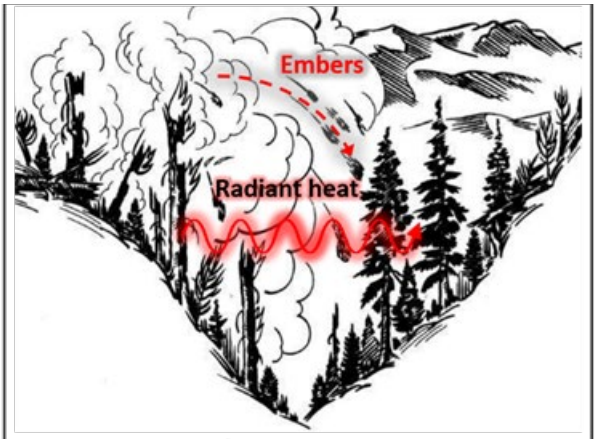
Topography (slope and aspect) influences fire intensity, speed, and spread. In the northern hemisphere, north-facing slopes experience less sun exposure during the day, resulting in higher fuel moisture. Tree density is often higher on north-facing slopes due to higher soil moisture. South-facing slopes 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 unburnt fuels below.

Narrow canyons can experience increased combustion because radiant heat from a 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.



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 impacting fire behavior include temperature, relative humidity, precipitation, wind speed, and wind 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 an 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.

Direct sunlight and hot temperatures impact 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.

RED FLAG CRITERIA

Red flag days are warnings issued by the National Weather Service (NWS) to indicate that warm temperatures, very low humidity, and stronger winds are expected to result in elevated fire danger in the next 24-48 hours.

The NWS Denver/Boulder Forecast Office has two options for red flag criteria:

Option 1	Option 2
Relative humidity <= 15% Wind gusts >= 25 mph Dry fuels	Widely scattered dry thunderstorms Dry fuels

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.

Categories of Fire Behavior

Weather, topography, and fuels influence fire behavior, and fire behavior in turn influences the tactical options available for wildland firefighters and the risks posed to lives and property. Three general categories of fire behavior are described throughout 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 four feet and with equipment when flame lengths are less than eight feet. Surface fires can emit significant radiant heat, which can ignite nearby vegetation and homes.
- **Passive crown fire –** Fire that arises when a surface fire ignites the crowns of trees or groups of trees (aka, torching). Torching trees reinforce the rate of spread, but passive crown fires travel along with surface fires. Firefighters can sometimes address passive crown fires with an 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 the 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). Historically, passive and active crown fires 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 the 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 and at the top of steep slopes and within ravines and 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 (Gropp, 2019; Johnston, 2018). Embers can ignite structures when they land on roofs, enter homes through exposed eaves, 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 destructive home-to-home ignitions, as evidenced by the destructive 2021 Marshall Fire in Boulder County. Structural characteristics of a home can increase its exposure to embers and risk of combustion, such as wood shingle roofs and unenclosed eaves and vents (Hakes et al., 2017; Syphard and Keeley, 2019). Embers can also penetrate homes if windows are destroyed by radiant or convective heat.

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 (20:51 minute video)
- Understanding Fire from California State University (website)
- S-190 Introduction to Wildland Fire Behavior Course Materials from the National Wildfire Coordinating Group (PowerPoints, handouts, and videos)

Appendix B. Community Risk Assessment and Modeling Methodology

WUI Delineation

Delineating the wildland-urban interface is a critical component of CWPPs in compliance with the Healthy Forest Restoration Act (HFRA) of 2003. Communities can extend the WUI boundary into adjacent areas that pose a wildfire threat to their community, that can serve as a strategic location for wildland firefighting, and that are adjacent to evacuation routes for the community (HFRA 4 U.S.C. §101.16). Strategic wildfire mitigation across the WUI can increase the safety of residents and wildland firefighters and reduce the chances of home loss.

We delineated the WUI for CCCFPD to include any area that could transmit wildland fire into the residential area of evacuation routes for the community within a 4-hour period in the absence of firefighter suppression and control measures under extreme fire weather conditions with 25 mph winds out of the west based on our wildfire modeling with FlamMap (see below).

Fire Behavior Analysis

Interpretations and Limitations

Fire behavior models have been rigorously developed and tested based on over 40 years of experimental and observational research (Sullivan, 2009). Fire behavior models allow us to identify areas that could experience high-severity wildfires and pose a risk to lives, property, and other values at risk.

We used the fire behavior model FlamMap, which is a fire analysis desktop application that simulates potential fire behavior and spread under constant weather and fuel moisture (Finney, 2006). FlamMap is one of the most common models used by land managers to assist with fuel treatment prioritization, and it is often used by fire behavior analysts during wildfire incidents.

Fire behavior analyses are useful for assessing relative risk across the entire CCCFPD and are not intended to assess specific fire behavior in the vicinity of individual homes. It is not feasible to predict every combination of fire weather conditions, ignition locations, and suppression activities that might occur during a wildfire. Uncertainty will always remain about where and how a wildfire might behave until a fire is actually occurring, and even then, fire behavior can be erratic and unpredictable.

Important Considerations about Fire Behavior Predictions

Fire behavior models can provide reasonable estimates of relative wildfire behavior across a landscape. However, wildfire behavior is complex, and models are a simplification of reality. Models also struggle to capture impacts of structures on wildfire spread and home-to-home ignitions. It is recommended to use these fire behavior analyses at a landscape scale to assess relative risk across the entire CCCFPD, not at the parcel-level.

Exceptional hot, dry, and windy conditions are increasingly common due to climate change and could result in even more extreme fire behavior across CCCFPD than predicted by this analysis.

Fire behavior models like FlamMap do not include structures as a fuel type. Structures like homes, sheds, fences, and other buildings are absolutely a source of fuel during wildland fires and can produce massive amounts of embers that contribute to home-to-home ignitions (Maranghides et al., 2022). However, FlamMap cannot account for fine-scale variation in surface fuel loads, defensible space created by individual homeowners, and the ignitability of building materials, nor are these data available at the scale of individual homes across an entire fire protection district. In the absence of this information and a deeper quantitative understanding of interactions between structures and wildland vegetation during a wildfire, fire

behavior cannot be modeled for areas dominated by homes in the same fashion as areas dominated by grassland, shrubland, or forest vegetation. For this reason, we conducted a separate analysis to predict potential exposure of homes to radiant heat and ember cast (see section below).

Model Specifications and Inputs

We used FlamMap to model flame length, crown fire activity, potential fire sizes, and conditional burn probability. FlamMap requires information on topography and fuel loads across the area of interest (**Figure B.1**). See **Table B.1** and **Table B.2** for details on model inputs and specifications.

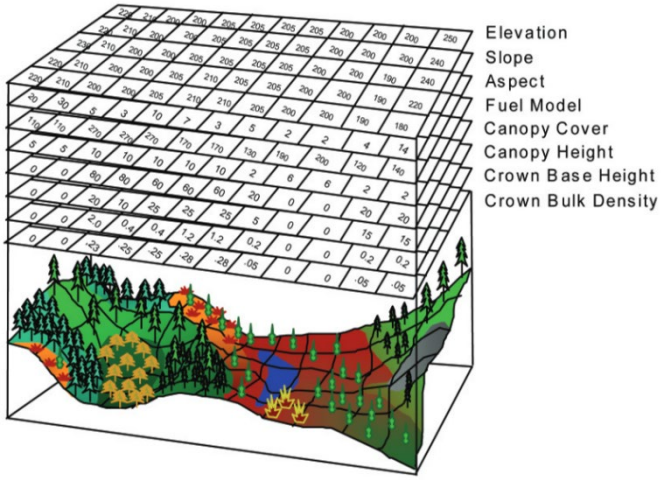


Figure B.1. *FlamMap requires a variety of information about topography and fuels. Image from Finney (2006).*

We used surface and canopy fuel data from the 2022 Colorado Wildfire Risk Assessment (CO-WRA) from CSFS as the basis for our modeling. The 2022 CO-WRA, available through the Colorado Forest Atlas, is the most recent and advanced version of the assessment. CSFS and Technosylva made impressive improvements in methodology for the 2022 update, notably greater ground-truthing of input data, new approaches for predicting wildfire spread into suburban and urban areas, and a higher spatial resolution (CSFS and Technosylva, 2023b, 2023a).

Methodology for creating the surface and canopy fuel layers are provided by (CSFS and Technosylva, 2023b). Fuel models are a stylized set of fuel bed characteristics used as input for a variety of wildfire modeling applications to predict fire behavior. **Figure B.2** depicts the fire behavior fuel models present across CCCFPD. The most dominant fuel models in CCCFPD are the custom timber understory model (TUML1) and the custom timber litter model (TLM1) from the 2022 CO-WRA. The eastern portion of CCCFPD is covered in low load, dry climate grass (GR2), moderate load, dry-climate grass-shrub (GS2), and the custom oak shrubland model (SH7-oak shrubland) from the 2022 CO-WRA.

We quality controlled fuel data and worked with CCCFPD to assess the reasonableness of model predictions. We reduced crown base height by 30% for areas covered by lodgepole following the approach used by the Colorado Forest Restoration Institute. Reducing crown base height helps replicate observed crown fire activity in this forest type.

Our maps of fire behavior predictions include areas indicated as "unburnable / not modeled"—parking lots, roadways, bodies of water, and barren areas are considered unburnable; areas dominated by homes and buildings were classified as "not modeled" because fire behavior models do not include structures as a fuel type (Scott and Burgan, 2005).

Fire behavior models require estimates of fire weather conditions, and a common practice is to model fire behavior under hot, dry, and windy conditions for an area—not the average conditions, but extreme conditions. Wildfires that grow to large sizes, exhibit high-severity behavior, and overwhelm suppression capabilities tend to occur under extreme fire weather conditions (Williams, 2013).

We modeled potential wildfire behavior under moderate (75th percentile) and extreme (97th percentile) fire weather conditions (**Table B.2**). Weather conditions came from historic observations collected at the Pickel Gulch and Sugar Loaf Remote Automated Weather Station (RAWS) and analyzed using FireFamilyPlus. 75th percentile conditions are like a normal summer day, whereas 97th percentile conditions are extremely hot, dry days—days that would qualify for Red Flag Warnings and could result in large-fire growth, for example, weather conditions in July 2016 during the Cold Springs Fire.

Winds across the Front Range of Colorado are unpredictable and can be extremely gusty in mountainous areas. We modeled 20-foot windspeeds of 20 mph for moderate fire weather conditions and 30 mph for extreme fire

weather conditions. Wind speeds of 25 mph qualify as Red Flag Warnings when coinciding with low relative humidity and dry fuels. We modeled potential fire spread under winds blowing out of the west (270°) based on observations from the Pickel Gulch and Sugar Loaf RAWS and observations of local firefighters.

FlamMap offers two methods for calculating crown fire initiation and spread: the Scott and Reinhardt method and the Finney method. We used the Scott and Reinhardt method as this method resulted in predictions of crown fire occurrence more consistent with expectations and has been found more reliable than the Finney method (Scott, 2006). Conditional burn probability is calculated as the percentage of simulated fires that burn each 20-meter by 20-meter (0.1 acre) area under specified fire weather conditions, wind directions, and wind speeds.

Fire spread was modeled with FlamMap's "minimum travel time" algorithm to predict fire growth between cells and account for fire spread through spotting. We modeled fire growth under 6,500 random ignitions across the landscape, and we allowed fires to grow for 4 hours in the absence of firefighter suppression and control measures. We modeled fire behavior in an area several times larger than CCCFPD to capture the landscape-scale movement of fire.

Table B.1. *Model specifications used for fire behavior analyses with FlamMap for the 2024 CCCFPD CWPP.*

Model specification	Value
Crown fire calculation method	Scott/Reinhardt (2001)
Wind options	Gridded winds
Wind grid resolution	20 meters
Number of random ignitions	6,500*
Resolution of calculations	20 meters
Maximum simulation time	240 minutes
Minimum travel paths	500 meters
Spot probability	0.7
Spotting delay	15 minutes
Lateral search depth	6 meters
Vertical search depth	4 meters

*We used the same random ignition locations for fire spread analysis under moderate and extreme fire weather conditions.

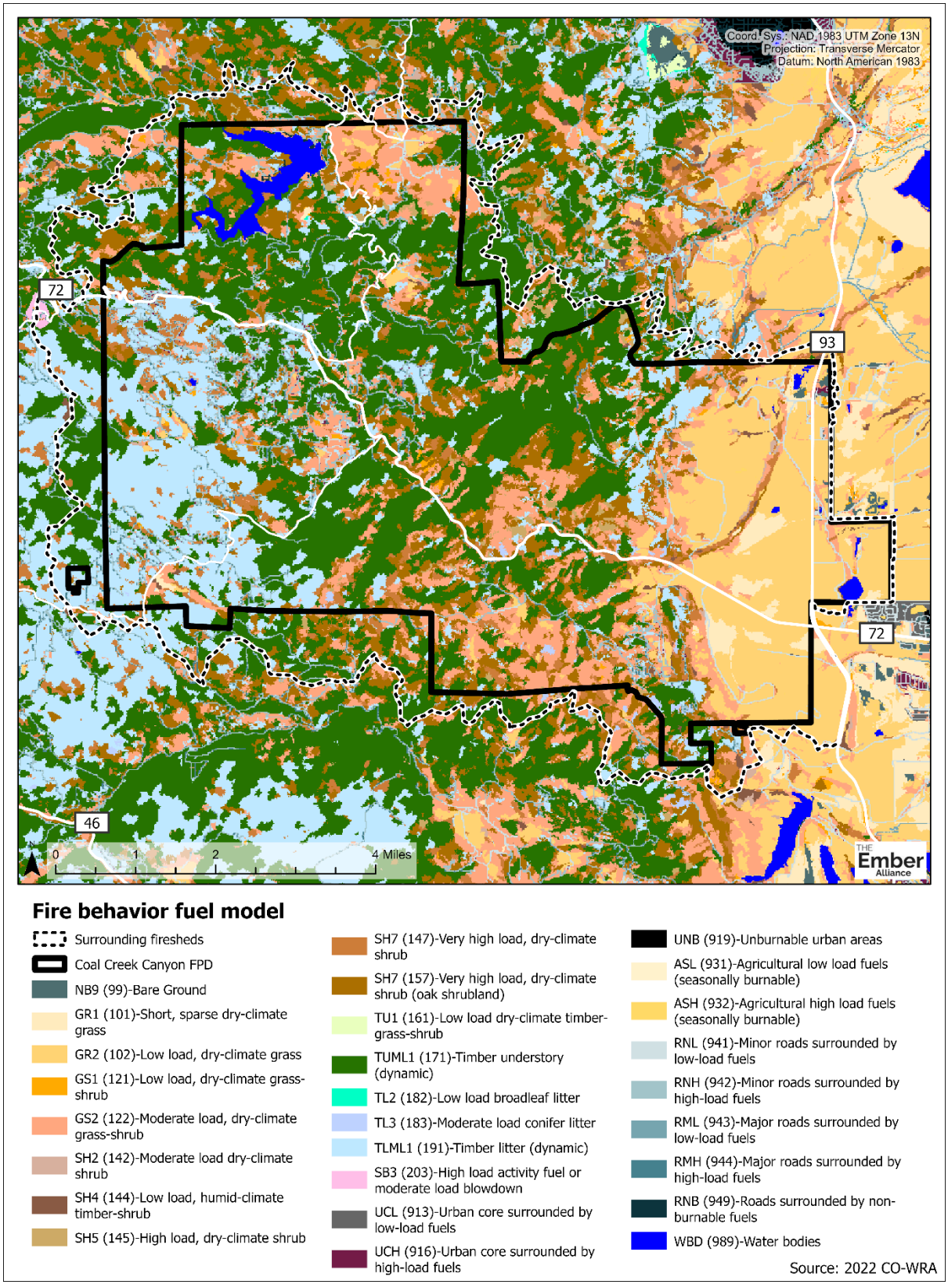


Figure B.2. *Fire behavior fuel models are an important input for making fire behavior predictions. See (CSFS and Technosylva, 2023b) for a description of each fuel model. Fire behavior was summarized for CCCFPD and adjacent "firesheds"—areas bounded by topographic features, water bodies, rivers, or roads that could transmit wildfire to or receive wildfire from CCCFPD, shown in the dashed black line. Source: 2022 Colorado Wildfire Risk Assessment, Colorado State Forest Service*

Table B.2. *Fire weather conditions utilized for fire behavior modeling are based on weather observations from the Pickle Gulch and Sugar Loaf Remote Automatic Weather Stations between June 15-October 15, 2014-2022 and fuel moisture predictions from FireFamilyPlus. Weather conditions on July 9-10, 2016, during the Cold Springs Fire in Nederland, CO are presented for comparison.*

Variable	Moderate fire weather (75th percentile)	Extreme fire weather (97th percentile)	Cold Springs Fire (for comparison)
Temperature	84°F	92°F	92°F
Relative humidity	18%	9%	10%
Wind direction	270° (west)	270° (west)	282° (west)
20-foot wind speed[1]	20 mph	30 mph	Gusts up to 35 mph
Fuel moisture[2]			
1-hour fuels	5%	3%	2.8%
10-hour fuels	8%	6%	6.6%
100-hour fuels	10%	8%	9.4%
1,000-hour fuels[3]	11%	10%	12.2%
Live woody	30%	30%	
Live herbaceous	62%	60%	

[1]20-foot wind speeds are approximately 5 times faster than winds at ground level in fully sheltered fuels; vegetation and friction slow down windspeeds closer to ground level (NWCG, 2021).

[2]One-hour fuels are dead vegetation less than 0.25 inch in diameter (e.g., dead grass), ten-hour fuels are dead vegetation 0.25 inch to 1 inch in diameter (e.g., leaf litter and pine needles), one hundred-hour fuels are dead vegetation 1 inch to 3 inches in diameter (e.g., fine branches), and one thousand-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.

[3]1,000-hour fuel is moisture not used by FlamMap for predicting fire behavior but is included here to provide additional context.

Predicted Fire Behavior

Wildland firefighters pay attention to current and expected fire behavior when making tactical decisions. Fire behavior classes are based on flame length, rate of spread, and crown fire activity and are utilized by firefighters to guide tactical decisions following the Haul Chart (**Table B.3**).

Flame length is the distance measured from the average flame tip to the middle of the flaming zone at the base of the fire. Flame length is measured at an angle when the flames are tilted due to effects of wind and slope (see image at right). Flame length is an indicator of fireline intensity—the amount of energy released by a fire. **Figure B.3** depicts predicted flame lengths across CCCFPD.

Figure B.4 shows the occurrence of torching (aka, passive crown fire) and active crown fire in CCCFPD, which are notable fire behaviors that must inform tactical decisions on the fireline. Both passive and active crown fires pose a significant risk to the safety of firefighters and residents and can destroy homes through radiant and convective heating and ember production. See **Appendix A** for a description of different types of fire behavior.

Fire behavior class was determined for CCCFPD by combining predictions of flame length and crown fire activity following the Haul Chart. Under moderate fire weather conditions—conditions typical of a summer day in CCCFPD—about 50% percent of CCCFPD could experience high to extreme fire behavior, and this percentage increases to 75% under less common but more extreme, hot, dry, and windy conditions (**Figure B.5**). High to extreme fire behavior includes ember production that ignites additional fires away from the main fire and the movement of high-intensity fire from treetop to treetop. Such fires are extremely challenging if not impossible to control until winds die down and fuel moistures increase.

Figure B.6 shows rates of spread for the head of a fire that is spreading with winds blowing out of the west. Rates of spread can be high to extreme in grasslands and shrublands in CCCFPD, particularly on steep slopes. Therefore, even residents living in areas with few to no trees can be at risk from wildfires.

Firefighters could struggle to suppress fires across CCCFPD under hot, dry, and windy conditions due to extreme flame lengths, ember production, and rapid rates of spread in different parts of the landscape. Exceptional hot, dry, and windy conditions are increasingly common due to climate change and could result in even more extreme fire behavior across CCCFPD than predicted by this analysis.

Table B.3. *The Haul Chart and tactical interpretations. The Haul Chart is a tool used by firefighters for relating fire behavior to tactical decision-making (NWCG, 2019).*

Fire behavior class	Flame length (feet)	Rate of spread (chains/hr)*	Tactical interpretation
Very low, smoldering	<1	0-2	Fire is not spreading and has limited flaming. Fire can be attacked at the head or flanks by persons using handtools. Handline will hold the fire.
Low, creeping, spreading	1-4	2-5	Fire can be attacked at the head or flanks by persons using handtools. Handline should hold the fire.
Moderate, running	4-8	5-20	Fires are too intense for direct attack on the head of the fire by persons using handtools. Handline cannot be relied on to hold fire. Equipment such as dozers, engines, and retardant aircraft may be effective.
High, torching and spotting	8-11	20-50	Fires present serious control problems with torching, crowning, and spotting. Control efforts at the head of the fire are probably ineffective.
Very high, active crown fire	11-25	50-150	Crowning, spotting, and major fire runs are expected. Control efforts at the head of the fire are ineffective.
Extreme and erratic	>25	>150	Extreme intensity, turbulent fire, and chaotic spread. Escape to safety should be considered.

*__Note:__ 1 chain = 66 feet. Chains are commonly used in forestry and fire management as a measure of distance. 1 chain/hour = 1.1 feet/minute.

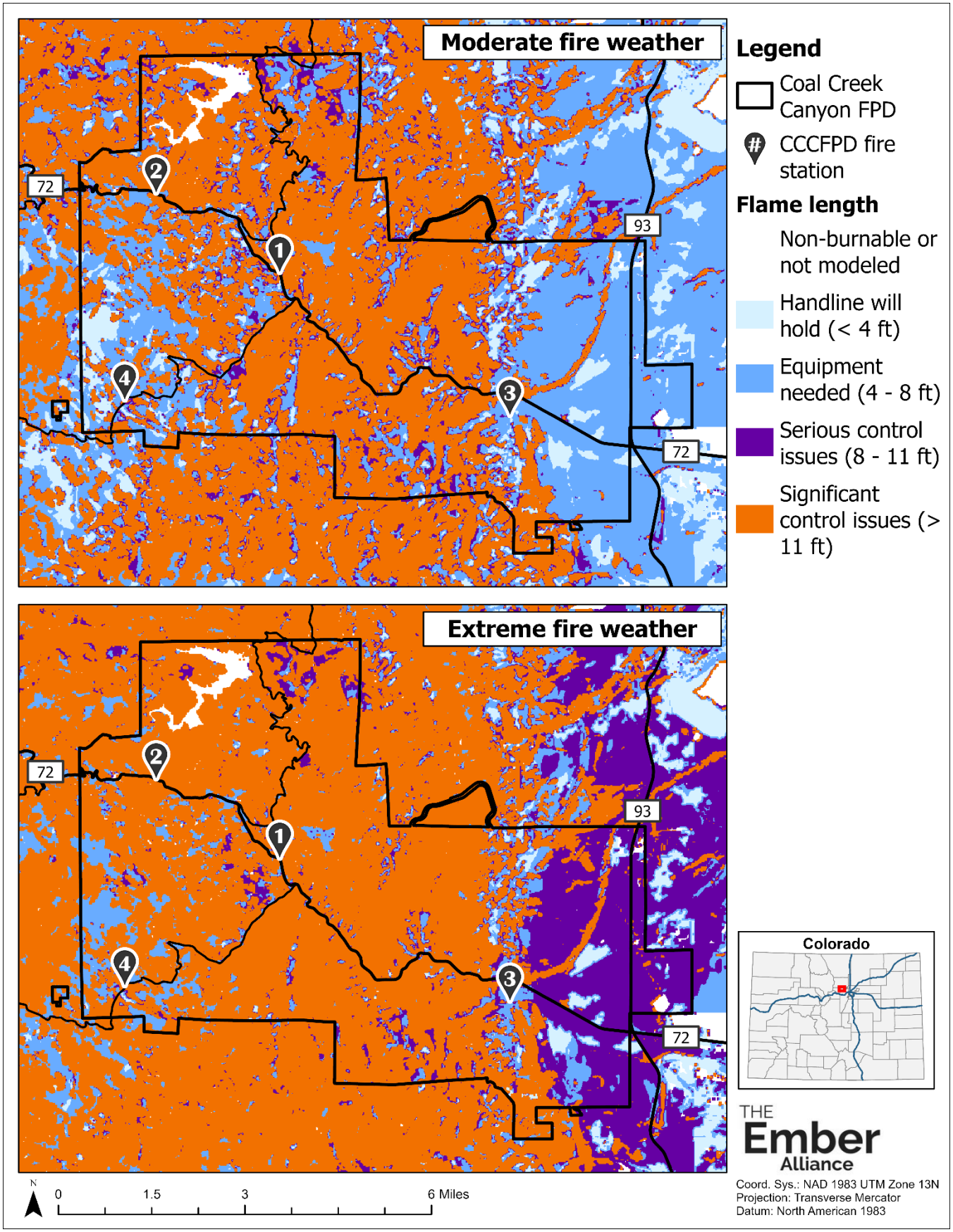


Figure B.3. *Flame lengths in CCCFPD under moderate and extreme fire weather conditions, categorized by the Haul Chart.*

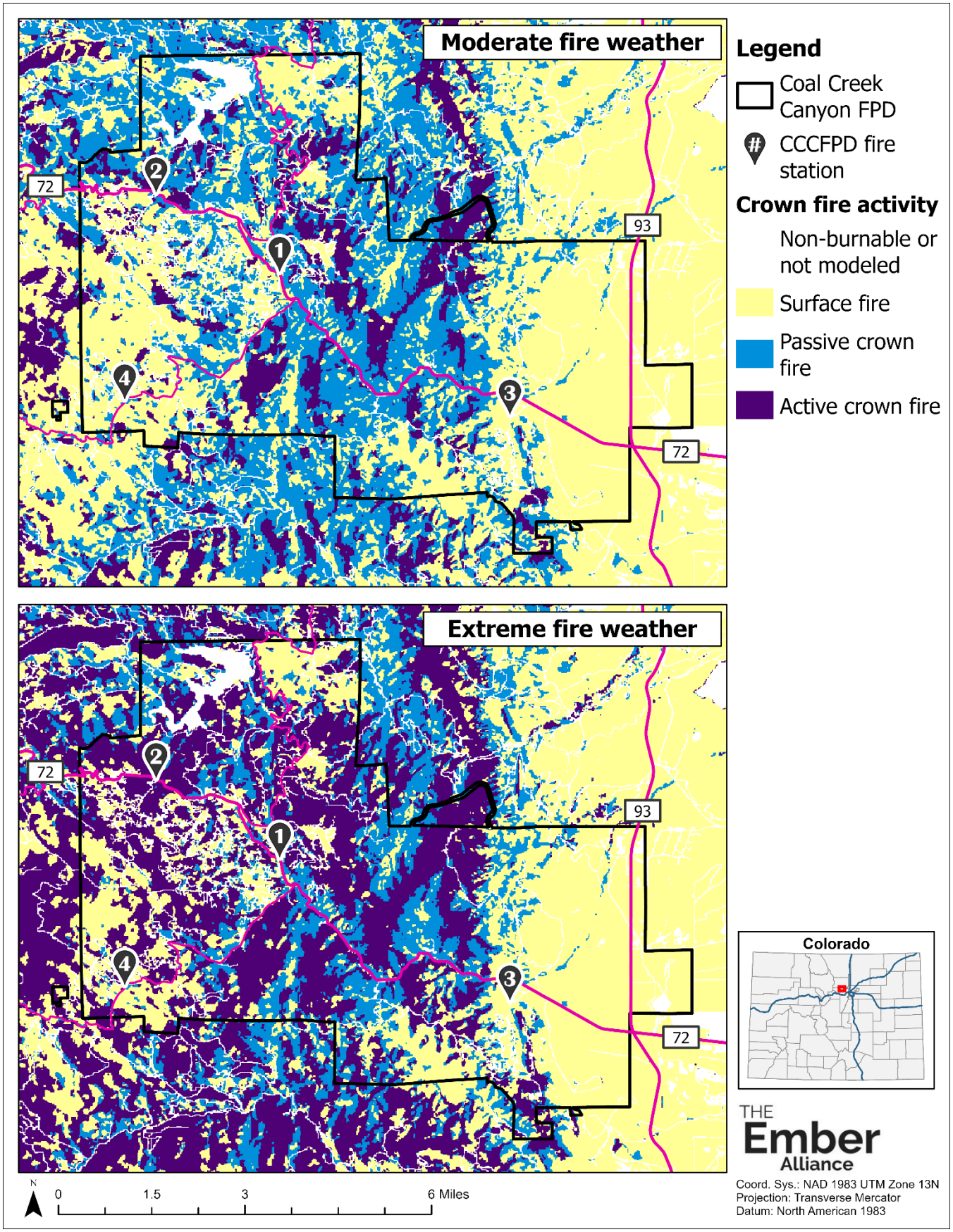


Figure B.4. *Crown fire activity in CCCFPD under moderate and extreme fire weather conditions.*

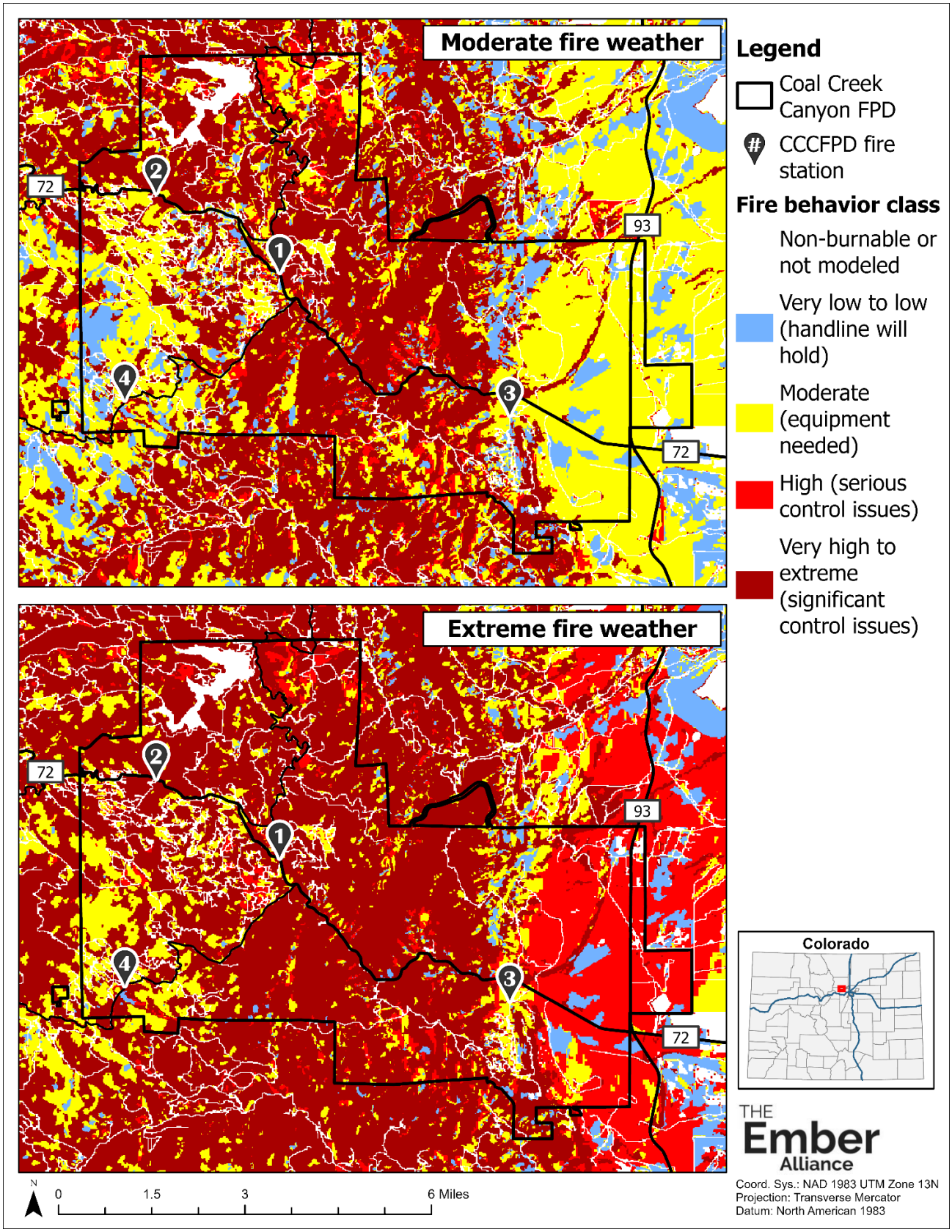


Figure B.5. *Under moderate fire weather conditions—conditions typical of a summer day in CCCFPD—50% percent of CCCFPD could experience high to extreme fire behavior, and this percentage increases to 75% under less common but more extreme, hot, dry, and windy conditions. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

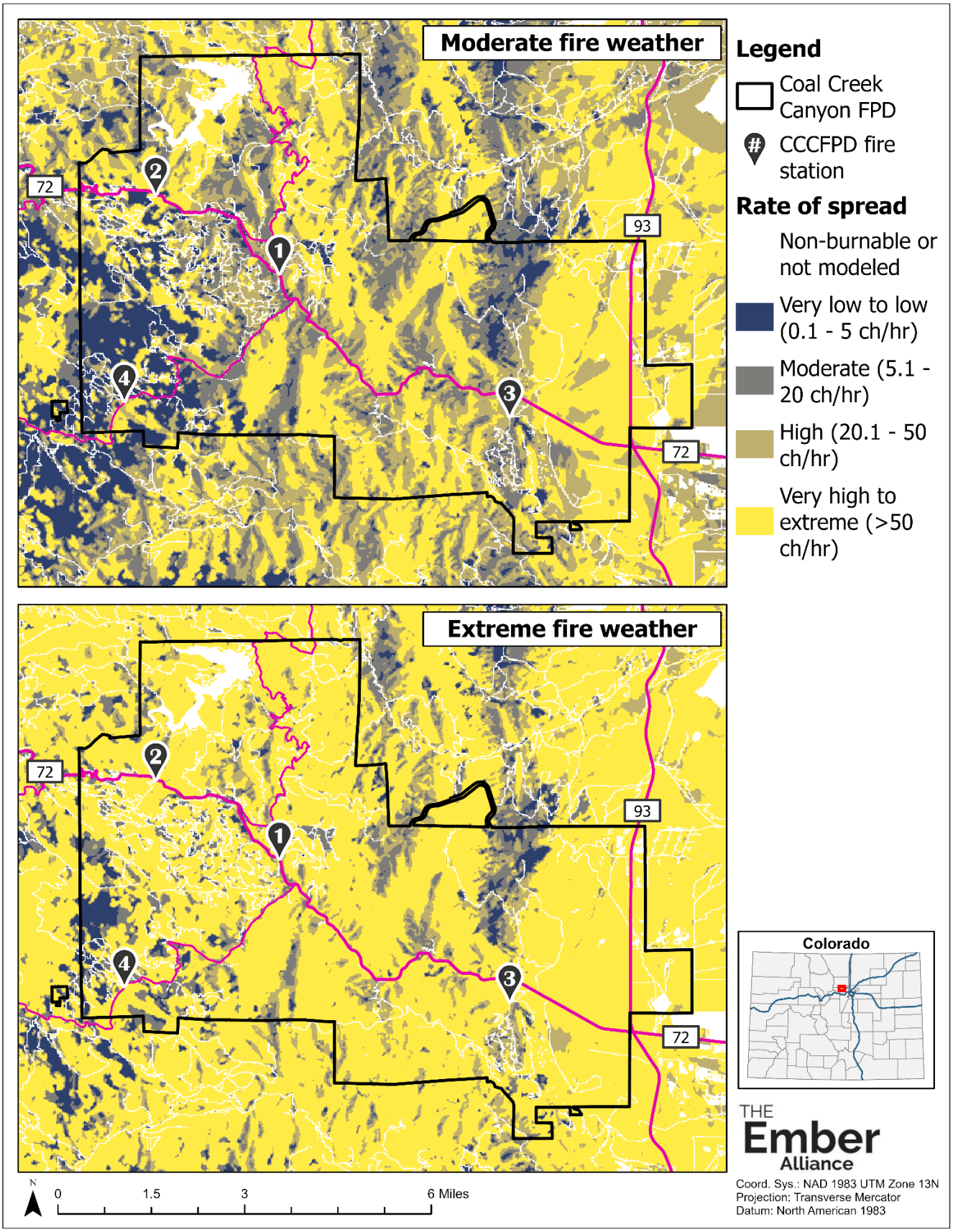


Figure B.6. *Rate of spread (chains/hour) in CCCFPD under moderate and extreme fire weather conditions, categorized by the Haul Chart. 1 chain = 66 feet. Chains are commonly used in forestry and fire management as a measure of distance. 1 chain/hour = 1.1 feet/minute.*

Predicted Relative Burn Probability

Relative burn probability indicates how likely an area is to burn during a wildfire compared to other areas. Wind direction strongly affects burn probability, carrying fires quickly up slopes facing toward the incoming winds. Topography, non-burnable barriers such as wide rivers, interstates, and highways, and fuel loads also influence conditional burn probability by dictating how fire spreads across the landscape.

Short-range transport of embers can cause spot fires to ignite even across unburnable barriers such as Colorado State Highway 72. Rapid fire growth and spotting across roadways is more likely under higher windspeeds and with drier fuel conditions. **Unpredictable wind conditions along the Colorado Front Range make it difficult to predict potential fire spread, making it imperative for residents across CCCFPD to take measures to mitigate their home ignition zone.**

Relative burn probability modeled specifically for CCCFPD (**Figure B.7**) should be interpreted differently from relative burn probability modeled for the entire state of Colorado for the 2022 CO-WRA (**Figure 2.f.5**). Relative burn probability for CCCFPD shows what parts of the district are more likely to burn relative to other parts of the district; therefore, the relative burn probability depicted in **Figure B.7** was useful for assessing relative risk among CWPP Plan Units and prioritizing fuel treatments. The CO-WRA relative burn probability shows what parts of the state are more likely to burn and is useful to assessing overall likelihood of fire in CCCFPD relative to other parts of the state. **Relative to the rest of the state, CCCFPD has a high relative burn probability**. See (CSFS and Technosylva, 2023a) for methodology used by CO-WRA for calculating relative burn probability.

Burn probability is generally higher in the eastern portion of CCCFPD due to the prevalence of grasslands (**Figure B.7**). More rapid rates of spread result in larger fire growth, increasing the likelihood that simulated fire perimeters overlap. Fuel types in lodgepole pine forests in the southwest part of CCCFPD tend to carry slower-moving wildfires, especially under moderate fire weather, resulting in lower relative burn probabilities. The pattern in burn probability mirrors historic fire behavior—grasslands tended to burn every couple of years whereas lodgepole pine forests burned every couple hundreds of years, but when lodgepole pine forests do burn under extreme conditions, the potential for extreme fire behavior is great. Forested areas in the central portion of CCCFPD can also experience more rapid rates of spread due to steep slopes, and therefore elevated relative burn probabilities.

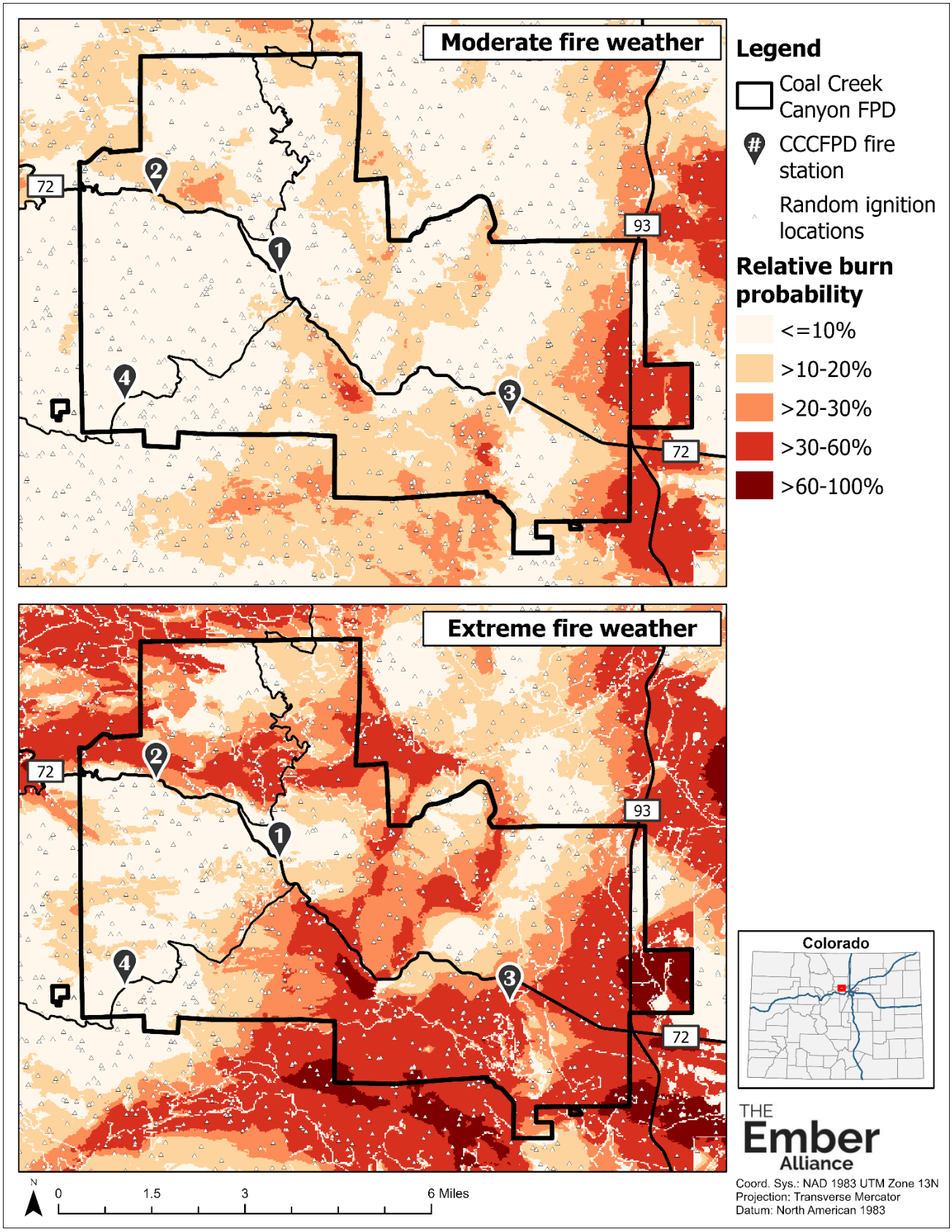


Figure B.7. *Relative burn probability under moderate and extreme fire weather conditions with winds bellowing out of the west. Wildfire spread was simulated for 4-hours without suppression activities from 6,500 random ignition locations across an area several times larger than and centered on CCCFPD. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

Predicted Radiant Heat and Ember Cast Exposure

We assessed the risk that radiant heat and short-range and long-range ember cast pose to structures[4]. See **Appendix A** for a description of how wildfires can ignite homes. Ember production and transport and their ability to ignite recipient fuels are guided by complex processes, so we utilized the simplified approach of Beverly et al., (2010) to assess home exposure to radiant heating and short- and long-range ember cast. Exposure is based on distance from long flame lengths and potential active crown fire assuming:

- Radiant heat can ignite homes when extreme fire behavior (flame lengths > 12 feet[5]) occurs within 33 yards (30 meters) of structures.
- Short-range embers can reach homes within about 110 yards (100 meters) of active crown fires.
- Long-range embers can reach homes within about 550 yards (500 meters) of active crown fires.

Embers can ignite homes even when the flaming front of a wildfire is far away. See Section 3.a. Mitigate the home ignition zone for tangible and relatively simple steps you can take to harden your home against embers. Mitigation practices, such as removing pine needles from gutters and installing covers over vents, can make ignition less likely and make it easier for firefighters to defend your property.

Distance thresholds used by Beverly et al., (2010) are based on observations from actual wildfires. (Caggiano et al., 2020) also found that a vast majority (95%) of home losses during WUI fires occurred within 100 m of wildland vegetation. Although embers can travel miles ahead of a wildfire, the number of embers reaching an area decreases exponentially with distance traveled, and the likelihood of structure ignition increases with the number of embers landing on the structure (Caton et al., 2016). Therefore, using conservative estimates of distance allows us to identify areas with the greatest risk of ignition from short- and long-range embers.

Potential exposure to radiant heating and long- and short-range ember cast is widespread across CCCFPD, and this awareness should encourage residents and business owners to complete home hardening practices to reduce the risk of ignition (**Figure B.8**). Under moderate fire weather, almost all homes in CCCFPD could experience long-range ember cast and 63% could experience short-range ember cast, but only about 20% could be exposed to damaging radiant heat (**Figure B.9**). Under extreme fire weather, many more homes (62%) could be exposed to damaging radiant heat.

Exposure to radiant heat and embers is lower in the eastern portion of CCCFPD due to the prevalence of grassland fuel types, which tend to support lower flame lengths and result in fewer ember production. Wildfires burning in steep, west-facing slopes covered in forests can produce long flame lengths and abundant embers, resulting in elevated structure exposure.

Most structures in CCCFPD (85%) could be exposed to short-range ember cast from other homes (**Figure B.10**). This creates the opportunity for home-to-home ignitions, especially if homes are not mitigated or hardened (Syphard et al., 2012). On average, homes could be exposed to short-range ember cast from four other homes, with some homes exposed to as many as 41 other homes. The Wondervu and Camp Eden Plan Units have the greatest potential for home-to-home spread due to higher housing densities.

Fuel treatments within HIZs and surrounding undeveloped areas could help reduce the exposure of homes to radiant heat and short-range ember cast. All homes should be built and upgraded with ignition-resistant materials to reduce the effects of short-range ember cast.

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[4] It is recommended to use this analysis to assess relative risk across the entire Fire Protection District and not to evaluate absolute risk to individual homes. FlamMap and the approach of Beverly et al. (2010) cannot account for defensible space, the fire resistance of materials used in home construction, and other fine-scale variation in fuel loads that contribute to the ignition potential of individual homes.

[5] Cutoff for flame length comes from research summarized by (Abo El Ezz et al., 2022) showing that 80-100% of structures were destroyed when exposed to >12-foot flame lengths during actual wildfires.

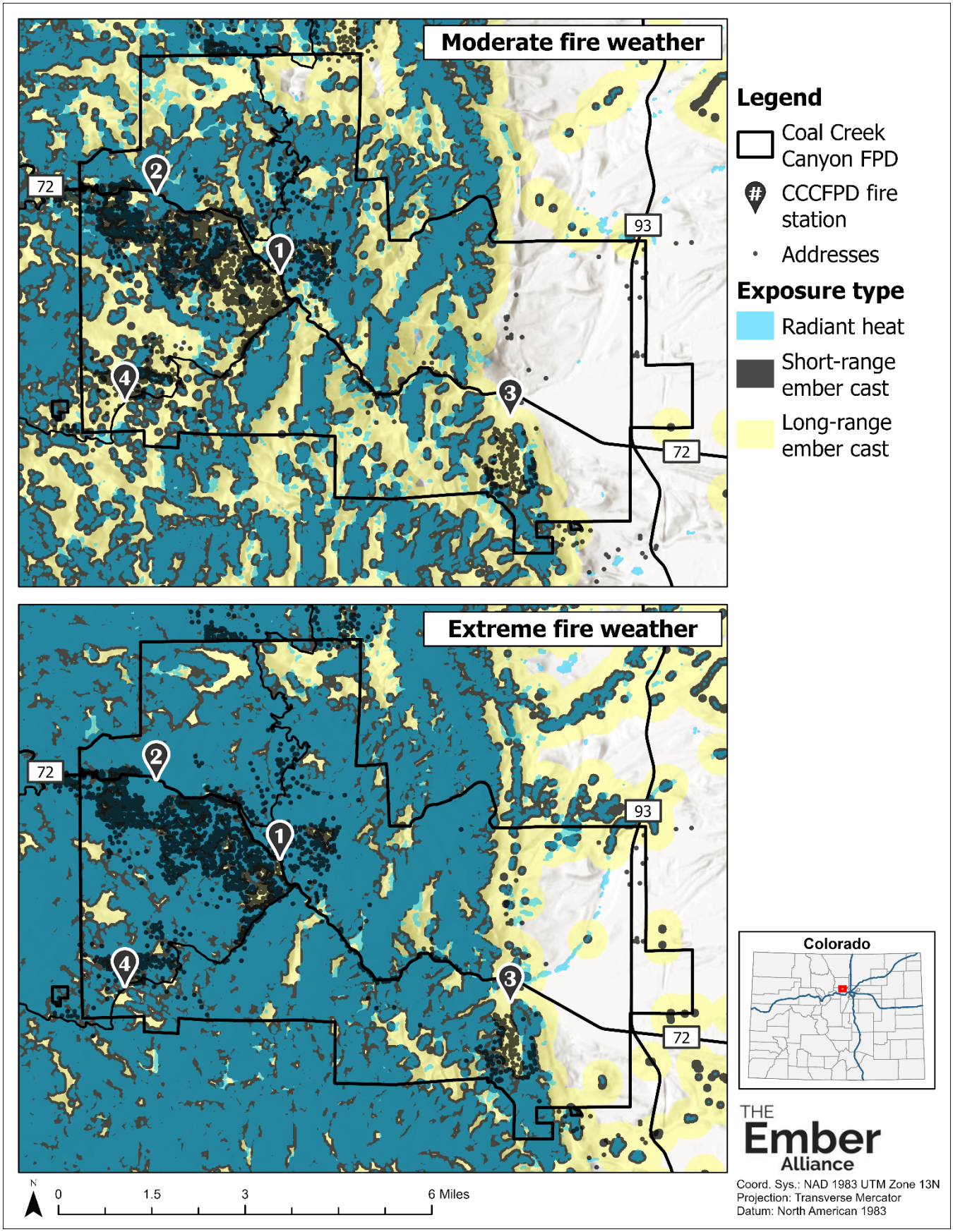


Figure B.8. *Predicted exposure to short- and long-range ember cast and radiant heat under moderate and extreme fire weather conditions in CCCFPD.*

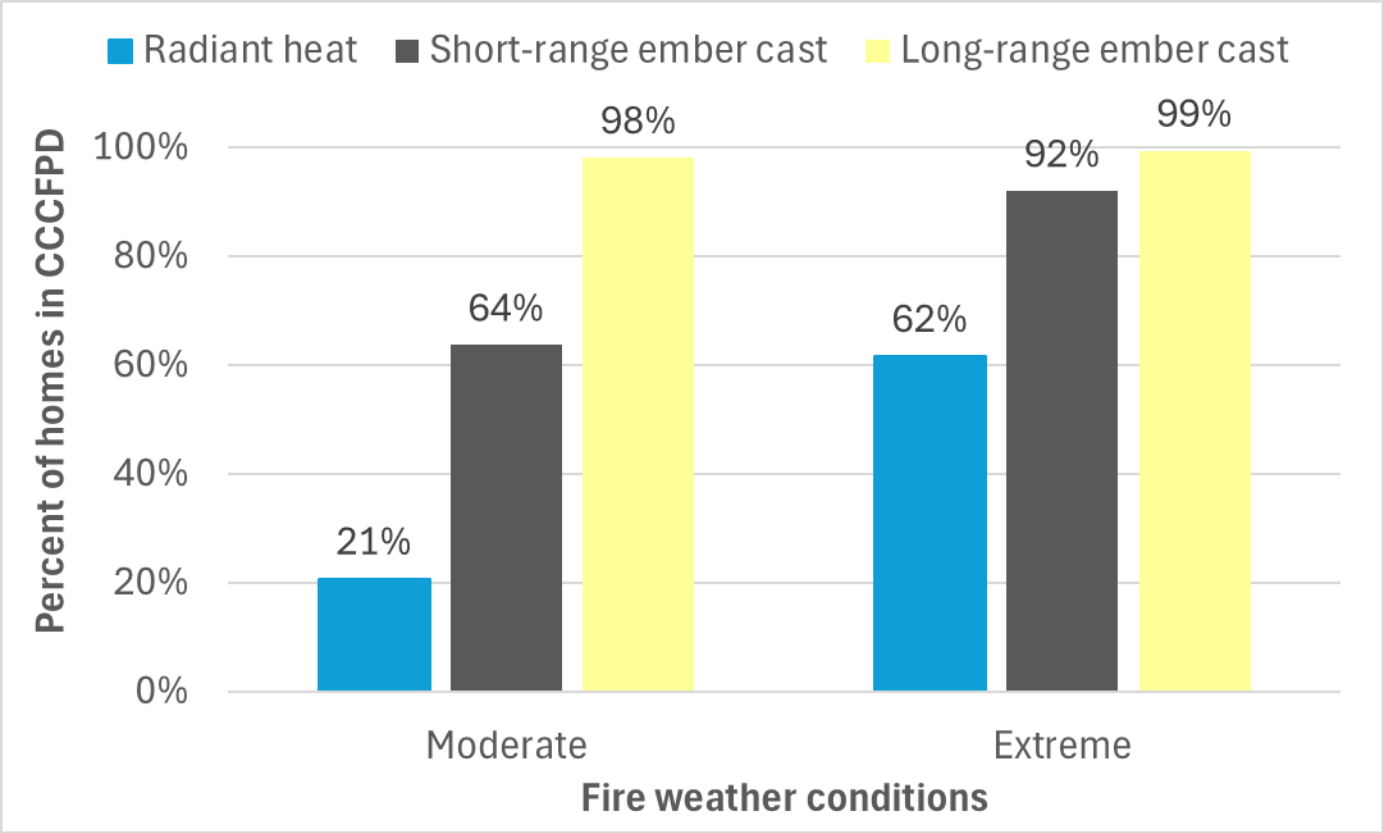


Figure B.9. *Percentage of homes in CCCFPD with different types of exposure to wildfire under moderate and extreme fire weather conditions. Radiant heat from burning vegetation can ignite nearby homes, and embers emitted from burning vegetation or other homes can travel long distances and ignite vegetation and homes away from the main fire.*

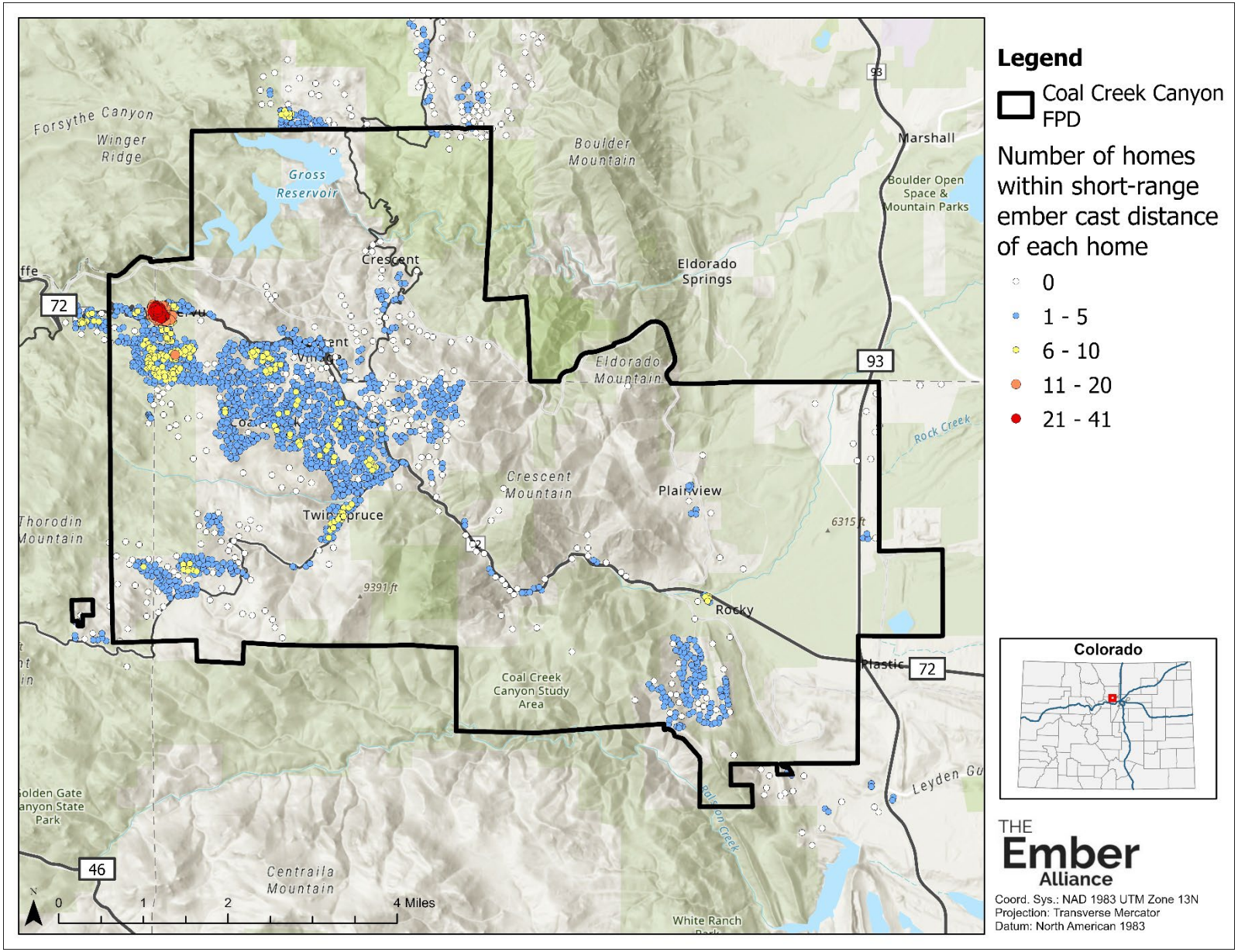


Figure B.10. *85% of homes could be exposed to short-range ember cast from at least one neighboring home, with the average home in CCCFPD potentially exposed to short-range ember cast from four other homes. Homes within 100-meters of other homes are at greater risk of home-to-home ignitions from short-range ember cast (Syphard et al., 2012).*

Exposure of Highly Valued Resources

We identified highly valued resources in areas that could experience damaging radiant heat and/or short-range ember cast and were within 100 m of areas with a relative burn probability of ≥10 percent (**Figure B.11**; **Table B.4**). This analysis informed fuel treatment prioritization and plan unit recommendations. Keep in mind that our fire behavior analyses occurred at the scale of 0.1 acres (20 x 20 meters), and input fuel data is developed via extrapolation of aerial imagery and satellite data. **Site-level assessments are vital to verify exposure of highly valued resources and develop specific plans for mitigation.**

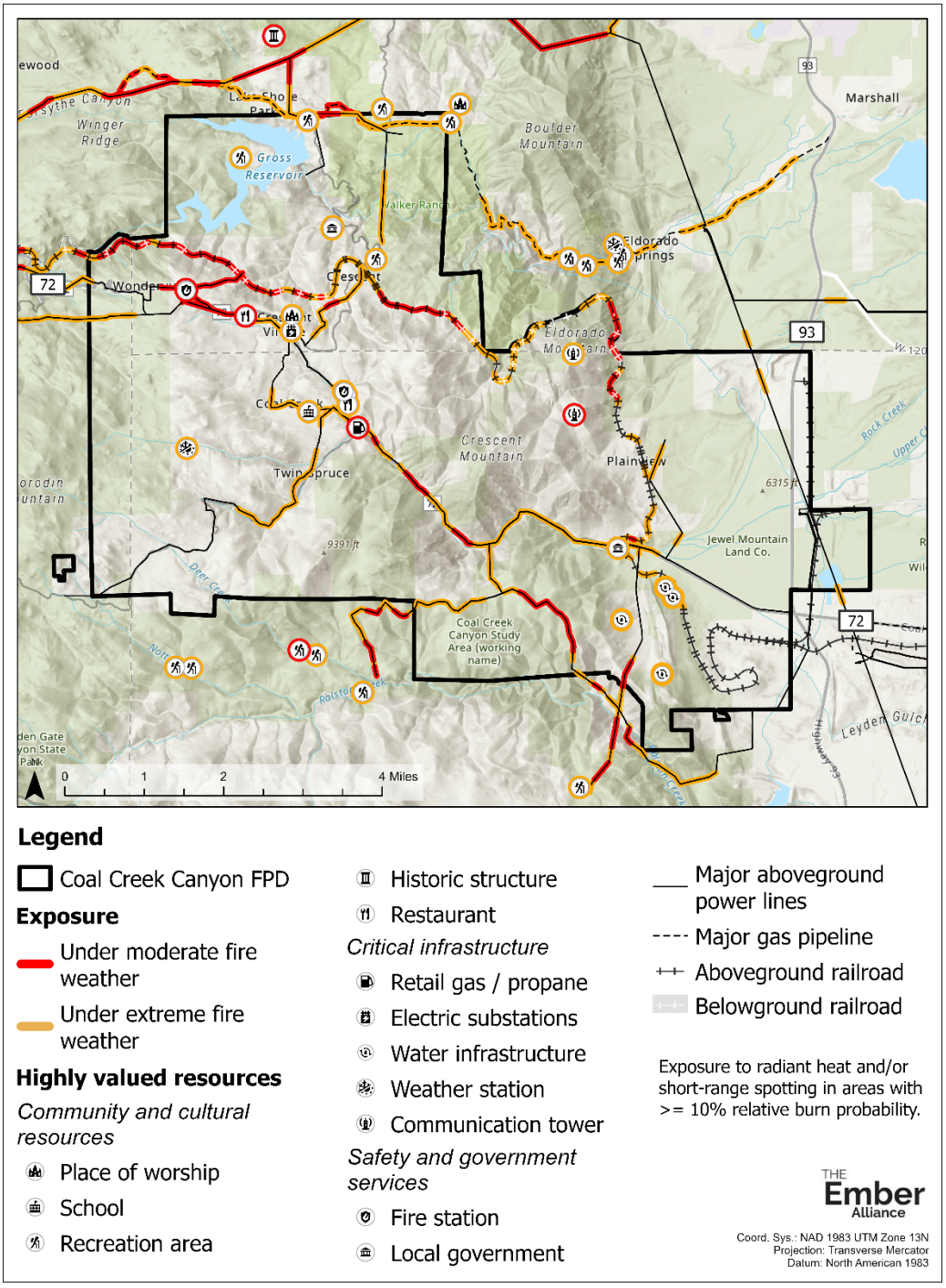


Figure B.11. *Predicted exposure of values at risk within one mile of CCCFPD. Areas that could experience exposure under moderate weather conditions are at greater risk than those that only experience exposure under extremely hot, dry, and windy conditions. See* ***Figure 2.a.1*** *for source credits for locations of highly valued resources.*

Table B.4. *Highly valued resources with potential exposed to radiant heat and/or short-range ember cast in areas with ≥10% relative burn probability. Areas that could experience exposure under moderate weather conditions are at greater risk than those that only experience exposure under extremely hot, dry, and windy conditions.*

Type	Name/location	Moderate fire weather	Extreme fire weather
Communication tower	Xcel Energy	X	X
Communication tower	KBCO-FM CH 247		X
Cultural resource	Sunshine School	X	X
Electric substations	Highway 72		X
Fire station	CCCFPD Station 1 and associated communication tower		X
Fire station	CCCFPD Station 2 and associated communication tower	X	X
Local government	Jefferson County Road & Bridge Maintenance Shop		X
Local government	Gross Reservoir--Denver Water offices		X
Place of worship	Whispering Pines Church		X
Place of worship	The 3 O'clock Wake Up Call		X
Recreation area	Golden Gate Canyon State Park, camping area	X	X
Recreation area	Golden Gate Canyon State Park, Vigil Historic Cabin		X
Recreation area	Golden Gate Canyon State Park, Forgotten Valley Campground		X
Recreation area	Golden Gate Canyon State Park, Tallman Pond Historic Cabin		X
Recreation area	Golden Gate Canyon State Park, camping area		X
Recreation area	Sourdough Campground		X
Recreation area	Eldorado Canyon State Park, Crescent Meadows parking area		X
Recreation area	East Winiger Ridge campground		X
Recreation area	Meyer's Homestead Trailhead		X
Recreation area	Gross Reservoir North Trailhead and parking lot		X
Recreation area	Eldorado Canyon State Park, Pika Road parking area		X
Recreation area	Eldorado Canyon State Park, Canyon overlook		X
Recreation area	Eldorado Canyon Trailhead		X
Recreation area	Fowler/Rattlesnake Gulch Trailhead		X
Recreation area	Eldorado Springs Trailhead		X
Restaurant	Canyon Tavern	X	X
Restaurant	Babooza's		X
Restaurant	Canyon Coffee		X
Retail gas / propane	Carl's Corner	X	X
School	Coal Creek Canyon Elementary School		X
Water infrastructure	Blue Mountain Water District, water treatment plant and other infrastructure		X
Weather station	Coop weather station (Coal Creek Canyon, ID 51681)		X
Weather station	Coop weather station (Gross Reservoir, ID 53629)		X
Weather station	Coop weather station (Hawthorne, ID 53850)		X

Evacuation Analysis

Evacuation concerns can weigh heavily on the minds of many residents in CCCFPD. The death of 86 people in Paradise, California during the 2018 Camp Fire, many of whom were stranded on roadways during evacuation, underscores the importance of evacuation preparedness and fuel mitigation along evacuation routes.

Evacuation Modeling and Scenarios

We modeled evacuation time and roadway congestion using ArcCASPER (Shahabi and Wilson, 2014). Estimates from ArcCASPER are useful for determining relative evacuation capacity and congestion across CCCFPD and are not intended to predict household-specific evacuation times. **Law enforcement personnel will direct traffic during a wildfire event, so our evacuation modeling is not meant to suggest alternate routes for individual residents.**

The ArcCASPER model considers roadway capacity, road speed, number of cars evacuating per address, and the relationship between roadway congestion and reduction in travel speed. The purpose of the model is to minimize evacuation time for the entire district, not to minimize the evacuation time for each individual resident.

ArcCASPER assumes simultaneous departure of vehicles, but the model's algorithm starts with the evacuee farthest from predefined scenario endpoint(s) and finds that evacuee's quickest path to an endpoint. It iteratively continues this process until there are no more evacuees left. During the analysis, ArcCASPER dynamically updates how long it takes to traverse each road segment based on the number of evacuees using that route and the relationship between traffic and travel speeds. The model adjusts evacuation routes until it minimizes the global evacuation time (i.e., the time it takes for all evacuees to reach predefined scenario endpoints).

Keep in mind: Simulation models cannot account for all variables present during an evacuation, so these results are useful as a guide for strategic planning rather than a depiction of what will occur in any specific evacuation event.

Estimates from ArcCASPER are useful for determining relative evacuation capacity and congestion across CCCFPD and are not intended to predict household-specific evacuation times. Law enforcement personnel will direct traffic during a wildfire event, so our evacuation modeling is not meant to suggest alternate routes for individual residents.

ArcCASPER does not account for unpredictable events, such as roadway blockage from accidents, non-survivable conditions along roadways burned-over by flames, or reduced visibility from smoke. It also does not consider emergency vehicles traveling the opposite direction of evacuation traffic.

For our analysis, we used an exponential traffic model with a critical density of 10 and saturation density of 120. The critical density is the maximum number of cars that can be on a road with two lanes (one lane in each direction) without a reduction in travel speed, and saturation density is the number of cars on the road at which the traversal speed reduces to half the original speed. Based on research by Beloglazov et al., (2016), we assumed that it takes 30 minutes for individuals to mobilize and depart their homes after receiving a mandatory evacuation order.

We worked with CCCFPD to conduct an extensive QAQC on road data from Open Street Map; an accurate road network is vital for evacuation modeling. Based on feedback from CCCFPD, we prevented simulated evacuees in Blue Mountain from using Brumm Trail as an alternate route—Brumm Trail is NOT an acceptable evacuation route due to inaccessibility. We also assumed the gates at Miramonte Road were unlocked.

We also work with CCCFPD to define evacuation scenarios, each assuming a wildfire moving out of a different direction and affecting the availability of evacuation routes. The scenarios were for a fire spreading out of the west, spreading out of the southwest, and spreading from the center of CCCFPD in all directions. Evacuees were routed to two to five different endpoints depending on the scenario (**Figure B.12**). **Endpoints were locations along major roads at which point the evacuation simulation ended; endpoints were NOT final evacuation destinations that would be used during an actual incident.**

We assumed district-wide evacuation scenarios for all residents in CCCFPD. Evacuation scenarios included 680 addresses located directly adjacent to CCCFPD boundary to simulate realistic traffic coming from neighborhoods that are likely to evacuate simultaneously with those inside CCCFPD boundary. We also included evacuees from recreation areas in Golden Gate Canyon State Park, Eldorado State Park, and Roosevelt National Forest, various trailheads in the area, and the Gross Reservoir work site (**Figure B.12**). The intent of running the evacuation model for all of CCCFPD at once was to assess an extreme scenario with the most cars on the road at the same time. This allowed us to identify areas of major congestion during a large-scale evacuation.

We modeled various number of vehicles departing from each address or recreation area depending on the address type and parking lot capacity (**Table B.5**). We assumed two vehicles per residential address. We used aerial imagery to estimate the number of parking spots at each recreational area, and we assumed maximum capacity at trailheads and camping areas. We assumed one vehicle per camping site. Denver Water provided estimates for the number of vehicles that might be at the Gross Reservoir work site.

Table B.5. *Number of vehicles simulated from each address type or location.*

Address type / location	# vehicles
Residential addresses	2
Restaurants, gas stations, and school	5
Gross Reservoir work site	100
Winiger Ridge camping area	126
Golden Gate Canyon State Park, Reverend's Ridge Campground	117
Golden Gate Canyon State Park, Rifleman Phillips Campground	15
Golden Gate Canyon State Park, Aspen Meadow Campground	35
Golden Gate Canyon State Park, Dude's Fishing Hole	8
Golden Gate Canyon State Park, Panorama Point	14
Eldorado Canyon State Park, Crescent Meadows parking area	35
Eldorado Canyon State Park, Pika Road parking area	13
Osprey Point Trailhead	56
Forsythe Canyon Trailhead	20
Meyer's Homestead Trailhead	38
Walker Ranch Loop Trailhead	48

Law enforcement personnel will direct traffic during a wildfire event. This evacuation analysis is not meant to suggest alternate routes for individual residents. **Residents need to follow guidance from law enforcement personnel during evacuation events, practice safe driving, and practice good evacuation etiquette (e.g., allowing cars to merge and not texting or stopping to take photographs).**

Evacuation Congestion

It is important for law enforcement personnel to plan for areas of high congestion when making decisions about how to conduct actual evacuations in CCCFPD. Roads were categorized by how much congestion may occur, and how much longer it may take to evacuate compared to everyday scenarios without evacuation traffic. We also combined predicted roadway congestion with potential roadway survivability to prioritize roads for fuel treatments.

Under all evacuation scenarios, portions of Highway 72 could experience extreme congestion with travel times 5-11 times longer than without evacuation traffic (**Figure B.12**; **Table B.6**). If a fire were to prevent traffic westbound on Highway 72 and Gap Road, Flagstaff Road could experience extreme congestion. Under other scenarios, Flagstaff Road could experience high congestion. The high density of homes in the Upper Twin Spruce and Burke Plan Units could also create high to extreme congestion on portions of Gap Road if fire spread were to prohibit residents from traveling west on Gap Road towards Highway 119. Ranch Elsie Road experienced high congestion under the scenario of wildfire spreading out of the west. Portions of Ronnie Road, Indian Peak Road, and Olde Carter Lake Road could experience high congestion under the scenario of wildfire spreading out of the southwest as traffic backs up merging onto Highway 72.

Table B.6. *Maximum congestion predicted for different segments of roads under three evacuation scenarios.*

Maximum Predicted Congestion	Name of Road	
Extreme (travel times 5.1-11.3 x longer)	CO Highway 72 Flagstaff Road Gap Road	
High (travel times 3.1-5 x longer)	Ranch Elsie Road Ronnie Road Indian Peak Road Olde Carter Lake Road	
Moderate (travel times 2.1-3 x longer)	Bison Drive Blue Mountain Drive Brook Road Burland Road Camp Eden Road Coal Creek Heights Drive Copperdale Lane County Road 68 County Road 68J Crescent Park Drive Divide View Drive Gross Dam Road Happy Trail	Hillcrest Road Katie Lane Lakeshore Drive Leon Lane Lillis Lane Miramonte Road Ridge Road Rudi Lane Skyline Drive (in Upper Twin Spruce) South Beaver Creek Road Spruce Canyon Drive Sylvan Road West Ranch Elsie Road

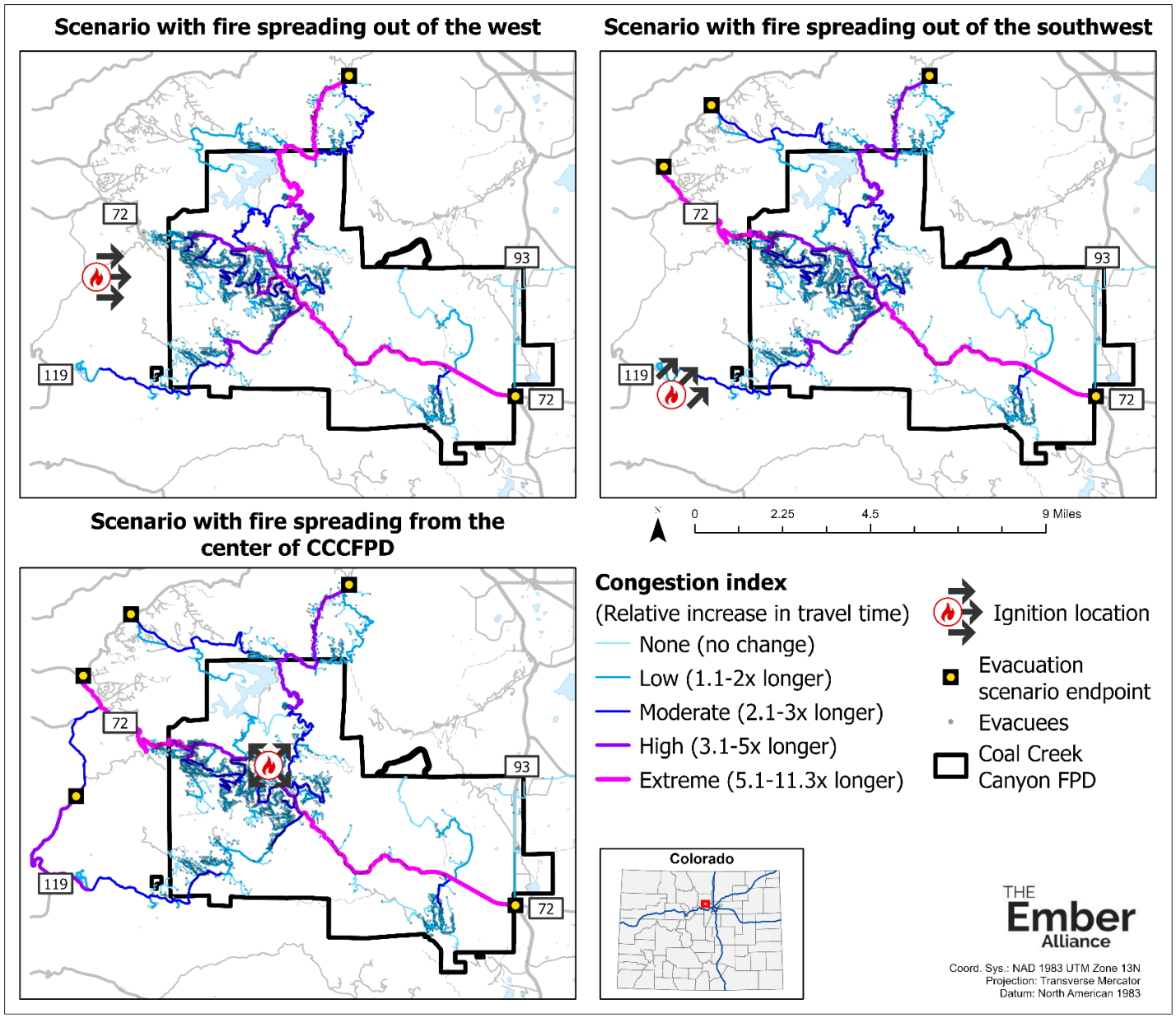


Figure B.12. *Predicted congestion across CCCFPD under a simultaneous district-wide evacuation order. Congestion categories (none, low, moderate, high, extreme) are based on the ratio between the time required to traverse a segment of road with congestion vs. without congestion. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

Evacuation Time

Evacuation time indicates how long it might take for a vehicle to receive an evacuation order, depart from an address, and reach a scenario endpoint. site Estimates of evacuation time can serve as a benchmark for emergency pre-planning and strategic decision making.

The time required to evacuate everyone from CCCFPD, surrounding neighborhoods, and recreation areas ranged from about 2 hours and 20 minutes to 3 hours and 40 minutes (**Figure B.13**). Longer evacuation times are possible were a fire to spread out of the west because it would significantly limit the number of safe routes available for evacuees. Long evacuation times could be widespread across CCCFPD as congestion builds up along Highway 72 heading east.

Predictions for evacuees from each Plan Unit by scenario are presented in **Figure B.14**. Residents in the Upper Twin Spruce Plan Unit could experience particularly long evacuation times were they unable to travel west on Gap Road towards Highway 119 due to fires spreading out of the west or southwest. The Coal Creek Heights Plan Unit could experience substantial evacuation congestion and long evacuation times as well—this plan unit is densely populated and could encounter congestion on Highway 72.

The actual time it would take to evacuate during a specific incident is influenced by a variety of factors not considered in this modeling effort, such as the staggering of evacuation orders, the nature of evacuation orders (i.e., voluntary versus mandatory), traffic accidents, delays from people stopping to take photographs, reduced visibility from smoke, etc.

Even with only one main route into and out of Blue Mountain, predicted evacuation times were shorter for the Blue Mountain Plan Unit than most parts of CCCFPD due to their proximity to Highway 72. Evacuation times were also short for the Pika Plan Unit because residents could hypothetically evacuate north along Flagstaff Road without much congestion, unless a fire were to spread out of the north and prohibit their use of Flagstaff Road. Plainview Plan Unit had short evacuation times due to the low housing density, but this situation could change with future development.

These model results should be interpreted as relative ratings showing what neighborhoods may take longer than others to evacuate. It is important to note that these times are given under the best-case scenario in which residents are safely and efficiently evacuating, there are no accidents blocking the roads, there is no smoke hindering visibility, and evacuation groups are departing individually. **It is important for residents to be prepared so they can leave promptly in the case of an evacuation order.**

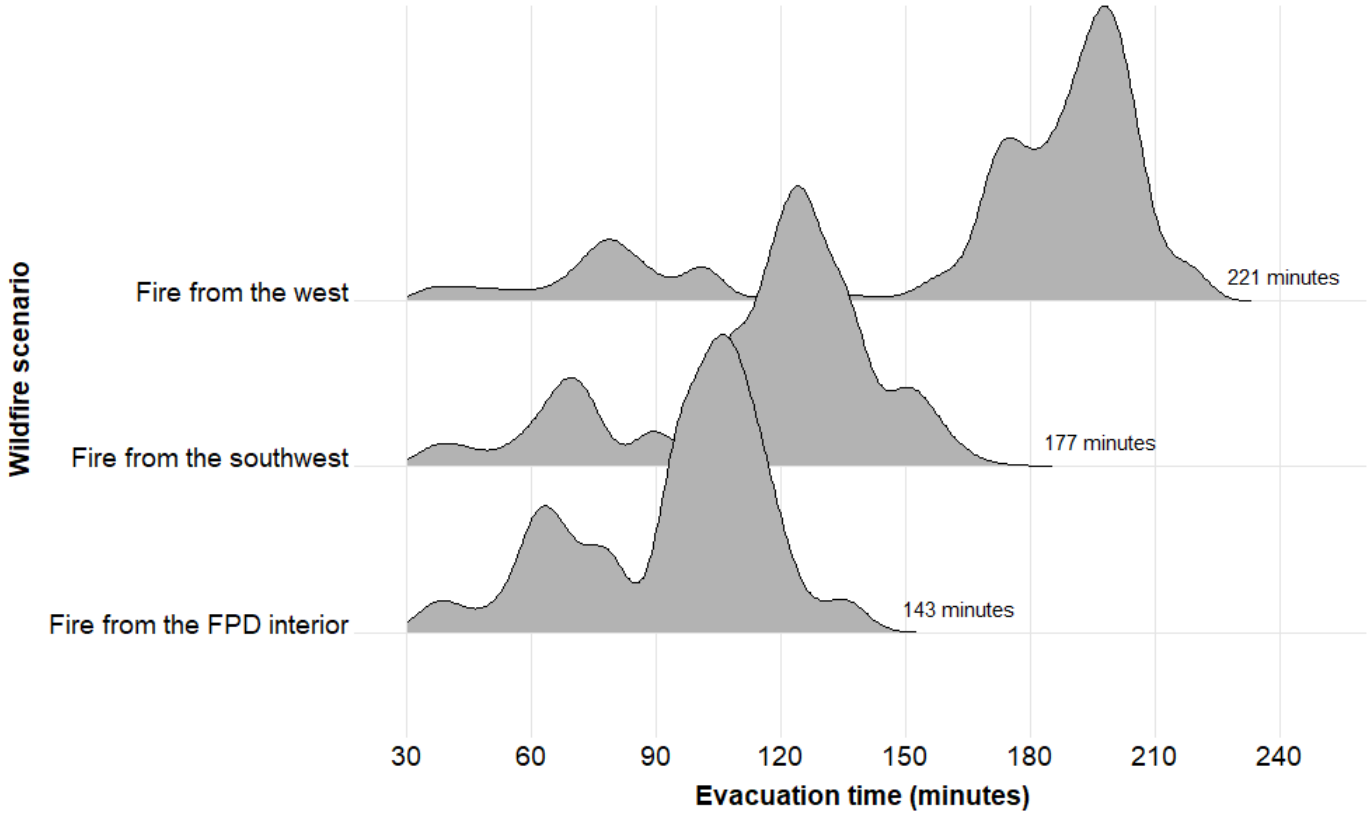


Figure B.13. *Distribution of predicted evacuation times under a simultaneous district-wide evacuation order. Peaks in the distribution indicate a larger number of evacuees with that predicted evacuation time. Predictions include 30 minutes for evacuees to mobilize and depart after receiving an evacuation order. Numbers to the right of each distribution indicate the total time required for all evacuees to arrive at scenario endpoints.*

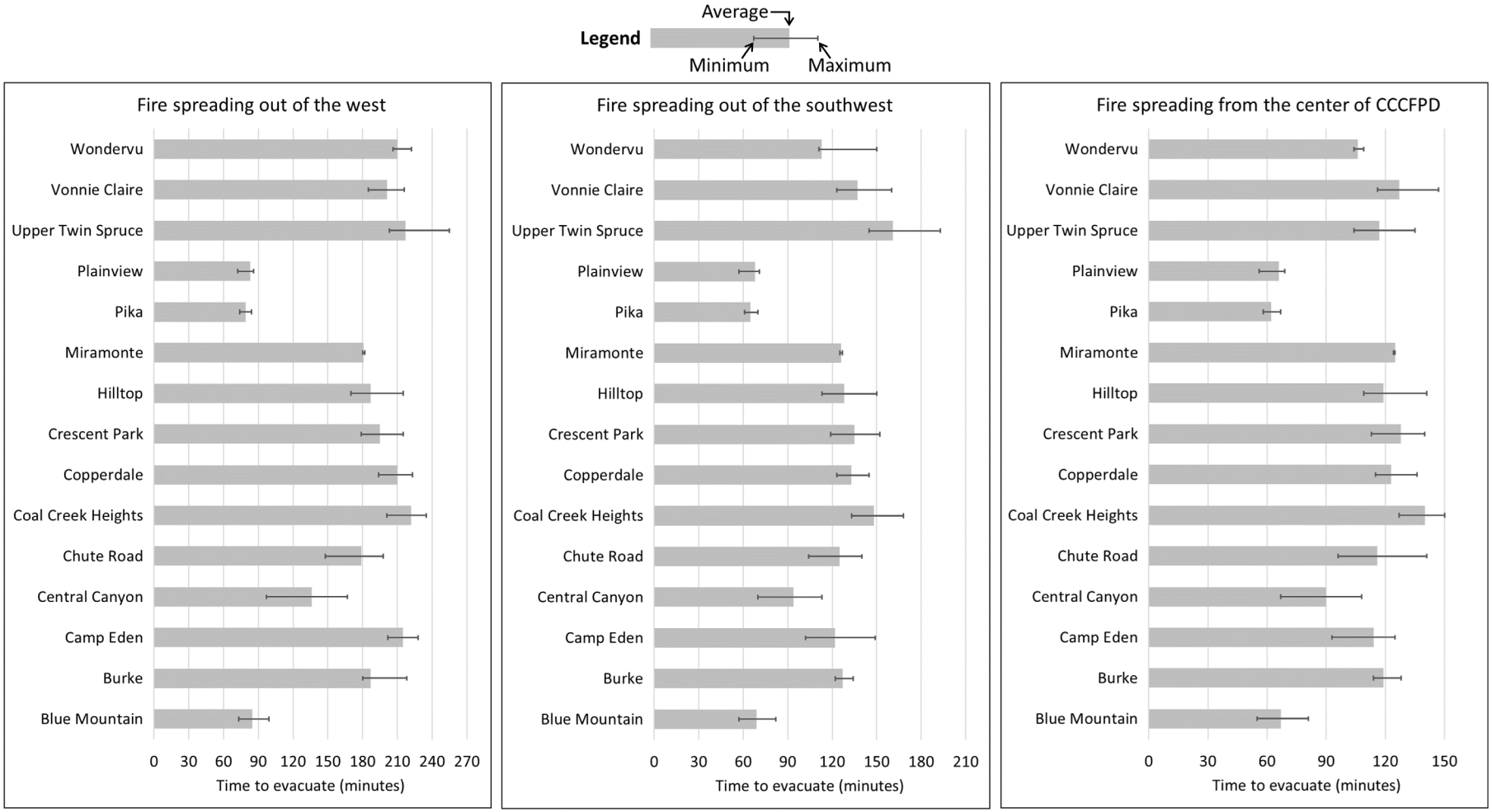


Figure B.14. *Average, minimum, and maximum evacuation times predicted for evacuees in each CWPP Plan Unit in CCCFPD under different evacuation scenarios. Predictions include 30 minutes for evacuees to mobilize and depart after receiving an evacuation order.*

Roadway Survivability

We utilized fire behavior predictions to identify road segments that could experience non-survivable conditions during a wildfire. We used roadway data from OpenStreetMap and the Colorado Department of Transportation, with modifications to the road network based on local expertise. We identified "non-survivable roadways" as portions of roads adjacent to areas with predicted flame lengths greater than 8 feet. Drivers stopped or trapped on these roadways could have a low chance of survival due to radiant heat emitted from fires of this intensity. This assumption is based on the Haul Chart, which is a standard tool used by firefighters to relate flame lengths to tactical decisions (**Appendix B, Table B.3**) (NWCG, 2019). Direct attack of a flaming front is no longer feasible once flame lengths exceed about 8 feet due to the intensity of heat output. Flames greater than 8 feet could also make roads impassable and cut residents off from egress routes. Non-survivable conditions are more common along roads lined by thick forests with abundant ladder fuels, such as trees with low limbs and saplings and tall shrubs beneath overstory trees.

Under moderate fire weather conditions, 10% of the roads in CCCFPD could experience non-survivable conditions, and this percentage rises to 44% under extreme fire weather conditions (**Figure B.15**). Over 20% of roads are potentially non-survivable in Chute Road, Crescent Park, and Miramonte plan units under moderate conditions, and over 50% of roads are potentially non-survivable in Chute Road, Camp Eden, Coal Creek Heights, Miramonte, and Crescent Park plan units under extreme weather conditions.

Some non-survivable road segments across CCCFPD are part of key evacuation routes, including portions of Coal Creek Canyon Road, Twin Spruce Road, Gap Road, Gross Dam Road, and Flagstaff Road. These areas are a high priority for roadside fuel mitigation to create safer conditions for residents, visitors, fire fighters, and other first responders.

Mitigation actions along sections of road with high risk for non-survivable conditions during a wildfire can increase the chances of survival for residents stranded in their vehicles during a wildfire and decrease the chance that roadways become impassable due to flames.

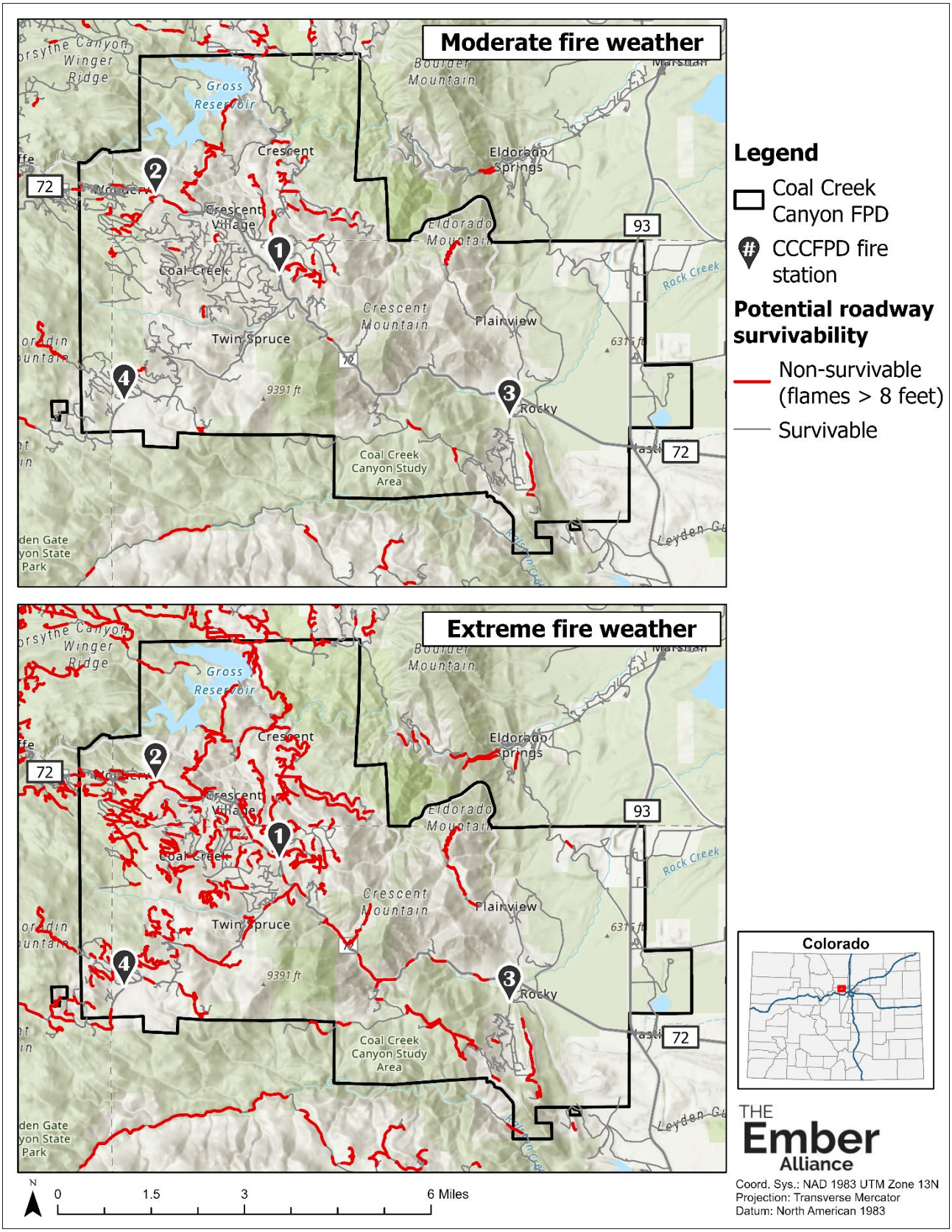


Figure B.15. *Under moderate fire weather conditions, 10% of roads and driveways in CCCFPD could potentially experience non-survivable conditions during wildfires (i.e., flame lengths over 8 feet). This percentage rises to 44% under extreme fire weather conditions.*

Post-Fire Sediment Delivery

Background

Impacts of wildfires do not end once the flames are extinguished. Intense rainfall events can result in flash floods, erosion, sediment delivery and debris flows the first few years following a wildfire (Neary et al., 2005). Wildfires kill vegetation that anchor soil in place and intercept rainfall, and they consume surface litter and organic matter that serve as a sponge absorbing rainfall and slowing the overland movement of water. Extreme heating from wildfires can break apart clumps of soil, known as aggregates, thereby reducing the stability of the soil and its ability to absorb water and resist erosion. Wildfires occasionally result in hydrophobic soils that repel water and exacerbate post-fire erosion, but water-repelling conditions diminish rapidly after a wildfire, in the matter of months to a few years (Binkley, 2020). Research suggests that post-fire sediment delivery is related to the loss of surface cover to a greater degree than to the formation of hydrophobic soils (Larsen et al., 2009).

Definitions

Debris flow: A fast-moving landslide made up of a mixture of water-saturated rock, soil, and debris with a consistency similar to wet cement.

Erosion: Detachment and transport of soil and rock due to gravity, water, or wind.

Sediment delivery: Movement of soil into streams. Rates of sediment delivery are less than rates of erosion. Variation in topography and other barriers can stop the downhill movement of soil before it enters a stream.

Watershed: Area of land where all precipitation falling in that area drains to the same location.

Erosion and sedimentation are natural processes that shape streams, transport soil and nutrients across a landscape and create diversity in streams and riparian habitats. However, extreme post-fire sediment delivery and debris flows can damage and destroy homes, community assets, infrastructure, fisheries, water quality, and riparian vegetation. Homes, community assets, and infrastructure in CCCFPD could be threatened by post-fire flooding sedimentation. Watersheds that intersect CCCFPD provide drinking water to about 770,000 residents according to an analysis by the U.S. Forest Service (Mack et al., 2022). Wildfires can significantly impair water quality, impact water infrastructure, and threaten the delivery of clean drinking water to tens of thousands of residents. Examples of post-fire impacts along the Colorado Front Range in Jefferson and Boulder Counties include:


Photo credit: Rope and Summit

2010 Fourmile Canyon Fire: Flood on July 13, 2011, caused evacuations for residents in the Fourmile burn area. Major rain over the course of a week in mid-September 2013 resulted in extreme flooding in the Fourmile Canyon, and sections of Fourmile Canyon Drive and Goldrun Road were completely washed away. Several bridges and homes were severely damaged or destroyed. Sources: Phys.org. Bulletin of the American Meteorological Society, Vol. 96, Issue 9, pp 1461-87. City of Boulder, self-guided hike.


Photo credit: M. Stevens, USGS

2002 Hayman Fire: Intense rainfall and flooding in July 2006 caused millions in damage to local highways and degraded water quality, and inundated lakes and reservoirs with sediment. Source: U.S. Geological Survey, Scientific Investigations Report 2012-5267.

1996 Buffalo Creek Fire: Two months after the fire on August 23, 1996, a 100-year thunderstorm resulted in erosion and flooding resulted in the death of two residents, washed out County Road 126, damaged the City of Buffalo Creek's potable water supply and telephone facilities, and inundated Stronita Springs Reservoir with sediment. Source: Land and Water, Vol 41, No 1, pp 27-29.

Emergency response, mitigation measures, and sediment removal after major flood events carry a hefty price tag—sometimes within the magnitude of wildfire suppression costs (**Table B.7**). Costs are borne by federal agencies, state agencies, municipalities, water providers, homeowners, insurers, and other parties. Suppression costs for the 2002 Hayman Fire were $39 million, and federal requests for mitigation activities by Burned Areas Emergency Response teams (BAER)[6] were $21 million. In addition, Denver Water spent over $27 million recovering from the 1996 Buffalo Creek and 2002 Hayman Fires in southern Jefferson County.

Key Findings

This assessment quantified the potential for destructive sediment delivery following a wildfire using the Water Erosion Prediction Project (WEPP), identified values at risk to post-fire sediment, and provides recommendations for residents, managers, and partners in CCCFPD to plan for and mitigate post-fire impacts. This assessment also informed priority recommendations for fuel treatments to mitigate wildfire and post-fire impacts. Detailed methodology follows this summary. Recommendations for post-fire preparedness, mitigation, and response are provided in **Sections 3.a** and **3.c.** of the CWPP.

The probability of sediment delivery (the likelihood that any amount of sediment is deposited after rainfall events) could be eight times greater the first year following wildfire in CCCFPD compared to current, unburned conditions. The magnitude of sediment delivery (the amount of sediment that could be dislodged from hills and transported into streams during intense rainstorms) could be almost 80 times greater than current, unburned conditions if 1-in-50-year storms followed a wildfire (**Table B.8**). Under current, unburned conditions, per-acre sediment delivery rates were all less than 2.1 tons/acre/year, even with 1-in-50-year precipitation. These values fall within observed erosion rates for undisturbed watersheds in the western United States (0 to 2.5 tons/acre/year) (Neary et al., 2005). Post-fire, per-acre sediment delivery exceeded 2.5 tons/acre/year for 72% of watersheds in the analysis area under 1-in-50-year precipitation. The highest per-acre sediment delivery rate at the watershed-scale was 16.8 tons/acre/year (**Figure B.16**). Steep slopes in parts of CCCFPD are the primary driver of elevated wildfire severity and post-fire sediment delivery.

About 345 homes and businesses in CCCFPD (18% of all addresses) occur in watersheds with a high- to very high-risk of damaging post-fire sediment delivery (**Figure B.17**). At-risk addresses primarily occur across Wondervu, Camp Eden, Burke, Central Canyon, and Chute Road Plan Units and the southern part of Blue Mountain Plan Unit. Whispering Pines Church and the Jefferson County Road & Bridge Maintenance Shop also occur in watersheds with high to very high risk of post-fire sediment. Infrastructure at risk includes the Blue Mountain substation, two communication towers in the Plainview Plan Unit, and the Foothills Landfill east of CCCFPD. 22% of major gas lines and 35% of major overhead powerlines are also at risk (**Figure B.17**; **Figure B.19**). Numerous trailheads, camping areas, and parking lot for recreation areas are also at high- to very high- risk of damaging post-fire sediment delivery, along with 35% of trails (21 of 33 miles).

[6] BAER teams are interagency teams of specialists, including hydrologists, soil scientists, and biologists, formed after wildfires to analyze post-fire conditions and undertake emergency stabilization action to prevent loss of life and damage to property, critical infrastructure, natural resources, and other values at risk.

Table B.7. *Suppression costs, funding requests for post-fire mitigation, and specific mitigation actions recommended by BAER teams for wildfires in Jefferson, Boulder, Larimer, and Douglas Counties.*

Fire	Burn severity	Suppression costs	Mitigation request	Recommended mitigation actions	Sources
Lefthand Canyon March 11-15, 2011 622 acres	Unburned: 0% Low: 92% Mod: 7% High: 1%	Not reported	$6.7K	Herbicide, trail work	U.S. Forest Service, BAER Report.
Fourmile Canyon Sept 6-13, 2010 6,179 acres	Unburned: 0% Low: 40% Mod: 49% High: 11%	$9.5 million	$67K	Channel debris clearing, channel deflectors, culvert upgrading, herbicide, secure mine openings, seeding (ground), storm patrol, straw mulch (aerial), warning signs, wood shreds	U.S. Forest Service, BAER Report.
Big Elk July 17-26, 2002 4,348 acres	Unburned: 0% Low: 30% Mod: 46% High: 24%	$4.3 million	$63K	Bridge-debris removal, bridge-secure trail bridges, culvert inlet/outlet armoring, early warning system, hand waterbar, hazard trees/rock, rolling dips/water bars, trash racks, warning signs, weed treatment	U.S. Forest Service, BAER Report.
Hayman June 8-July 2, 2002 137,784 acres	Unburned: 15% Low: 34% Mod: 16% High: 35%	$39 million	$21 million	Annual grass seed, heritage site treatment, hydromulch (aerial and ground), mulching, noxious weed treatment, private land protection, road maintenance, seeding - aerial, soil scarification (hand and mechanical), temporary gates	U.S. Forest Service, BAER report.
Schoonover May 21-26, 2002 3,862 acres	Unburned: 0% Low: 71% Mod: 23% High: 6%	$3.5 million	$50K	Contour felling, early warning system, herbicide, seeding (ground)	U.S. Forest Service, BAER report.
High Meadow June 12-27, 2000 10,970 acres	Unburned: 0% Low: 35% Mod: 37% High: 28%	$4.5-5 million	$1.4 million	Armored ford crossing, contour felling, debris basins, energy dissipaters, soil scarification, road drainage improvement, sand/soil/gravel bags, seeding (aerial), straw wattles, water impoundments, weed treatment, wildlife habitat planting	U.S. Forest Service, BAER report.
Buffalo Creek May 18-24, 1996 11,900 acres	Unburned: 0% Low: 9% Mod: 28% High: 63%	Not reported	$713K	Contour felling, debris basins, geotextile fabrics/geowebbing, rock grade stabilizers, sand/soil/gravel bags, seeding (aerial and ground), straw bale check dams	U.S. Forest Service, BAER report.

Twenty-three percent of roads within 0.5 miles of CCCFPD and four bridges on Highway 72 could also experience damaging post-fire sediment delivery (**Figure B.18; Table B.9**). Residents in CCCFPD experienced disruptions caused by damaging flooding along Highway 72 in 2013 and 2023, and this analysis suggests 4.0 miles of this road are at risk of damaging post-fire sediment delivery. Other roads with significant mileage at-risk include Brumm Trail, Chute Road, Glencoe Valley Road, Winiger Ridge, Lost Dove Trail, State Highway 93, and Twin Spruce Road (**Table B.9**).

The potential for damaging post-fire sediment delivery to rivers, streams, and waterbodies in CCCFPD is particularly concerning given the importance of watersheds in this part of Colorado for the delivery of clean drinking water to the greater Denver Metropolitan area. Almost 40% of the length of rivers/streams within 0.5 miles of CCCFPD (99 of 161 miles), Gross Reservoir, and 12 small ponds occur in areas with high- to very high-risk of damaging post-fire sediment delivery. Some infrastructure owned by Blue Mountain Water District are also at risk.

Table B.8. *Watershed-scale predictions for the likelihood of sediment delivery across 50 years of random weather simulations and the magnitude of sediment delivery under unburned conditions and the first year following wildfire for average and 1-in-50-year weather conditions. For comparison, sediment yields are typically 0-2.5 tons/acre/year in undisturbed watersheds across the western United States (Neary et al., 2005).*

	Average weather		1-in-50-year weather	
	Average	Range	Average	Range
Probability of sediment delivery				
Unburned (%)	8	0 - 57	N/A	N/A
1-year post-fire (%)	64	21 - 80	N/A	N/A
Ratio (post-fire: unburned)	8	1 - 333	N/A	N/A
Total sediment (tons/year)				
Unburned (tons/year)	0	0 - 44	11	0 - 1,179
1-year post-fire (tons/year)	47	0 - 575	873	1 - 8,848
Ratio (post-fire: unburned)	18	0 - 6,345	78	0 - 172,561
Per-acre sediment				
Unburned (tons/acre/year)	0	0 - 0.1	0.1	0 - 2.1
1-year post-fire (tons/acre/year)	0.3	0 - 1.2	6.2	0 - 16.8
Ratio (post-fire: unburned)	18	0 - 6,085	89	0 - 586,839

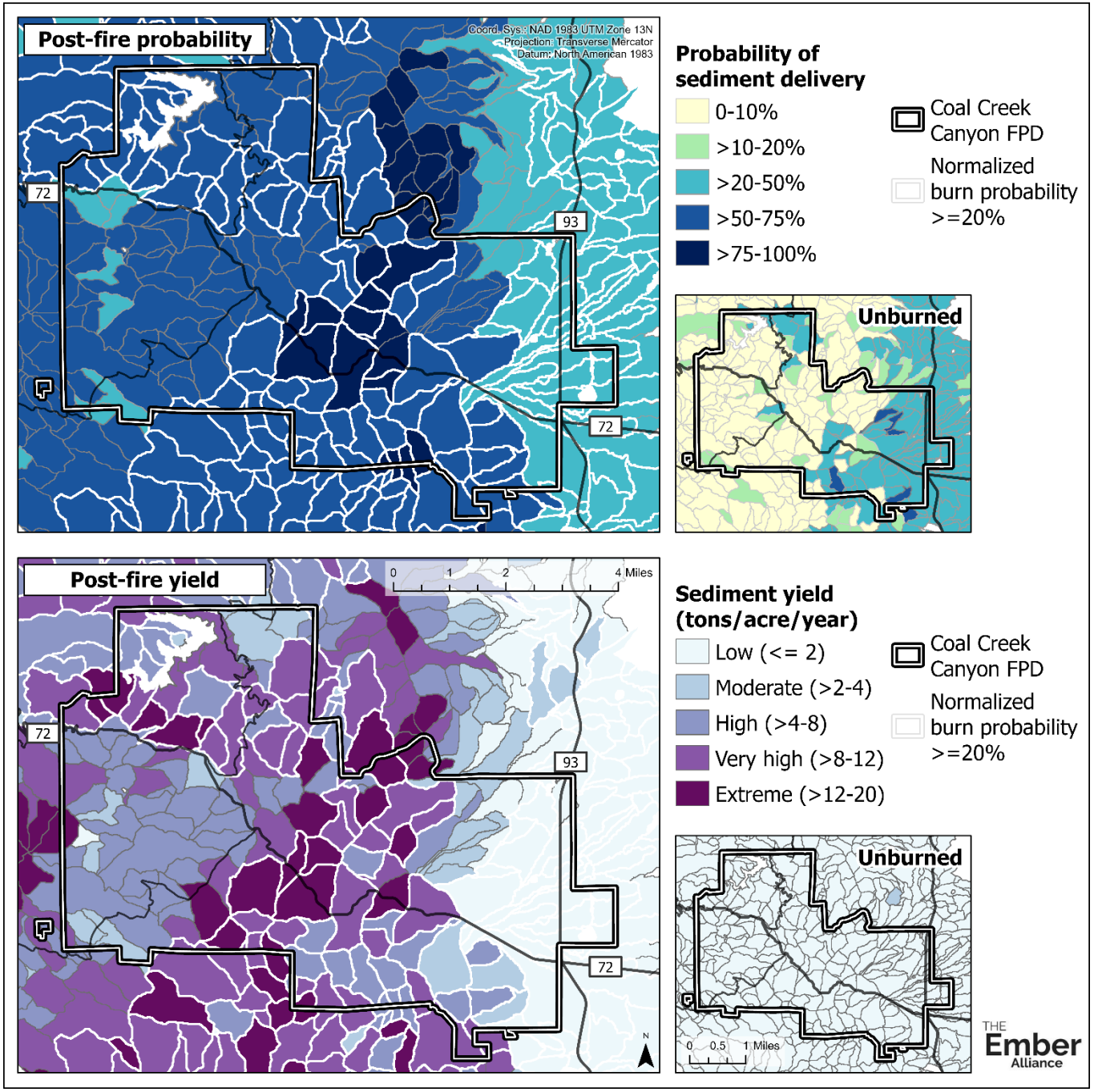


Figure B.16. *Watershed-scale predictions of the probability of sediment delivery (the percentage of 50 simulated weather scenarios that resulted in sediment delivery >0 tons/acre) and the magnitude of sediment delivery (tons/year) for unburned conditions and the first year following wildfire. Sediment yield is presented for 1-in-50-year weather conditions. Watersheds outlined in white have relative burn probabilities ≥20%. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

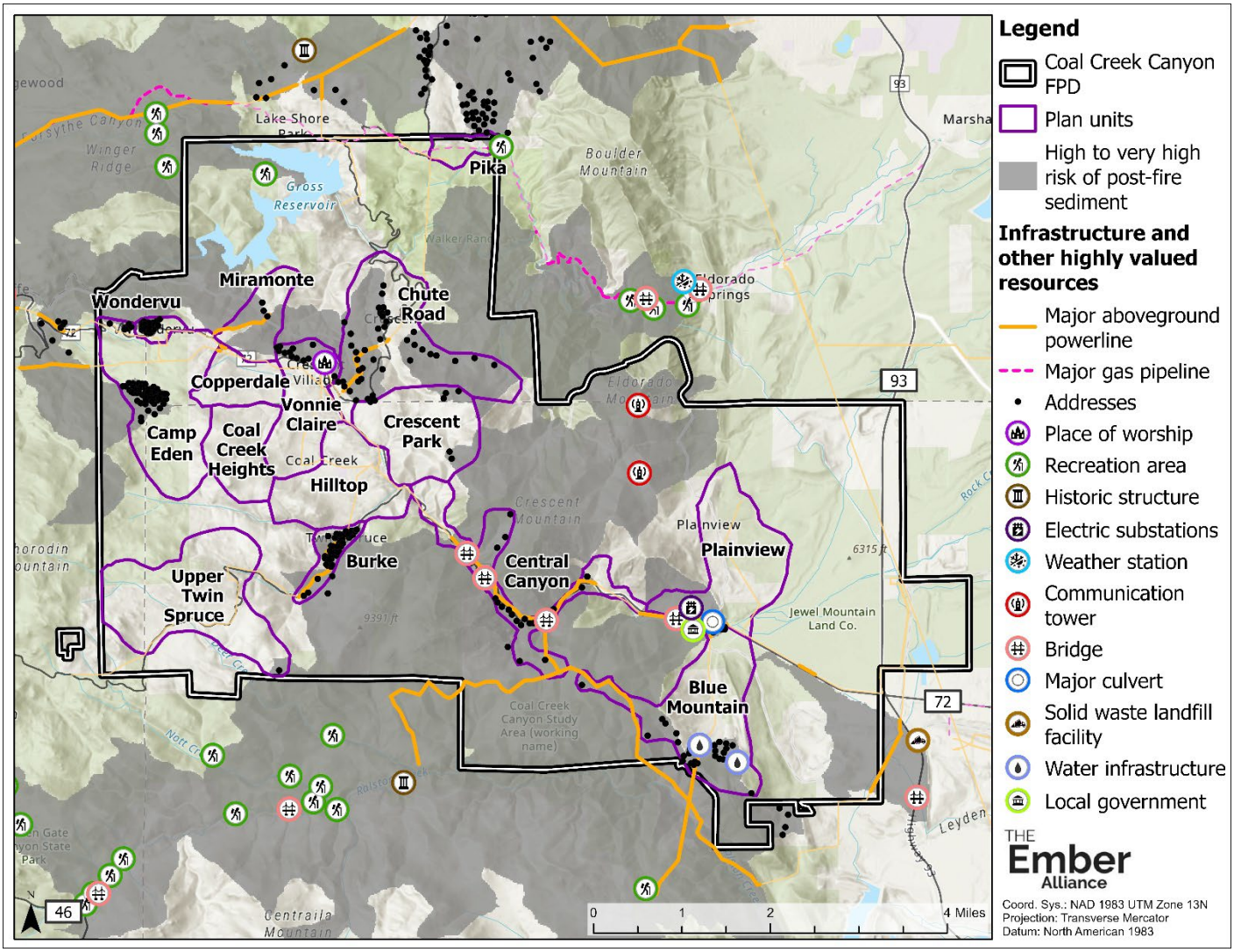


Figure B.17. *Homes, businesses, and infrastructure located in watersheds with high to very high risk of damaging post-fire sedimentation. Segments of aboveground powerlines and gas pipelines appearing in lighter shades are not at high risk. Only homes and non-residential highly valued resources with potential exposure to damaging post-fire sedimentation are displayed on the map.*

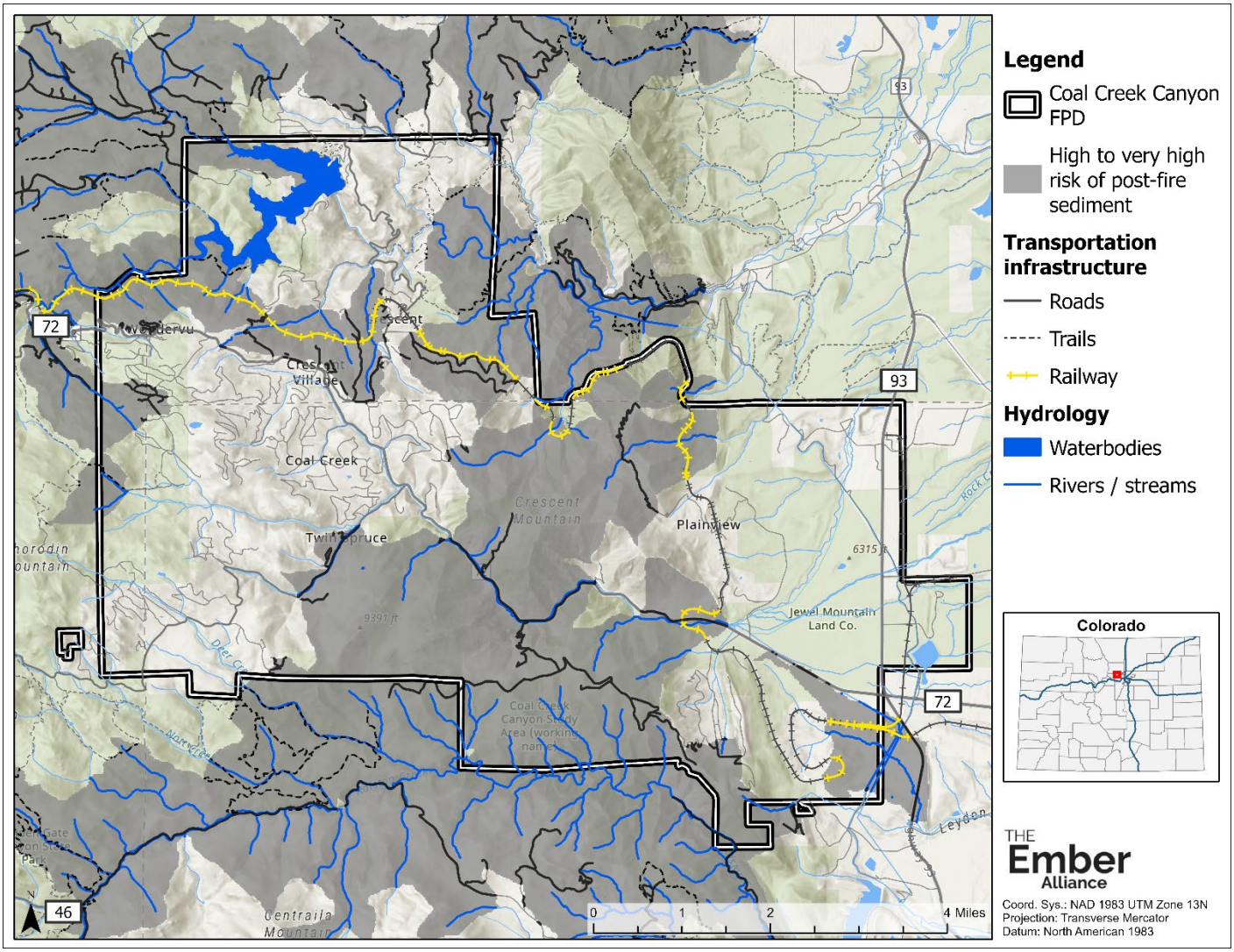


Figure B.18. *Roads, trails, railways, rivers/streams, and waterbodies located in watersheds with high to very high risk of damaging post-fire sedimentation. Features in lighter shades are those not at high risk.*

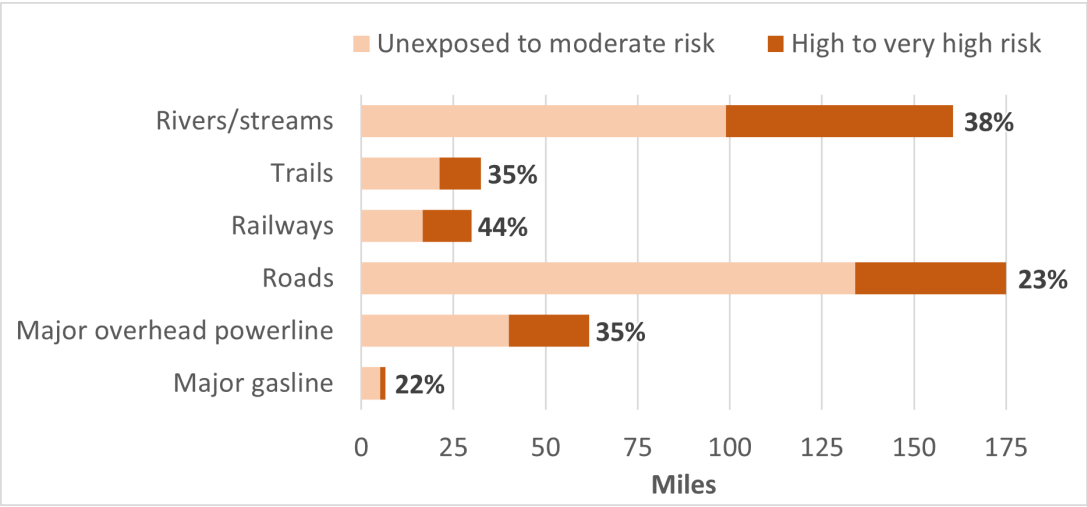


Figure B.19. *Miles of linear infrastructure and rivers/streams within 0.5 miles of CCCFPD with different levels of risk for damaging post-fire sedimentation. Numbers at the end of bars indicate the percentage of miles with high to very high risk.*

Table B.9. *Roads, trails, and rivers with over 1.0 miles that could face a high to very high risk of post-fire sediment delivery and occur within 0.5 miles of CCCFPD.*

Type	Name	Length with high to very high **risk (miles)**
Road	Brumm Trail	4.7
Road	Highway 72	4.0
Road	Chute Road	3.4
Road	Glencoe Valley Road	1.7
Road	Winiger Ridge	1.4
Road	Lost Dove Trail	1.3
Road	Highway 93	1.1
Road	Twin Spruce Road	1.1
Trail	Forsythe Canyon Trail (USFS)	1.5
Trail	Walker Ranch Loop (Boulder County Parks & Open Space)	1.4
Trail	Mountain Lion Trail (Gold Gate Canyon State Park)	1.1
Trail	Rattlesnake Gulch Trail (Eldorado Canyon State Park)	1.1
River	Ralston Creek	6.4
River	South Boulder Creek	5.0
River	Coal Creek	3.5
River	Leyden Creek	1.8
River	South Beaver Creek	1.0
River	Deer Creek	1.0

Detailed Methodology

We modeled erosion using the Water Erosion Prediction Project (WEPP) version 2.0 following the approaches of Elliot et al. (2016) and Miller et al. (2011). WEPP is a process-based model that predicts runoff and sediment yields from hillslopes and small, unchannelized watersheds (Elliot and Hall, 2010). WEPP models sheet and rill erosion and hydrological processes such as snow accumulation and melt, deep percolation of soil water and subsurface lateral flow under different land uses, climate and hydrologic conditions. WEPP does not model landslides, channel erosion or debris flows. The WEPP model was developed by the U.S. Department of Agriculture Forest Service, Agricultural Research Service, and numerous universities.

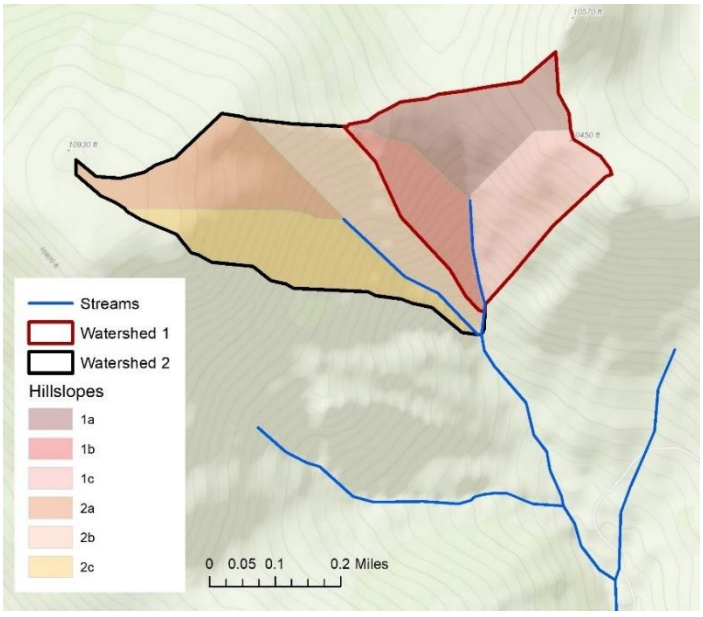


Figure B.20. *Small watersheds and nested hillslopes.*

We delineated hillslopes through ArcPro version 3.0.3 using a modified version of the WEPP Hillslope Toolbox, which is based on TOPAZ (Topographic Parameterization Software) from the USDA Agricultural Research Service. Small watersheds can be subdivided into at least three hillslopes—one on each side of a stream or river and one above the headwaters of the watershed (**Figure B.20**). The Ember Alliance modified the original toolbox to be compatible with ArcPro 3.0.3 and to improve model performance.

Hillslopes were delineated with a critical source area (CSA) of 12.4 acres and a minimum source channel length (MSCL) of 330 feet. Watersheds were delineated with a CSA of 148 acres and a MSCL of 330 feet. We delineated 4,478 hillslopes within the analysis area with an average size of 17 acres (range of 1 to 170 acres), and we aggregated results within 377 larger watersheds with an average size of 207 acres (range of 3 to 1,192 acres). Watershed predictions of sediment delivery in tons/acre/year were weighted averages based on hillslope size, and total sediment delivery was a sum of hillslope predictions in tons/year.

We used the WEPP batch processing spreadsheet available from the U.S. Forest Service to predict erosion from hillslopes within the analysis area. WEPP requires the following inputs: hillslope area, slope profiles for upper and lower portions of hillslopes, soil texture, percentage of soil as rock, vegetation type and/or burn severity, and surface cover (**Figure B.21**).

Soil textures came from the Soil Survey Geographic Database (SSURGO) produced by the USDA Natural Resources Conservation Service (NRCS). We associated soil textures from SSURGO with WEPP soil texture categories and assigned each soil type a percent rock value based on the NRCS Field Book for Describing and Sampling Soils (Schoeneberger et al., 2013).

There were very stark differences in soil texture classification at the boundaries of soil survey areas and county lines, and some soil series did not have an associated soil texture. We created the following rules to address these issues:

- Areas of silt loam in soil survey area CO645 (western Boulder County) were assigned to sandy loam to be consistent with soil textures in soil survey areas CO643 (eastern Boulder County), CO641 (Jefferson County), and CO653 (Gilpin County). The coarser-resolution STASTGO dataset from NRCS classified almost all central and western CCCFPD as sandy loam.
- Texture and rock content for terrace escarpments in soil survey area CO643 were changed from sandy loam with 25% rock content to clay loam with 7% rock content for consistency with soil survey area CO641.
- Areas that were rock outcrops and did not have an associated soil texture were assigned to sandy loam with 75% rock content.
- "Torrifluvents, very gravelly, 0 to 3 percent slope" were assigned to loam with 48% rock content.
- "Cryofluvents, 0 to 5 percent slopes" along rivers were assigned to loam with 7% rock content.
- Areas of loam were assigned a rock content of 7% if they occurred along riparian areas.
- Areas of sandy loam were assigned a rock content of 25%.
- Areas identified as "extremely stony" or "very stony" were assigned a rock content of 48%.

We associated 2022 CO-WRA fire behavior fuel models with WEPP vegetation categories, with considerations of canopy height and canopy cover. Percent ground cover estimates for WEPP vegetation categories were based on default values from the online WEPPcloud Post-Fire Erosion Prediction tool (**Table B.10**). CO-WRA vegetation types could not be used for this analysis because they were produced at a different cell-size and with different methodology from the fuel model dataset that was used for fire behavior modeling. It was important to maintain spatial congruency between fire behavior predictions and WEPP vegetation types for this post-fire analysis.

We associated predicted flame length from FlamMap under extreme (97th percentile) fire weather conditions with burn severity classes and percent cover values following Elliot et al. (2016) and default values from the online WEPPcloud Post-Fire Erosion Prediction tool (**Table B.11**). See above in Appendix B for a description of FlamMap fire behavior modeling. The post-fire scenario assumed that wildfires burned every portion of a watershed—a reasonable assumption given the size of nearby wildfires (1,100-acre El Dorado Fire in 2000, 2,700-acre Plainview Fire in 2006, and 528-acre Cold Springs Fire in 2016).

We modeled sediment delivery under 50 years of different weather conditions generated by the Rocky Mountain Research Station Climate Generator (Rock:Clime) (Elliot et al., 1999). Weather scenarios were based on historical observations at the Gross Reservoir weather station (NWS cooperative station 053629) from 1978 to 2016. Based on simulated climate scenarios from Rock:Clime, average annual precipitation (rainfall and snowfall) was 21.1

inches for the Gross Reservoir weather stations, and annual precipitation under 1-in-50-year conditions was 37.5 inches.

Weather scenarios did not incorporate the potential for altered rainfall intensity with climate change. Climate change is likely to make large, high-intensity wildfires and extreme rainfall events more likely and therefore could result in greater sediment delivery than predicted here (Sankey et al., 2017). However, spatial patterns in relative sediment delivery across the analysis area are likely to stay the same; topography and soil texture will not change for centuries to millennia, and dominant vegetation types are unlikely to change in the coming decades.

We quantified the risk of community values and infrastructure being damaged by post-fire sediment by combining intensity (relative predictions of 1-in-50-year post-fire sediment yield) and likelihood (average conditional burn probability). We multiplied per-acre sediment yield and total watershed-scale sediment yield by relative burn probability, normalized these values, and identified watersheds with high to very high relative risk as those in the upper 65th percentile (**Figure B.22**). Some watersheds have a higher relative per-acre sediment yield and others have a higher total watershed-scale sediment yield, and both values are important. Watershed-scale sediment yield is dependent on per-acre sediment yield and watershed size. Watersheds with a higher per-acre sediment yield could be relatively more problematic if only small portions of the landscape burned, but those with a higher total sediment yield could be relatively more problematic if entire watersheds burned.

We considered all community assets within a watershed to share the same risk regardless of their specific topographic position within a watershed or their sensitivity to damage. Due to the scale of analysis, we could not model different exposure levels for infrastructure located at the top of a watershed versus at the bottom of a watershed, but it is likely that infrastructure near the bottom of watersheds have a greater exposure to cumulative sedimentation.

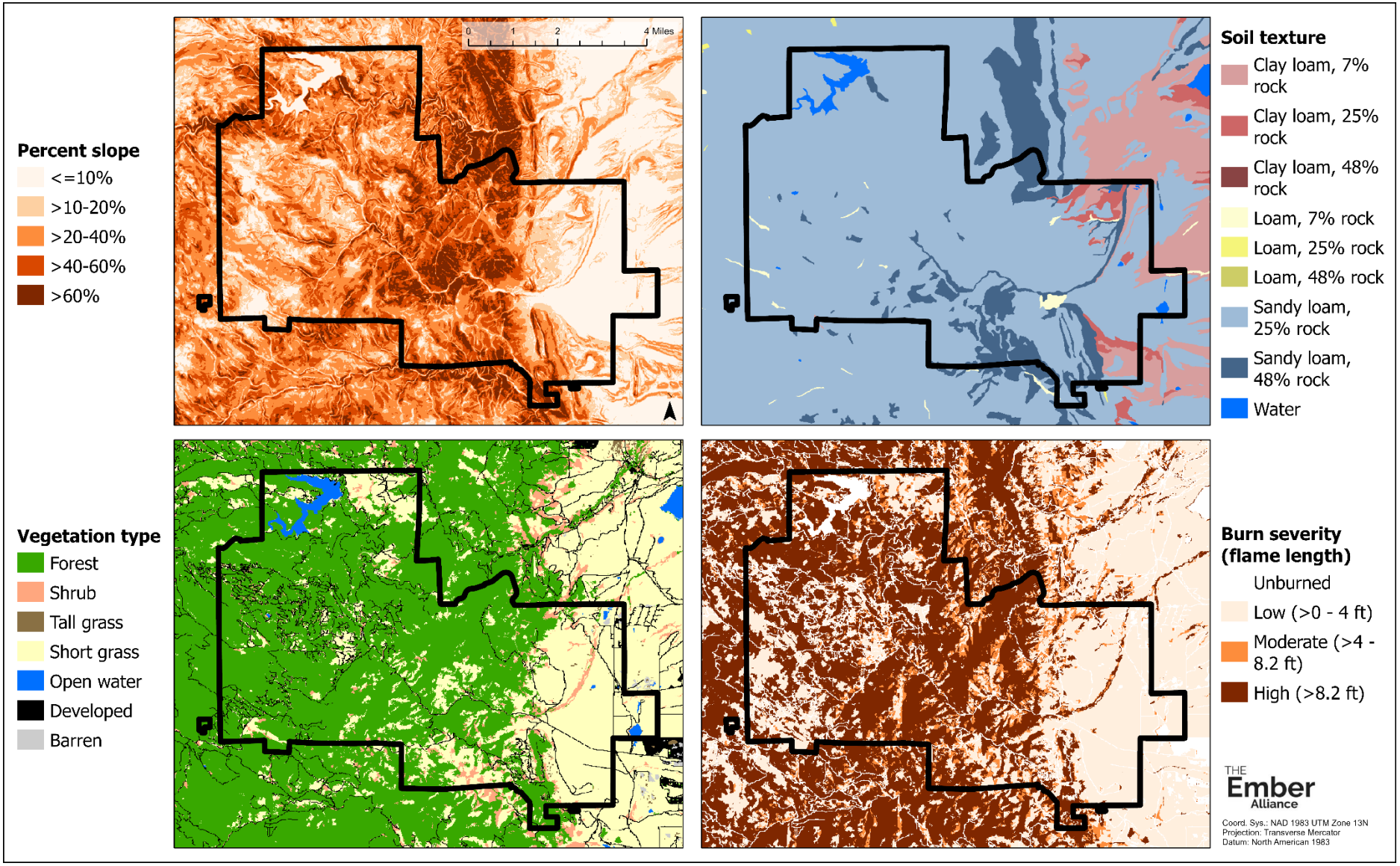


Figure B.21. *Inputs used for predicting sediment delivery with WEPP. Sources: Slope from 2022 CO-WRA, soil texture reclassified from the Soil Survey Geographic Database, from the Soil Survey Geographic Database, burn severity derived from flame length predictions under extreme fire weather conditions, and vegetation type reclassified from 2022 CO-WRA.*

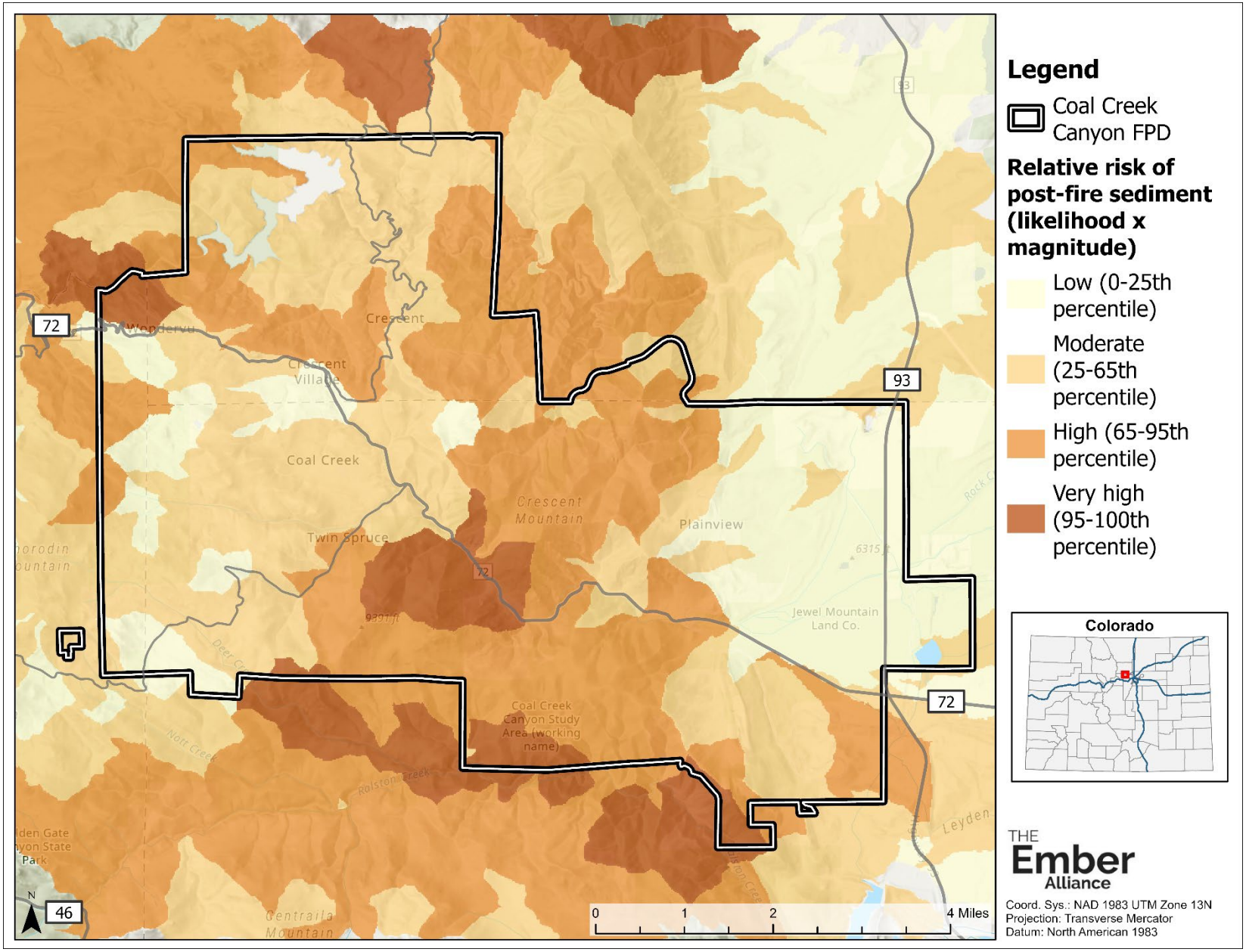


Figure B.22. *Burn probability, total post-fire sediment delivery at the watershed-scale, and per-acre sediment delivery were combined to produce a relative risk of an area experiencing damaging post-fire sedimentation.*

Table B.10. *Association of fire behavior fuel model, canopy height, and canopy cover from the 2022 CO-WRA with WEPP vegetation categories and percent ground cover.*

Fire behavior fuel description (code)	WEPP vegetation	Percent ground cover (%)
Bare ground (99)	Barren[1]	50
Short sparse grass (101)	Short grass	70
Low load grass (102)	Short grass	70
Moderate load grass (104)	Short grass	70
Low load dry grass-shrub (121)		
Canopy height = 0 ft; canopy cover <30%	Short grass	70
Canopy height = 0 ft; canopy cover ≥30%	Shrub	70
Canopy height >0 ft; canopy cover = 10-<30%	Shrub	70
Canopy height >0 ft; canopy cover ≥30%	20-year forest	90
Moderate load dry grass-shrub (122)		
Canopy cover <30%	Short grass	70
Canopy cover ≥30%	20-year forest	90
Moderate load dry shrub (142) or Low load timber-shrub (144)		
Canopy height = 0 ft	Shrub	70
Canopy height >0 ft; canopy cover <50%	Shrub	70
Canopy height >0 ft; canopy cover ≥50%	20-year forest	90
High load shrub (145), Very high load shrub (147), or Very high load oak shrub (157)		
Canopy height = 0 ft	Shrub	70
Canopy height >0 - <50 ft; canopy cover <20%	Shrub	70
Canopy height >50 ft; canopy cover ≥20%	20-year forest	90
Low load timber-grass-shrub (161)		
Canopy height = 0 ft	Short grass	70
Canopy height >0; canopy cover ≥10-<30%	Shrub	70
Canopy height >0 ft; canopy cover ≥30%	20-year forest	90
Timber understory (171)	20-year forest	90
Low load broadleaf litter (182)	20-year forest	90
Moderate load conifer litter (183)		
Canopy height = 0 ft	Shrub	70
Canopy height >0	20-year forest	90
Timber litter (191)	20-year forest	90
High load activity or moderate load blowdown (203)	20-year forest	
Urban core with low fire behavior fuel (913)	Developed[1]	50
Scattered urban with high fire behavior fuel (915)	Tall grass	70
Urban with high fire behavior fuel (916)		
Canopy height = 0 ft	Developed[1]	50
Canopy height >0; canopy cover ≥10-<30%	Developed[1]	50
Canopy height >0 ft; canopy cover ≥30%	20-year forest	90
Unburnable urban (919)	Developed[1]	50

Fire behavior fuel description (code)	WEPP vegetation	Percent ground cover (%)
Low load agricultural, seasonally burnable (931)	Tall grass	70
High load agricultural, seasonally burnable (932)	Tall grass	70
Golf course (938)	Tall grass	70
Agricultural field, non-burnable (939)	Tall grass	70
Minor road low fire behavior fuel (941), Minor road high fire behavior fuel (942), Major road low fire behavior fuel (943), or Major road high fire behavior fuel (944)		
Canopy height = 0 ft	Developed[1]	50
Canopy height >0; canopy cover ≥10-<30%	Short grass	70
Canopy height >0 ft; canopy cover ≥30%	20-year forest	90
Road with non-burnable fuel (949)	Developed[1]	50
Waterbody (989)	Open water	

[1] WEPP does not have a category for barren or developed, so short grass was used but with a lower percent cover.

Table B.11. *Relationship between predicted flame length, burn severity and percent cover following Elliot and others (2016) and default values from the online WEPPcloud Post-Fire Erosion Prediction tool.*

Burn severity	Predicted flame length (ft)	Percent ground cover (%)
Unburned	0 ft	Variable, see Table B.11
Low	>0 to 4	60
Moderate[1]	>4 to 8.2	45
High	>8.2	15

[1] WEPP does not have a cover category for moderate severity fire, so low-severity fire was used with the ground cover value indicated above.

Climate Change Assessment

Climate change has a measurable impact on fire intensity, frequency, and size, and these impacts are likely to continue over the coming decades (Parks et al., 2016). Fire behavior modeling for this CWPP utilizes weather data from 2014-2022 and does not include future weather predictions. To explore the potential for exacerbated fire weather conditions in the future, we used the Climate Toolbox's future boxplots and future time series tools (Hegewisch et al., 2021). These tools model climate scenarios for the next 50-100 years using two representative concentration pathways (RCP) that assume different levels of global greenhouse gas emissions The RCP 4.5 scenario assumes that greenhouse gas emissions stabilize before the year 2100, peaking around 2040, and the RCP 8.5 scenario assumes that greenhouse gas emissions are not curtailed by 2100 (IPCC, 2014).

We selected three variables for this assessment: maximum temperatures in the summer (June, July, and August), the number of days with very high fire danger, and vapor pressure deficit (VPD) in the summer. The Climate Toolbox defines very high fire danger as days with 100-hour fuel moisture below the 10th percentile fuel moisture from 1971-2000. VPD is a meaningful measurement of moisture stress experienced by plants, more so than relative humidity because VPD is independent of temperature. High values of VPD indicate that the air can draw more moisture out of leaves while they photosynthesize, resulting in drier fuels. Higher values of VPD are strongly related to summers with a greater number of acres burned in the western U.S. (Seager et al., 2015).

The models predict that maximum summer temperatures in CCCFPD could increase by 3-4.4° Fahrenheit by 2050, going from 75.9°F in 2005 to 79.0-80.3°F in 2050 (**Figure B.23**). CCCFPD could experience 10-14 more days per year with very high fire danger**,** and average summer VPD could increase from 1.3 to 1.7 kilopascal (kPa) (**Figure B.24**). Drier fuels in the summer have a greater potential to carry large wildfires; an increase in summer VPD from 1.3 to 1.7 kPa is related to a 45 fold increase in annual area burned in forested parts of the western U.S. (Seager et al., 2015).

Fire behavior may be even more extreme, frequent, and extensive in the coming decades in CCCFPD. Mitigating actions in the coming years, including fuel treatments, defensible space around homes, and structure hardening, are critical to protect the life safety of residents and enhance community resiliency now and into the future.

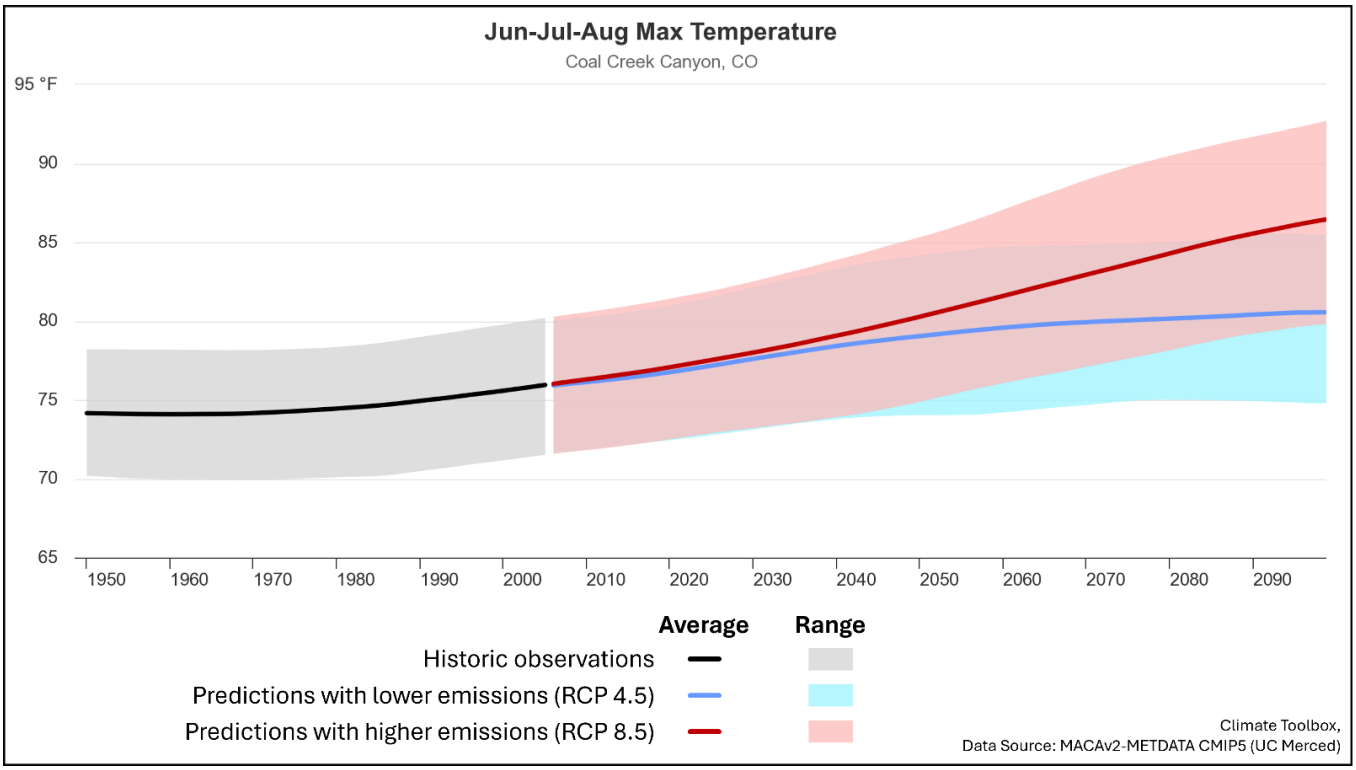
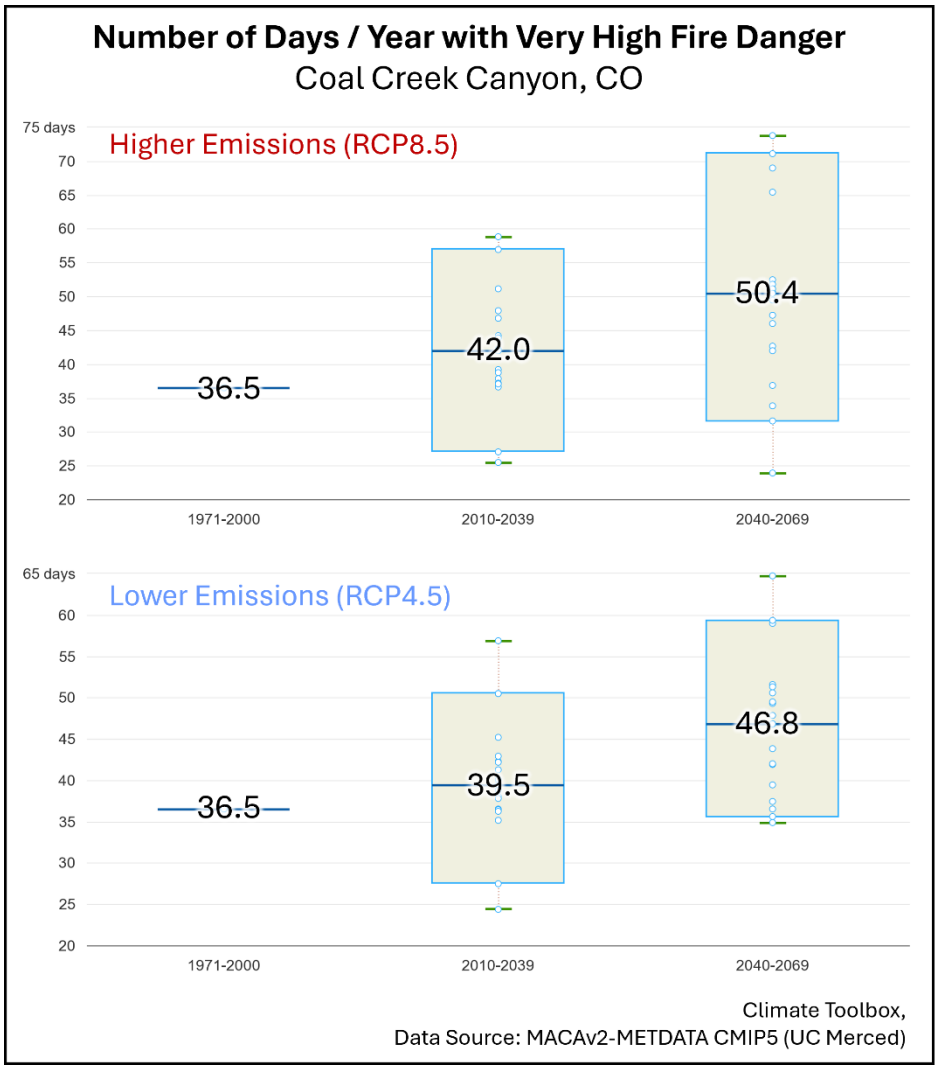


Figure B.23. *Predicted maximum summer temperature in CCCFPD under lower and higher greenhouse gas emission scenarios. Source: Climate Toolbox (Hegewisch et al., 2021).*



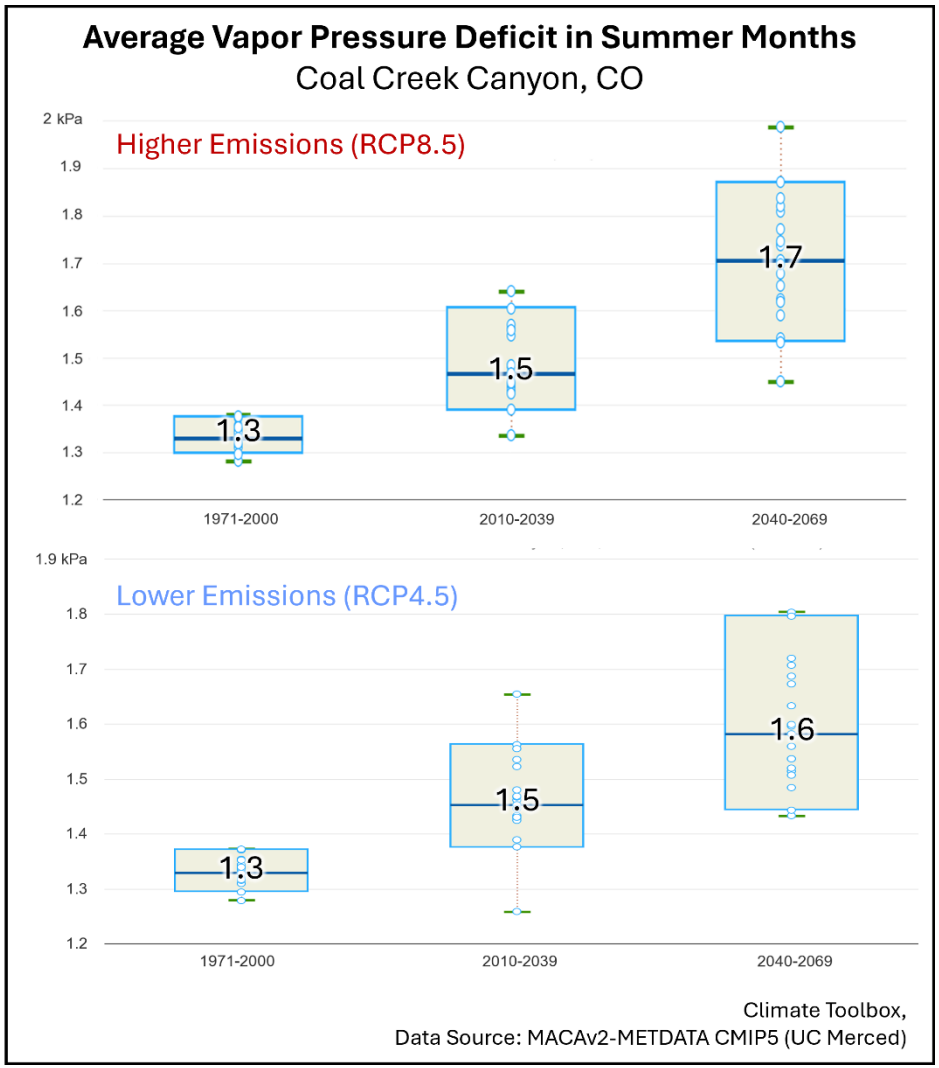


Figure B.24. *Predicted number of days with very high fire danger (left) and average summer vapor pressure deficit (right) in CCCFPD under lower and higher greenhouse gas emission scenarios. Source: Climate Toolbox (Hegewisch et al., 2021). Boxplots show 5th percentile, median, and 97th percentile predictions. Numbers indicate median values. Whiskers show minimum and maximum predictions. Dots represent individual predictions from different climate models.*

Plan Unit Relative Risk Assessment

CWPP Plan Units

We compared the ***relative*** risk that wildfires pose to life and property in 15 plan units across CCCFPD (**Figure B.25**). Plan units are areas with shared fire risk where residents can organize and support each other to effectively mitigate hazardous fuels across the plan unit. Plan Unit boundaries were developed by considering clusters of addresses, connectivity of roads, topographic features, land parcels, land ownership, and local knowledge of community organization. Topographic features were considered by utilizing sub-watershed boundaries to guide plan unit boundaries. We included topographic features into the delineation process to ensure that different units encompass areas with similar fire behavior. Amendments were made to boundaries based on local knowledge of the CWPP Core Team.

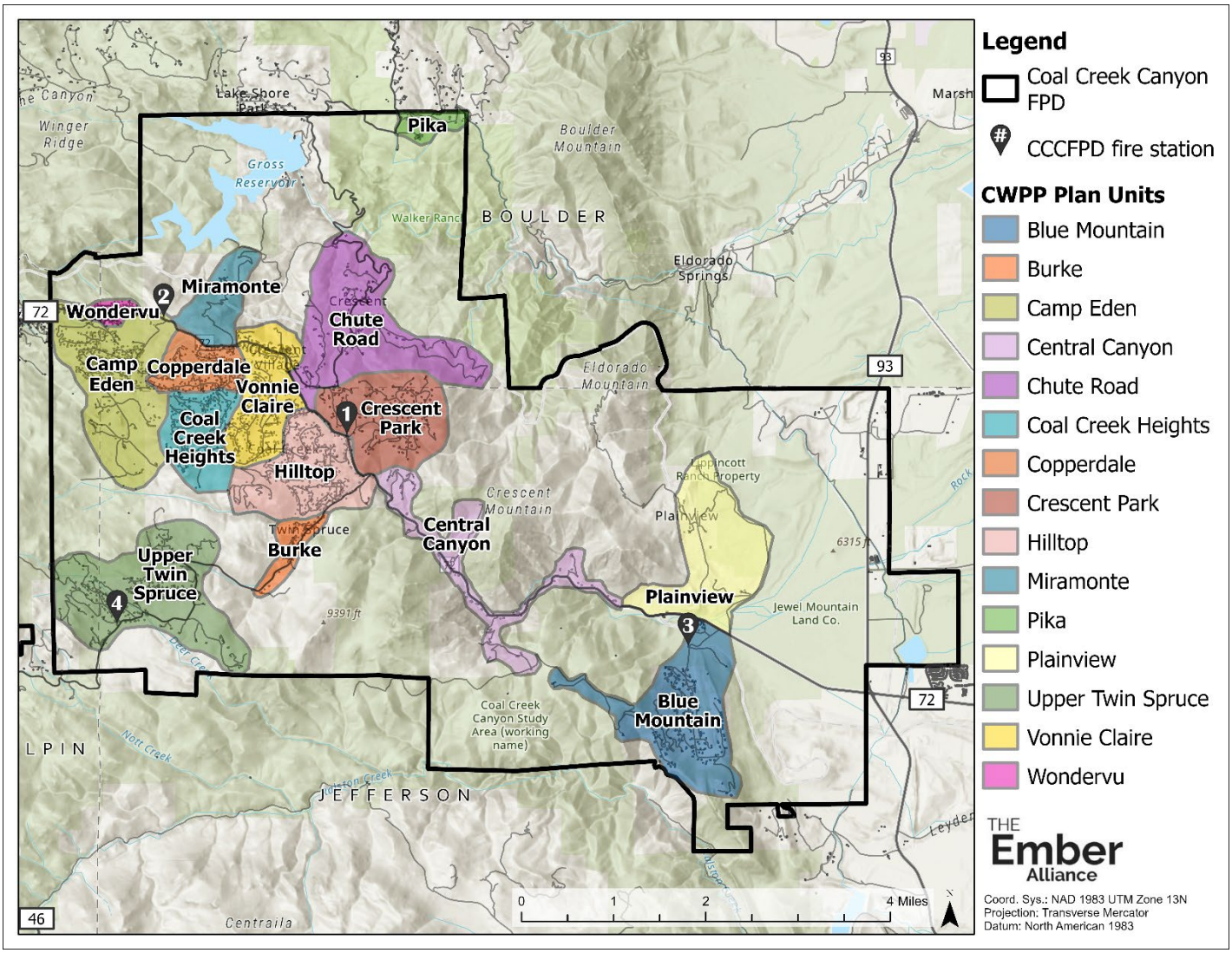


Figure B.25. *CWPP plan units in CCCFPD. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

Risk Rating Approach

Some plan units CCCFPD have extreme risk from wildfire damage, and to help prioritize hazard mitigation, we developed a rating of relative risk. A plan unit receiving a relative rating of "moderate risk" has risk factors that are lower than risk factors in other plan units, but it is still an area with wildfire hazards. We assessed hazards in four categories: fire risk, fire suppression challenges (e.g., limited hydrant availability and engine access), evacuation hazards, and home ignition zone hazards. **We developed the ratings of relative risk specifically for CCCFPD, so the assessment is not suitable for comparing this fire protection district to other communities in Colorado or the United States.**

Our assessment was based on predictions of fire behavior, radiant heat and ember cast exposure, roadway survivability, and evacuation time, as well as an on-the-ground assessment of each plan unit. In summer 2023, employees of The Ember Alliance drove around CCCFPD and used a modified version of the NFPA Wildfire Hazard Severity Form Checklist (NFPA 299 / 1144) to rate home ignition zone hazards within each plan unit.

A rating scale was developed specifically for CCCFPD based on the range of values observed across the community (**Table B.12**). The purpose of the assessment is to compare relative hazards within the community and is not suitable for comparing CCCFPD to other communities.

Table B.12. *Relative risk rating values for CCCFPD. Hazard categories were ranked from Moderate to Extreme. The overall risk was ranked from Moderate to Very Extreme, adding the additional category for the two the plan units (Wondervu and Burke) that had overall scores that stood out significantly from the rest.*

Hazard category	Max. points possible	Range of values in CCCFPD Plan Units	Moderate	High	Extreme	Very extreme
A. Fire risk	55	21-52	20-40	41-46	47-52	N/A
B. Fire suppression challenges	40	6-27	6-18	19-22	23-27	N/A
C. Evacuation hazards	55	10-35	10-24	25-29	30-35	N/A
D. Home ignition zone hazards	58	21-58	21-32	33-45	46-58	N/A
Overall risk	208	90-158	90-109	110-139	140-149	150+

Relative Risk Rating Form

A. Fire Risk	Points
1. Average flame length[1]	
<4 feet	0
4-8 feet	6
>8 feet	12
2. Percent area predicted for active crown fire[2]	
<10%	0
10-<50%	6
≥50%	12
3. Percent of homes exposed to extreme radiant heat[2]	
<5%	0
5-<50%	6
≥50%	12
4. Average relative burn probability[2]	
<10%	0
10-<25%	3
≥25%	6
5. Additional risk factors	
Mid-slope homes	2
Homes on ridge tops	2
Saddles / ravines / chimneys	4
Utilities (gas / electric) placement	
All underground	0
Infrequent overhead powerlines	3
Frequent overhead powerlines	5
A. Total points possible	**55**

[1]Predictions from FlamMap under 75th percentile fire weather conditions for plan unit and adjacent watersheds.
[2]Predictions from FlamMap under 97th percentile fire weather conditions for plan unit and adjacent watersheds.
*Different percentile fire weather conditions were used for flame length than other metrics of fire behavior to capture a greater variation in potential fire behavior among plan units.

B. Fire Suppression Challenges	Points
1. Percentage of homes near hydrants	
>75%	0
25-75%	5
<25%	10
2. Presence of dip / draft sites	
At least one dip / draft site OR not necessary due to hydrants	0
No dip / draft site	5
3. Road/driveway accessibility for Type 3 engines (percent of roads/driveways)	
>90%	0
75-90%	5
50-75%	10
<50%	15
4. Presence of legible and reflective signs (percent of roads and homes)	
>90%	0
75-90%	3
<75%	5
5. Presence / absence of HazMat	
Absent	0
Present	5
B. Total points possible	**40**

C. Evacuation Hazards	Points
1. Number of lanes in each direction	
At least 1 lane on >75% of roads	0
At least 1 lane on >50-75% of roads	5
Less than 1 lane on >50% of roads	10
2. Mean household evacuation time[3]	
<100 minutes	0
100-200 minutes	7
>200 minutes	15
3. Number of main egress routes	
2 or more	0
Only 1	5
4. Percentage of road with non-survivable conditions under 97th percentile fire weather	
<25%	0
25-50%	10
>50%	20
5. Presence of livestock that could take multiple trips to evacuate	
Few property (0-1)	0
Some properties (2-5)	3
Many properties (>5)	5
C. Total points possible	**55**

[3]Estimates from ArcCASPER (see evacuation modeling methodology above).

D. Home ignition zone Hazards	Points
1. Roof construction material	
Class B or C on <10% of homes	0
Class B or C on 10-15% of homes	5
Class B or C on >25% of homes	10
Class C on >50% of homes	15
2. Percent of homes with combustible or non-ignition resistant siding	
<10%	0
10-50%	3
>50%	5
3. Percent of homes with combustible or non-ignition resistant decking	
<10%	0
10-25%	3
>25%	5
4. Percent of homes with wooden fences	
<10%	0
10-25%	1
>25%	2
5. Percent of homes with adequate mitigation in HIZ 1	
>90%	0
75-90%	3
50-75%	6
<50%	10
6. Percent of homes with adequate mitigation in HIZ 2	
>90%	0
75-90%	3
50-75%	6
<50%	10
7. Percent of homes with additional HIZs 1 and 2 (e.g., wood piles, propane tanks, wooden sheds)	
<10%	0
10-25%	1
25-50%	3
>50%	5
8. Average number of homes potentially exposed to short-range ember cast from other homes	
0 homes	0
1-2 homes	3
≥3 homes	6
D. Total points possible	**58**

Prioritization of Fuel Treatments

Roadside Fuel Treatments

We assessed the potential need for roadside fuel treatments based on the potential for non-survivable conditions (predicted flame lengths >8 feet) to arise under moderate (75th percentile) and extreme (97th percentile) fire weather conditions, and potential congestion under a district-wide evacuation order. Segments of road with non-survivable conditions under moderate fire weather are at greater risk than those with conditions that only become non-survivable under extreme percentile weather. **Table B.13** describes the criteria used for rating the potential need for roadside fuel treatments. Keep in mind that our fire behavior analyses occurred at the scale of 0.1 acres (20 x 20 meters), so locations of recommended treatment areas are approximate.

Roads in need of fuel treatments are abundant and scattered across the western portion of CCCFPD. Areas with recommended roadside treatments overlapped closely with locations that residents expressed concerns about evacuation safety (**Figure B.26**). Due to limited points of egress, evacuation congestion could be experienced across much of the community, and dense forests lining many roadways could result in non-survivable conditions during wildfires. Partners used this assessment of treatment need to inform the identification of priority projects for the CWPP.

Table B.13. *Methodology for ranking potential need for roadside treatments to mitigate fire hazards along roadways in CCCFPD. Potentially non-survivable conditions are those where >8-foot flame lengths could occur along segments of roadways.*

Need for roadside fuel treatment	Conditions
Highest	Potentially non-survivable conditions under extreme fire weather conditions, and Extreme evacuation congestion (congestion index >5.0). **OR** Potentially non-survivable conditions under moderate fire weather conditions, and High to extreme evacuation congestion (congestion index >3.0).
High	Potentially non-survivable conditions under extreme fire weather conditions, and High evacuation congestion (congestion index >3.0 to ≤5.0). **OR** Potentially non-survivable conditions under moderate fire weather conditions, and Moderate evacuation congestion (congestion index >2.0 to ≤3.0).
Moderate	Potentially non-survivable conditions under extreme fire weather conditions, and Low to moderate evacuation congestion (congestion index >1.0 to ≤3.0).

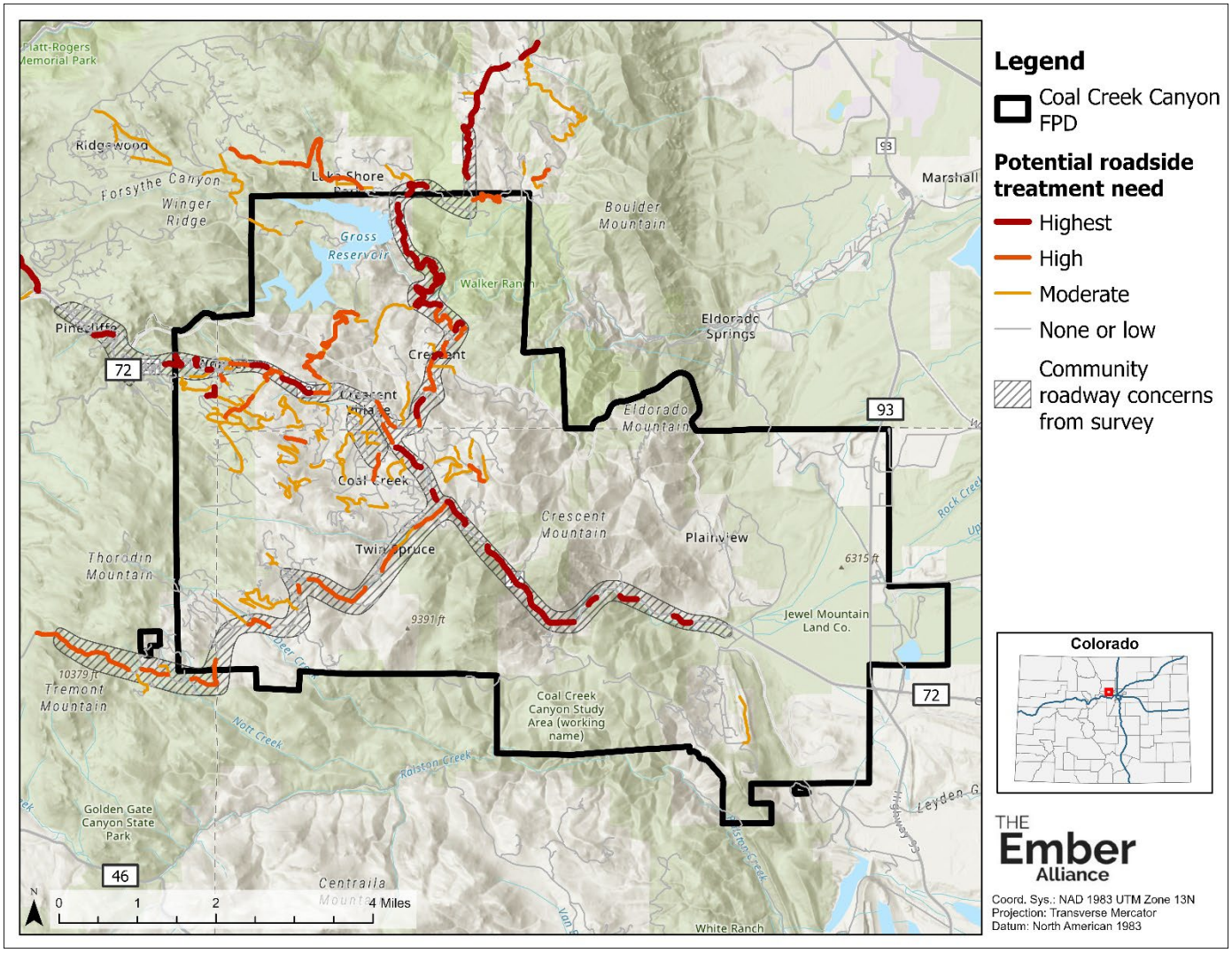


Figure B.26. *Potential need for roadside fuel treatments based on potential fire behavior and evacuation congestion in and around CCCFPD. Our fire behavior analyses occurred at the scale of 0.1 acres (20 x 20 meters), so locations of potential treatment areas are approximate. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

Stand-Scale Fuel Treatments

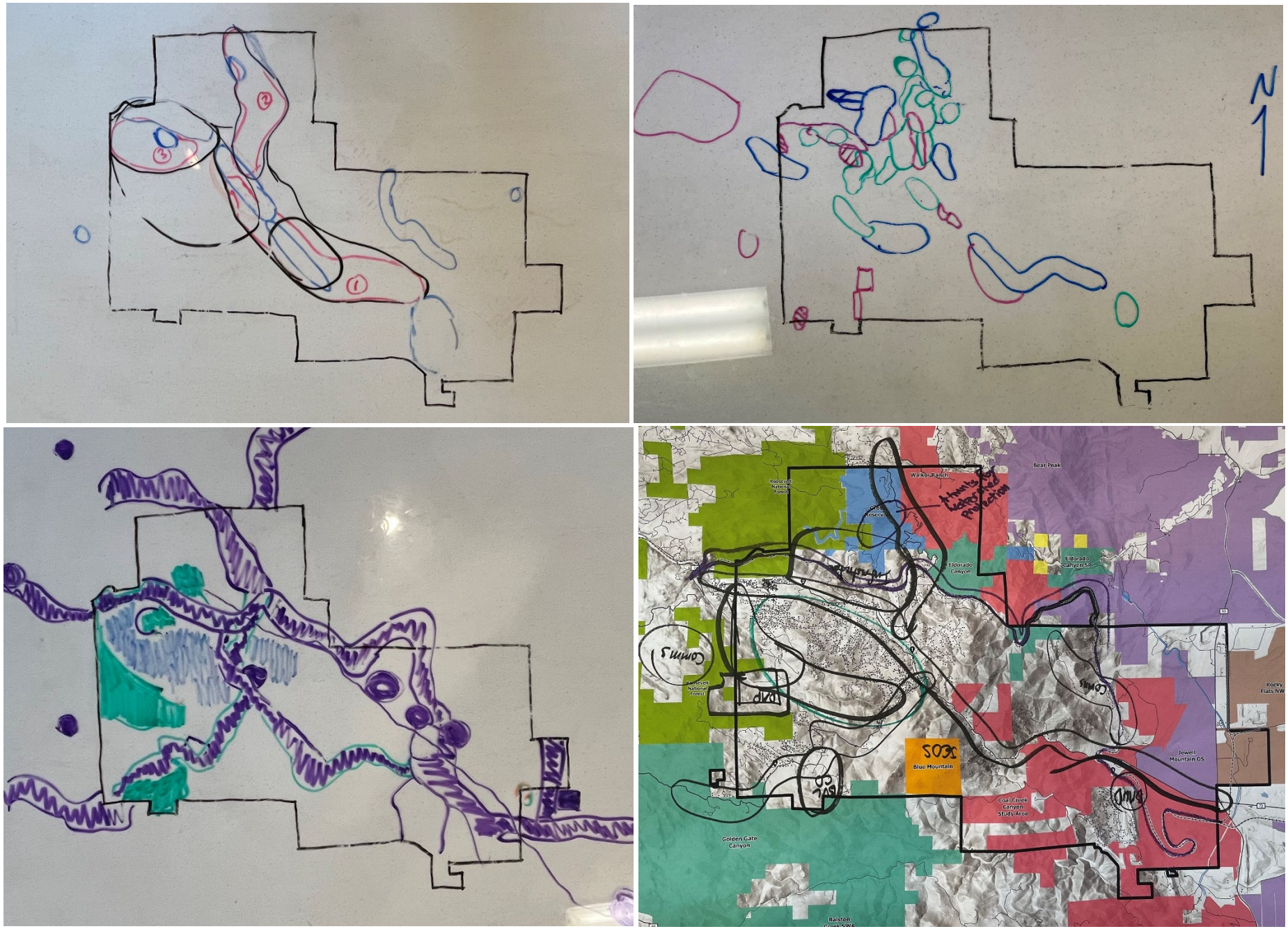
Stand-scale fuel treatments resulted in projects recommended in **Section 4.b**. After completing fire modeling, post-fire erosion modeling, roadway analysis and values at risk analysis, residential hazard analysis, and compiling data of prior fires and fuels treatments, the Core Team and partners met in person to prioritize locations and projects. These decisions were made by representatives from CCCFPD, Boulder Watershed Collective, Blue Mountain Forest Stewardship Initiative, Crescent Park Community Fire Protection Association, Arvada Water, Timberline Fire Protection District, Mountain View Fire Protection District, Colorado State Forest Service, US Forest Service, Saws and Slaws, United Power, Jefferson County Open Space, CSU Extension Offices, Colorado Department of Transportation, and the Coal Creek Canyon Collaborative.

Eight maps were used in this process: modeled wildfire behavior, burn probability, post-fire sediment delivery, roadway congestion and safety, infrastructure and values at risk of wildfire, land ownership, ember cast, and past fires and fuel treatments. In groups, the partners drew treatment boundaries on clear sheets that they could move around between each of the maps. The groups gradually refined their potential projects into those that were the most impactful and feasible.

The three groups shared and compared their maps, which showed significant overlaps in top priority locations and goals. The process showed a clear shared goal to begin this work by protecting life safety within the community before anything else. Evacuation routes, resident homes, and communication infrastructure were prioritized by most of the groups.

In December 2023 and January 2024, the CWPP Core Team refined priority project areas, created goals, and decided on leaders and timelines (**Figure B.27**; **Section 4.b**). There are many areas of CCCFPD that need fuels treatment and forest health work; however, local land managers and partners are unable to accomplish all this work in the next 5-10 years, so only the top priority projects were chosen and detailed in this CWPP. Future CWPP updates can consider second and third priority projects (**Figure B.28**).

At the time of the initial prioritization meeting, there were no PODs (potential operational delineations) that covered CCCFPD, however they were created collaboratively shortly after and have been incorporated into the priority project areas. The POD boundaries align with the Core Team and community priority areas. According to the USFS, "PODs are spatial units or containers defined by potential control features, such as roads and ridge tops, within which relevant information on forest conditions, ecology, and fire potential can be summarized. PODs combine local fire knowledge with advanced spatial analytics to help managers develop a common understanding of risks, management opportunities, and desired outcomes to determine fire management objectives. The PODs pre-planning framework has been applied on over 40 national forests and counting, often including adjacent landowners and jurisdictions for cross-boundary planning." See the PODs storymap from the Rocky Mountain Research Station for more information.



Priority project areas as defined by the three groups, and the map that shows the shared project priorities between each of the three groups. This map was further refined in future meetings. All groups highlighted the primary communication towers, Highway 72, the landscape directly west of Camp Eden and Wondervu, Gross Dam Road, and the Blue Mountain Water District Infrastructure.

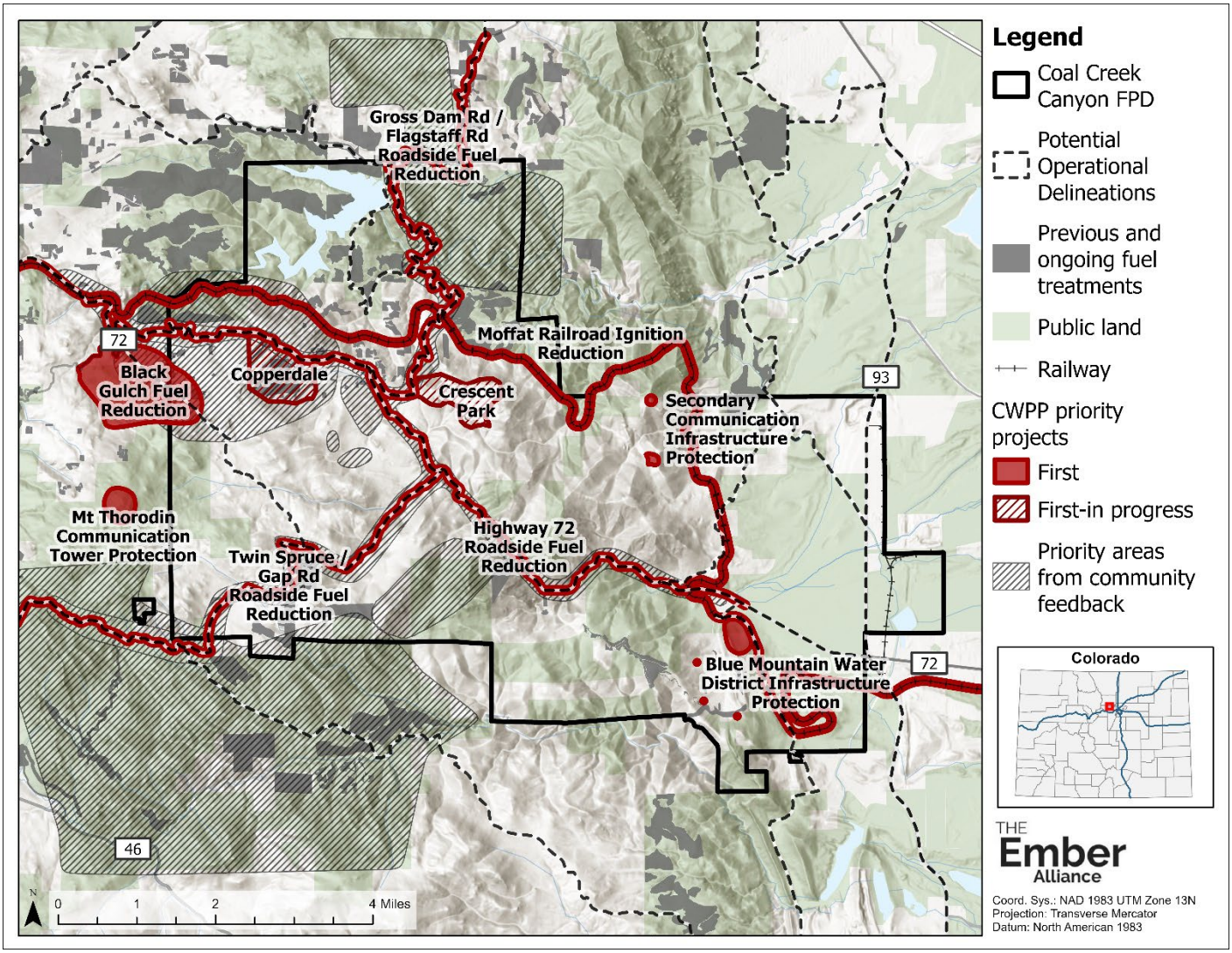


Figure B.27. *First priority projects identified by the Core Team and partners. The black hatched areas are the community priorities, with the most community members identifying the roadways as their priority for fuels treatment. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

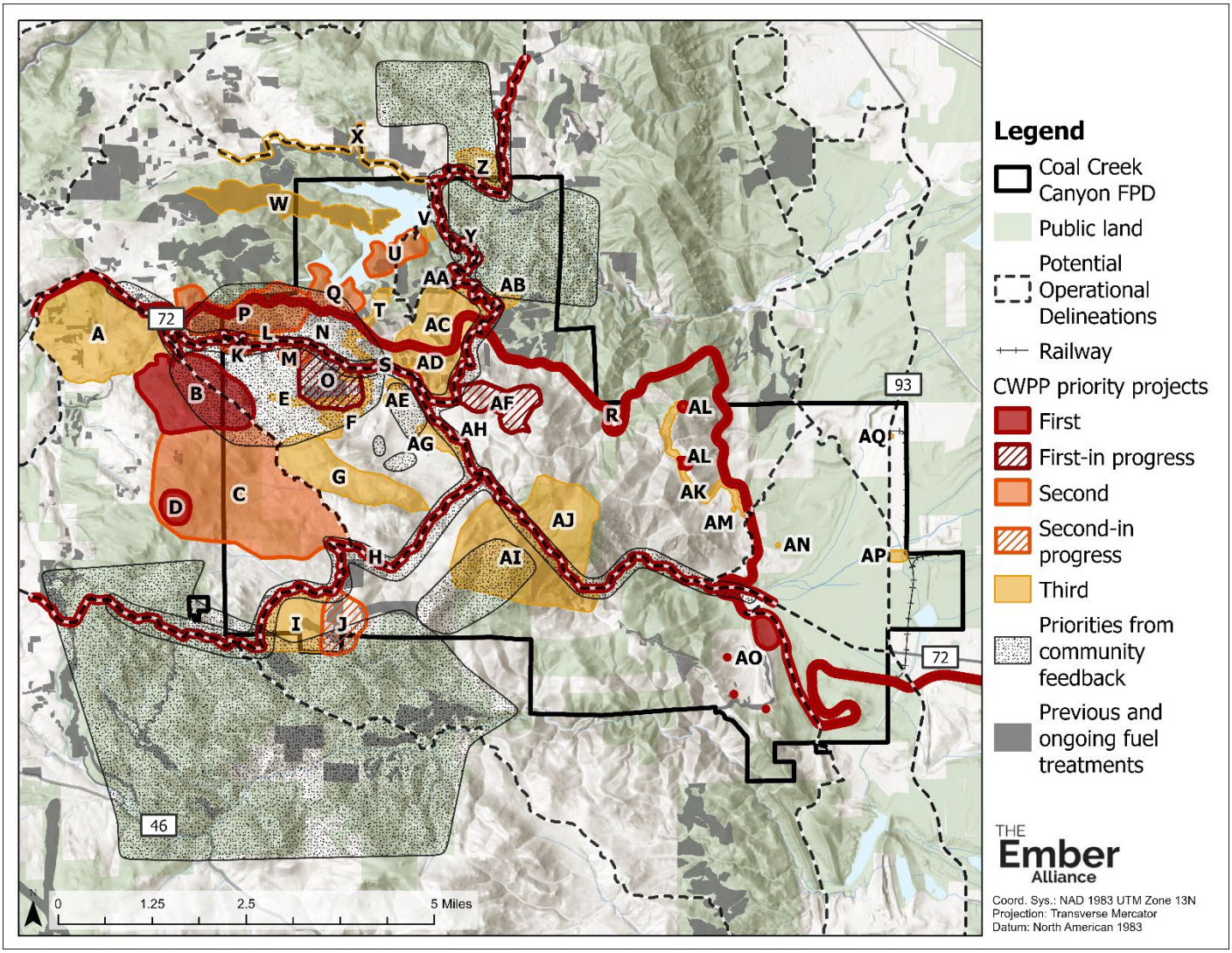


Figure B.28. *First, second, and third priority projects identified by the Core Team and partners. There are many areas of CCCFPD that need fuels treatment and forest health work; however, local land managers and partners are unable to accomplish all this work in the next 5-10 years, so only the top priority projects were chosen and detailed in this CWPP. Future CWPP updates can consider second and third priority projects. You can find links to an interactive version of this map at CoalCreekCWPP.org.*

Prioritization of Non-Spatial Recommendations

The Core Team, partners, and residents had many ideas and suggestions on actions that would help create a more fire-adapted community that were not directly tied to on-the-ground fuels treatment. TEA collected all the ideas that came up during Core Team meetings, the public survey and focus groups, a Core Team brainstorming session, and during partner meetings. In all, there were over 150 listed ideas.

TEA and members of the Core Team combined similar ideas and grouped them based on categories from the National Wildland Fire Cohesive Strategy: Fire Adapted Communities, Safe and Effective Response, Resilient Landscapes.

The Core Team met and ranked each recommendation by its impact and value to the community and its feasibility. They discussed each recommendation and shared thoughts on its impact and value. The Core Team was not told what ideas came from their group, their partners, or the public, and ranked each one on merit alone. Those that were deemed not feasible, not relevant, or already completed were removed from the list. Some statements were vague or confusing and the Core Team ranked them based on their interpretation of the action stated.

Impact/Value was ranked from a 1 – 10, with 10 having the highest impact or value to the community. Effort was ranked from 1 – 10, with 10 requiring the most effort. Each recommendation was given an average ranking for both Impact and Effort. Because High Impact was desirable and Low Effort was desirable, we took each recommendation's Effort score and subtracted it from 10. This left us with an Effort score that meant 10 was low effort and 1 was high effort. These two numbers were multiplied together to get a final score that would range from 0 – 100, with 100 representing the highest impact actions that would require the least effort.

After combining similar ideas and removing the impractical ones, 97 action items remained. These were divided into four categories: Priority 1, 2, 3, and Other Projects. To correlate with the place-based priority action rankings, these are called "Immediate Action, Short-term Action, Mid-Term Action, and Other Projects" respectively. Each of the final recommendations was given a name, goals, and partners who should be involved.

Members of the Core Team reviewed amended, combined, and edited the recommendations again, and these final recommendations were included in the **Implementation Activities and Responsibilities** Table.

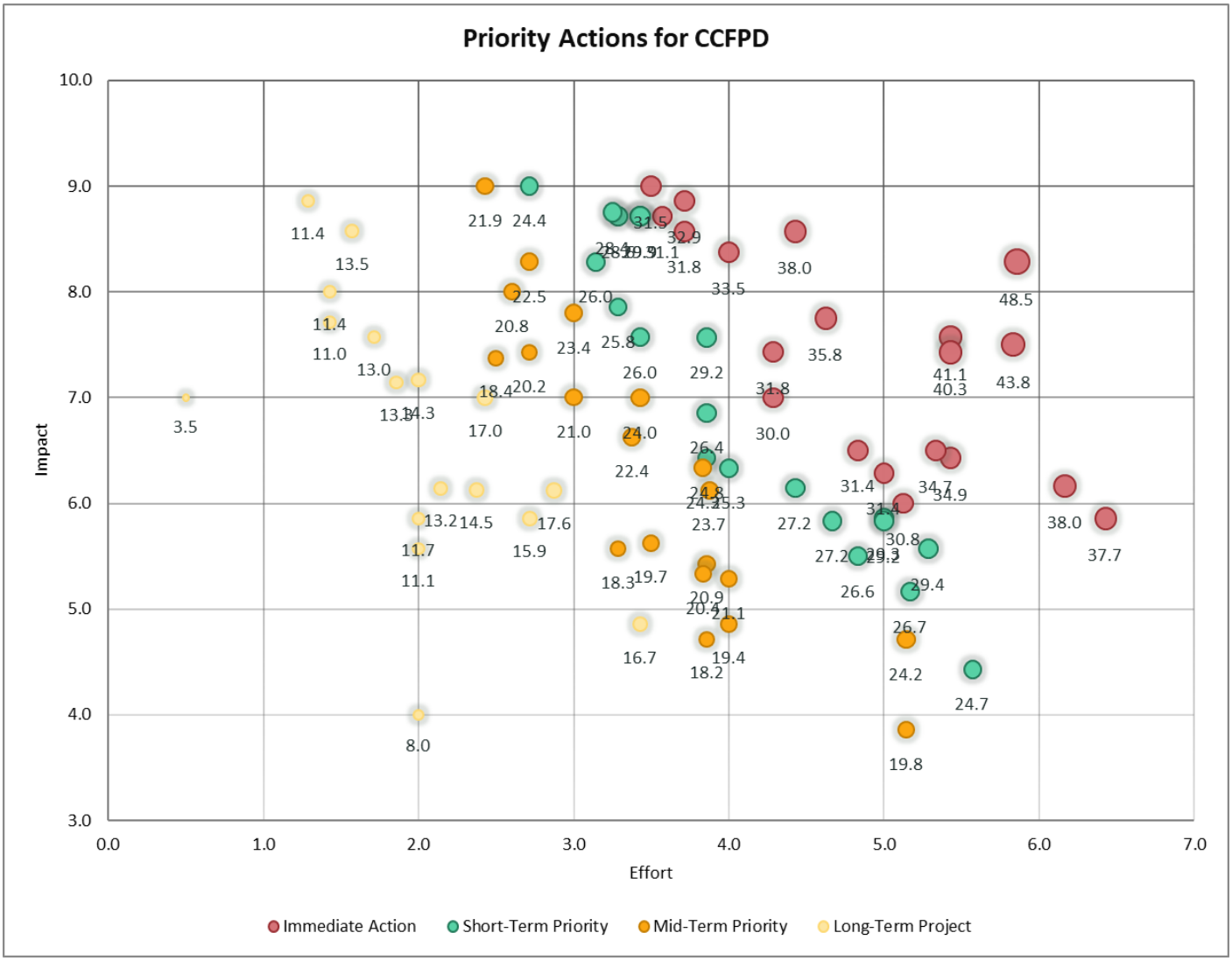


Figure 5.c.1. *Chart showing all 77 final non-spatial recommendations mapped with their relative Impact and Effort scores. The number below each dot is its Rank, or the Impact score multiplied by the Effort score. The colors represent the priority level for each action item. See* ***Table 5.c.1.*** *for each recommendation listed.*

Table 5.c.1. *Each of the final 77 Recommendations, in order of highest Rank, and color-coded to match* ***Figure 5.c.1.***

Recommendation	Effort	Impact	Rank
Encourage homeowners to install green reflective address signs	5.9	8.3	48.5
Spotlight model properties with good mitigation	5.8	7.5	43.8
Hold a go-bag workshop. + Conduct evacuation training	5.4	7.6	41.1
Provide education on evacuation routes and how routes could change	5.4	7.4	40.3
Hold another round of Fire Station Focus Groups in spring	6.2	6.2	38.0
Find grants to help fund private mitigation work. Wildfire Partners has this already for Boulder County residents	4.4	8.6	38.0

Recommendation	Effort	Impact	Rank
Offer remote meeting options for out-of-town landowners for all wildfire education events.	6.4	5.9	37.7
Use notification boards during high-risk times	4.6	7.8	35.8
Story collection and resharing on mitigation success and action	5.4	6.4	34.9
Provide greater clarification on how alerts work for each county	5.3	6.5	34.7
Electric Red Flag Warning sign at bottom of canyon	4.0	8.4	33.5
More resources for fire department to respond	3.7	8.9	32.9
Require HIZ mitigation / home hardening for new homes and remodels	3.7	8.6	31.8
Improve notification infrastructure	4.3	7.4	31.8
Coordination across county lines	3.5	9.0	31.5
Utilize the CoalCreekCwpp.org website to coordinate CWPP implementation by plan unit groups	5.0	6.3	31.4
One primary website and/or lists with crucial information for new residents	4.8	6.5	31.4
Improved communication equipment	3.6	8.7	31.1
Smoke preparedness communications	5.1	6.0	30.8
Complete post-fire playbook, update annually	4.3	7.0	30.0
Consistent communication plans	3.4	8.7	29.9
Develop a small crew of paid firefighters for CCCFPD	3.4	8.7	29.9
More education and information on best mitigation practices for the community	5.3	5.6	29.4
Provide printed mitigation material to residents	5.0	5.9	29.3
Shared mitigation team for CCC and neighboring FPDs	3.9	7.6	29.2
Address locked gates that can impair evacuation / emergency response	5.0	5.8	29.2
Financial aid to residents for mitigation	3.3	8.7	28.6
Get grant for 1 fulltime FPD Wildfire Mitigation Specialist	3.3	8.8	28.4
Install reflective road guardrail markers that you could see in smoke	4.7	5.8	27.2
Provide resources for replanting fire safe fuels, including aspen	4.4	6.1	27.2
Clear communications for partner resource	5.2	5.2	26.7
Push for an evacuation plan for Gross Reservoir	4.8	5.5	26.6
FPD works with HOAs and neighborhood groups to create HOA regulations on HIZ safety	3.9	6.9	26.4
Treat fuels along transmission lines in JCOS	3.1	8.3	26.0

Recommendation	Effort	Impact	Rank
Better signage for major evacuation routes	3.4	7.6	26.0
Figure out how to get evac alerts to people when the power or cell service is down	3.3	7.9	25.8
Need neighborhood evacuation plans, starting with Wondervu	4.0	6.3	25.3
Build a Community Ambassador program	3.9	6.4	24.8
Educational programs about ecological benefits of fire in some ecosystems	5.6	4.4	24.7
Improve coordination with JeffCo	2.7	9.0	24.4
Get Gilpin to allow non-county residents to sign up for hyper-reach	3.8	6.3	24.3
Increase social media presence	5.1	4.7	24.2
Develop program to help older / mobility- and ability-impaired residents with mitigation	3.4	7.0	24.0
Notify community when burning w/permit	3.9	6.1	23.7
Install cisterns in Crescent Park	3.0	7.8	23.4
24/7 County Fire Duty Officers	2.7	8.3	22.5
Develop CERT team	3.4	6.6	22.4
Ancillary power to cell towers for communications	2.4	9.0	21.9
Reengaging the watershed group	4.0	5.3	21.1
Encourage neighborhood evacuation contingency plans for people that need help with pets/kids	3.0	7.0	21.0
Re-vamp C4 to be implementation team	3.9	5.4	20.9
Install cistern in Upper Twin Spruce area	2.6	8.0	20.8
Expand the use of registries for animals and encourage CCCFPD to work with GCART	3.8	5.3	20.4
Mitigating at the fire stations	2.7	7.4	20.2
WUI checkpoints and FPD-facing events	5.1	3.9	19.8
Create Safety zones/Shelter-in-place locations	3.5	5.6	19.7
Weed management plan	4.0	4.9	19.4
Coordinate with Jeffco Road and Bridge to mow along county roads in CCC grasslands	2.5	7.4	18.4
Develop a CB or ham radio network for resident emergency communication	3.3	5.6	18.3
Consider grazing as a potential mitigation option	3.9	4.7	18.2
Volunteer brigade of trained HIZ assessors in Jeffco and Gilpin counties	2.9	6.1	17.6
Coordinate road maintenance and mitigation priorities	2.4	7.0	17.0

Recommendation	Effort	Impact	Rank
Neighborhood phone tree for emergency warnings	3.4	4.9	16.7
Targeted outreach to absentee landowners	2.7	5.9	15.9
Systematic education for visitors	2.4	6.1	14.5
Require better coordination between emergency alerts from Gilpin, Boulder, and Jefferson	2.0	7.2	14.3
Increase cell service in area	1.6	8.6	13.5
Community evacuation drill for residents	1.9	7.1	13.3
Enforcement ability for fire regulation violations	2.1	6.1	13.2
Starting a group like Wildfire Partners in Jeffco or CCCFPD	1.7	7.6	13.0
Policy for absentee homeowners or properties without structures	2.0	5.9	11.7
Create a slash depot	1.4	8.0	11.4
Require future development of utilities to have underground powerlines, or other protected power sources	1.3	8.9	11.4
Use Biochar Now Mobile Unit for slash removal	2.0	5.6	11.1
Ensuring access to protect infrastructure	1.4	7.7	11.0
Develop agreement with contractors to reduce rates for multiple landowners together	2.0	4.0	8.0
Address illegal camping on private land and campfire ignitions	0.5	7.0	3.5

Appendix C. Community Survey Methodology and Results

Survey Methodology

The Coal Creek Canyon FPD community survey was developed by the CCCFPD Community Outreach Team. The team used Wildfire Research Center (WiRE) and The Ember Alliance (TEA) surveys to develop their own resident survey. The aim of the survey was to provide vital information on the concerns of community members living in a wildfire prone environment and to guide the prioritization of mitigation projects in the district.

The survey was available from May 10 to July 5, 2023 through Google Forms. CCCFPD Community Outreach Team disseminated the survey through their master email list and promoted it in the local magazine, on their website, and through social media. There were 245 respondents, most full-time residents of Coal Creek Canyon.

TEA summarized the survey data collected by the CCCFPD Community Outreach Team. Results and comments from the survey were used to inform the priorities in the CWPP.

Survey Questions and Answers

1. Type in your Community Plan Unit, please

Table C.14. *Community Plan Units represented in the 2023 CCC CWPP Community Survey separated by focus group section and the percent of 245 respondents who live in each Plan Unit.*

Section	Plan Unit	Percentage
1	Chute Road	0.8%
	Crescent Park	8.6%
	Pika	0.4%
	Vonnie Claire	4.1%
	Hilltop	7.3%
2	Camp Eden	6.5%
	Coal Creek Heights	2.9%
	Copperdale	5.3%
	Wondervu	2%
3	Blue Mountain	5.3%
	Central Canyon	2.9%
4	Burke	1.6%
	Upper Twin Spruce	5.7%
	Did not answer	46.5%

2. What is your residency status in Coal Creek Canyon? Check all that apply:

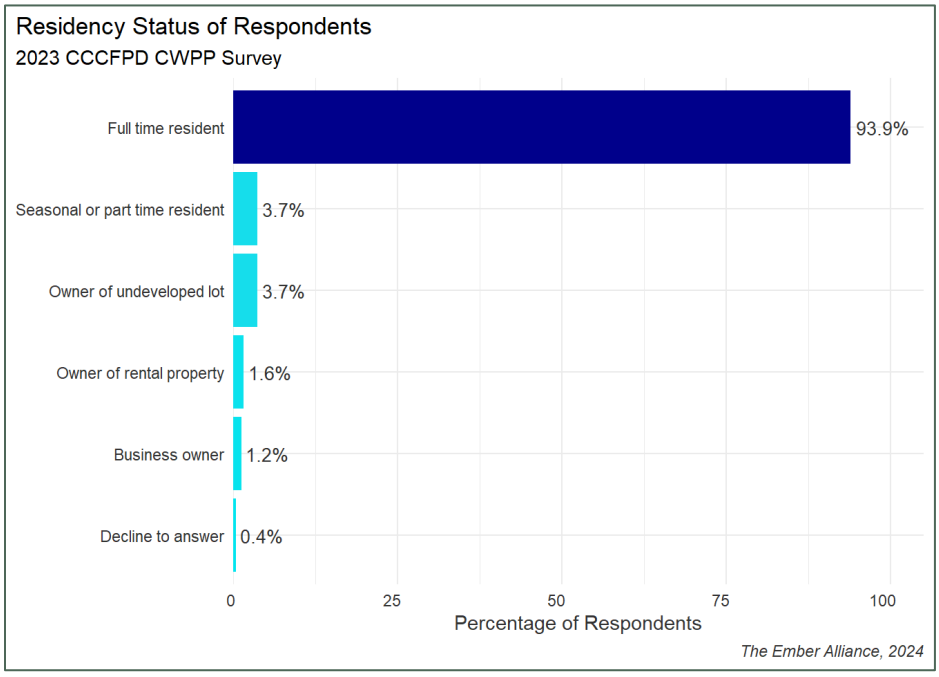


Figure C.2. *Residency status of CCC CWPP Community Survey respondents (n= 245 individuals).*

3. My beliefs and concerns about wildfire: [Choose Strongly Agree, Agree, Disagree, Strongly Disagree, Not Applicable for each]

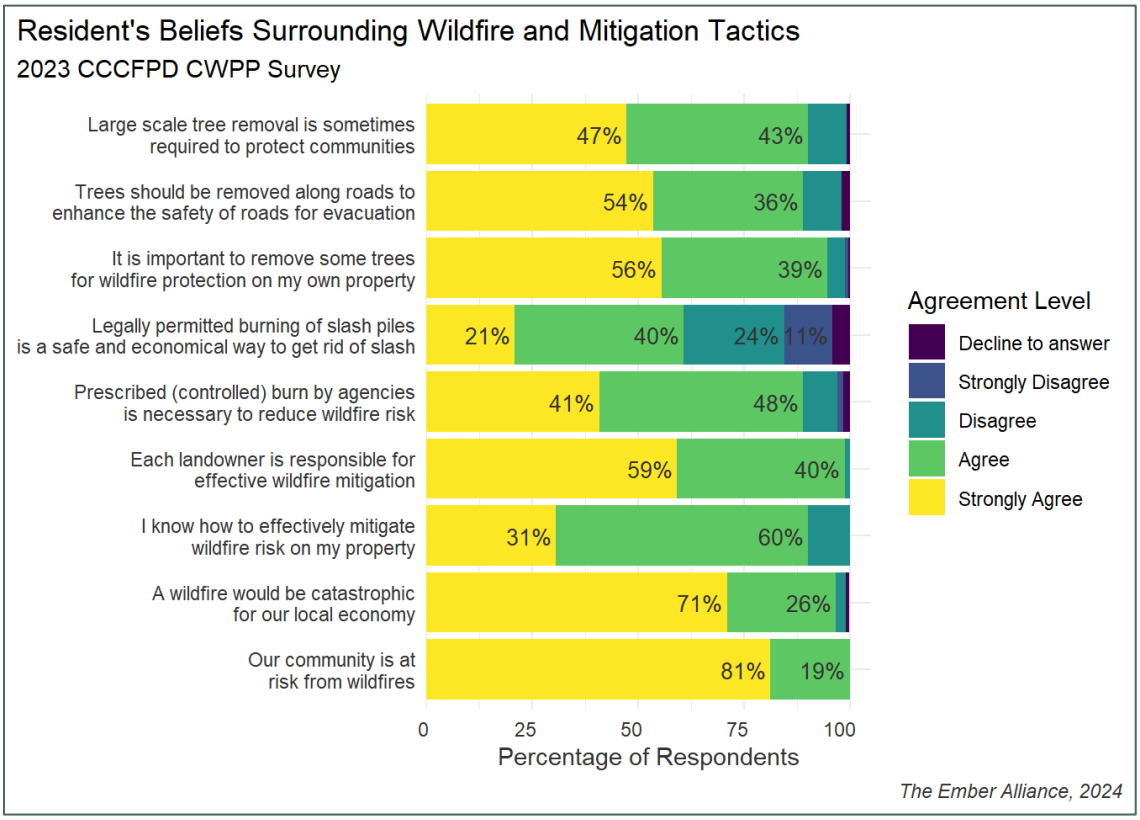


Figure C.3. *Beliefs of CCC CWPP Community Survey respondents surrounding wildfire mitigation tactics (n=245). Answers ordered as they appeared in survey.*

4. How concerned are you about the following wildfire related issues? [Choose Very Concerned, Moderately Concerned, Slightly Concerned, Not Concerned, Not Applicable for each]

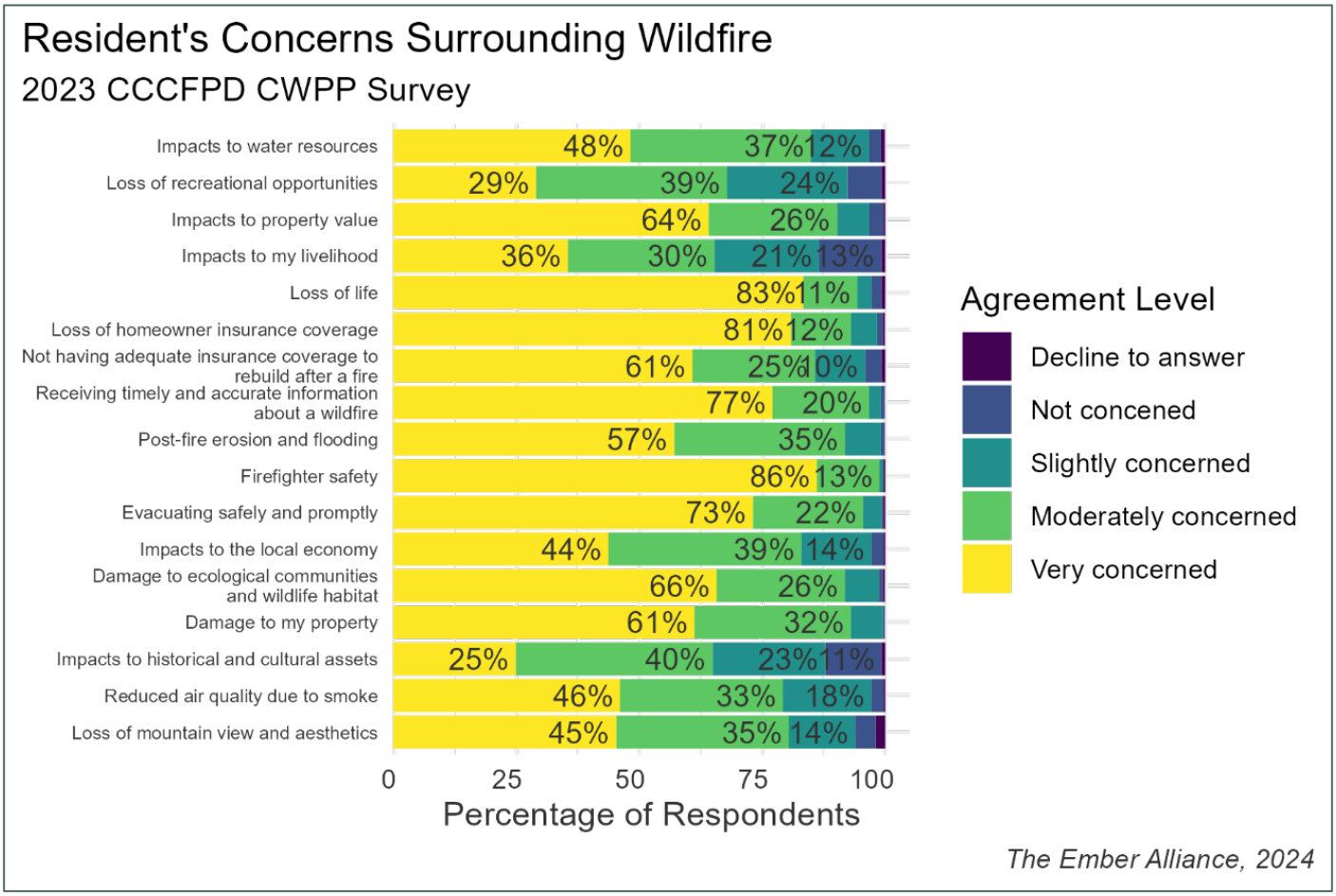


Figure C.4. *Wildfire-related concerns of CCC CWPP Community Survey respondents (n=245). Answers ordered as they appeared in survey.*

5. I am aware of ordinances and/or building codes requiring wildfire mitigation work in our area.

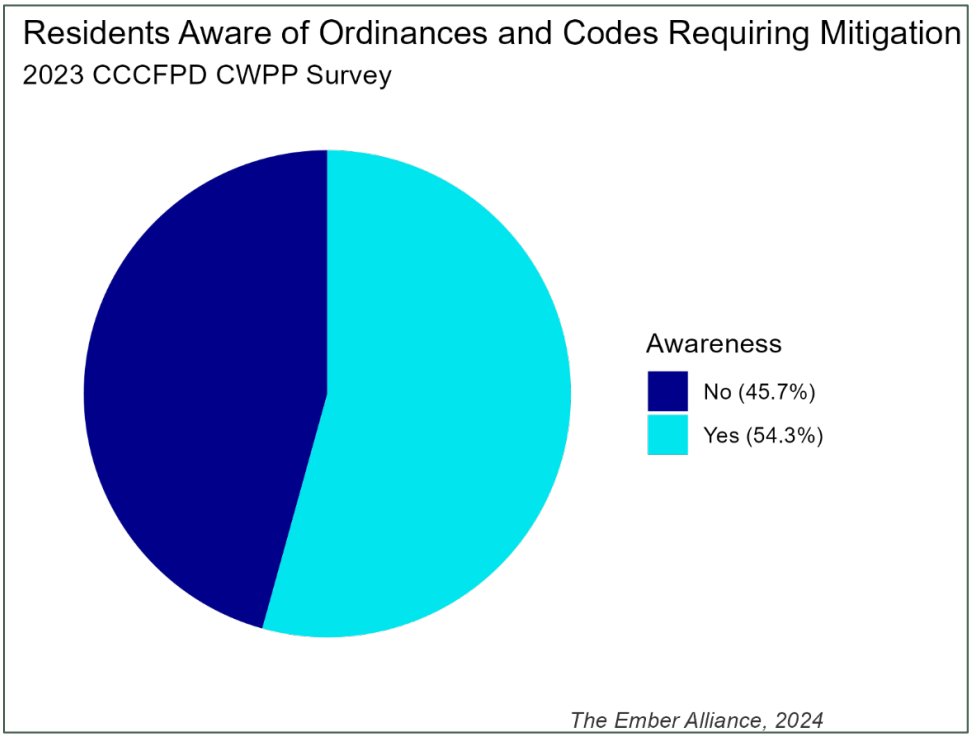


Figure C.5. *Proportion of CCC CWPP Community Survey respondents aware of local ordinances and codes requiring wildfire mitigation (n=245).*

6. I am aware of the following financial assistance and/or grant programs to support residential wildfire mitigation efforts.

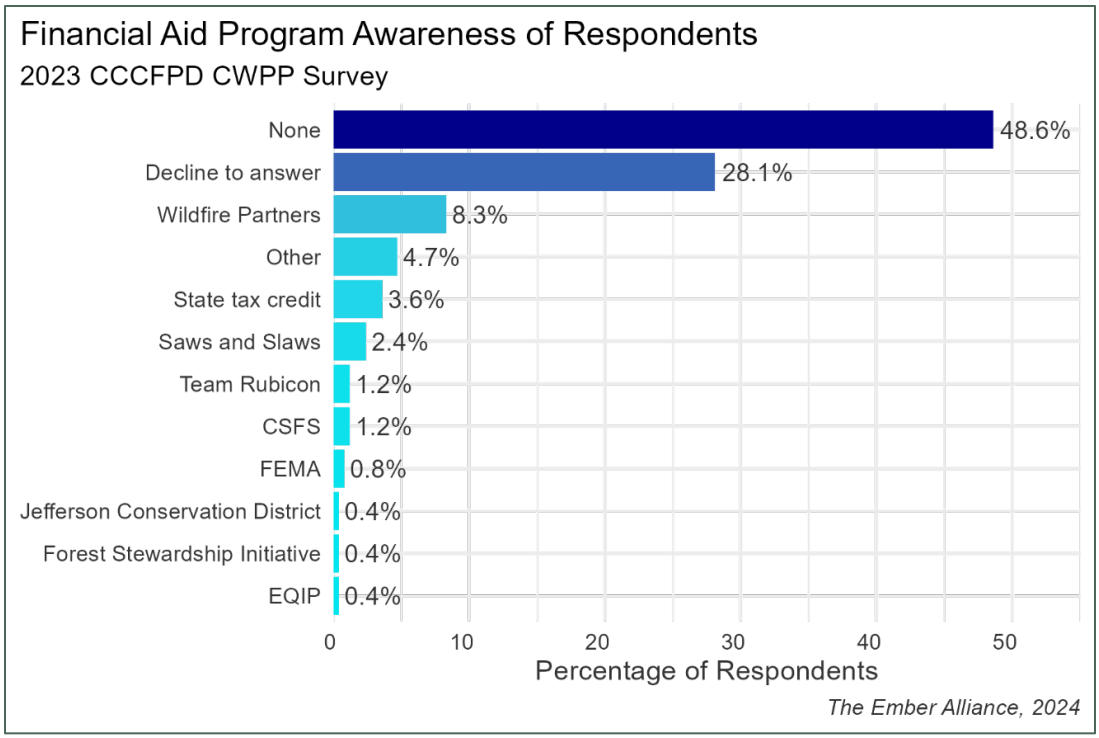


Figure C.6. *Proportion of CCC CWPP Community Survey respondents aware of financial assistance and/or grant programs available to support residential wildfire mitigation efforts (n=245).*

7. I have completed the following to reduce the risk of wildfire on my property. Check all that apply:

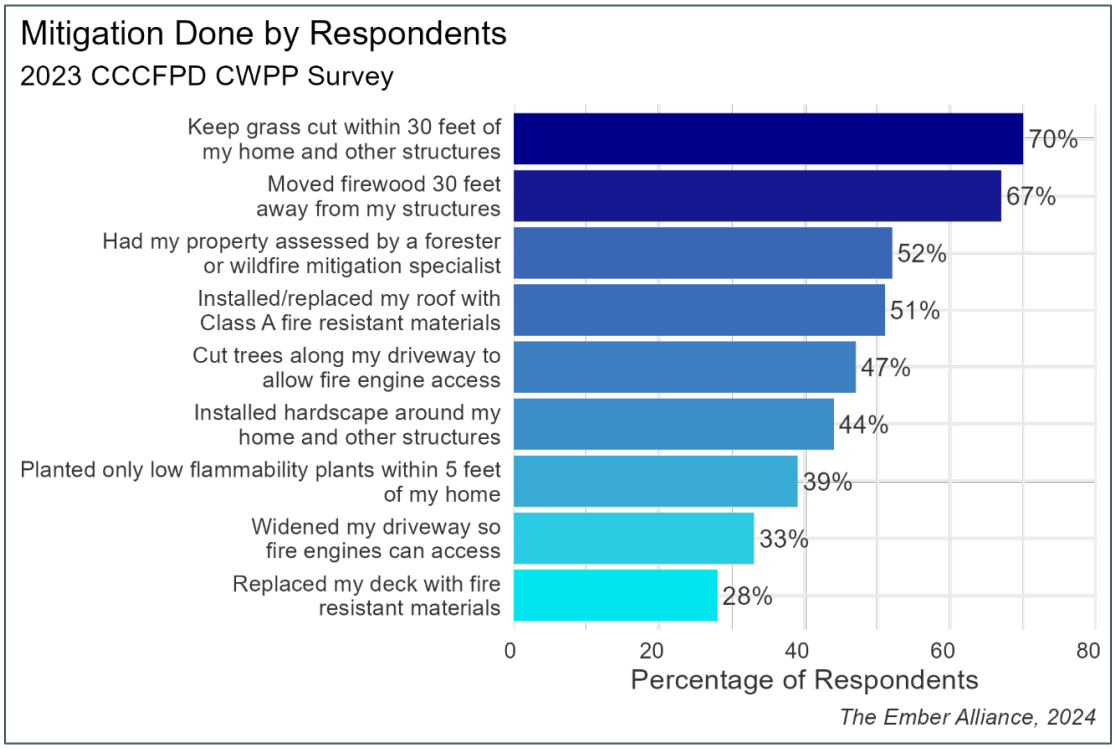


Figure C.7. *Wildfire mitigation actions taken by CCC CWPP Community Survey respondents (n=239).*

8. What are the obstacles that have kept you from doing wildfire mitigation? Check all that apply:

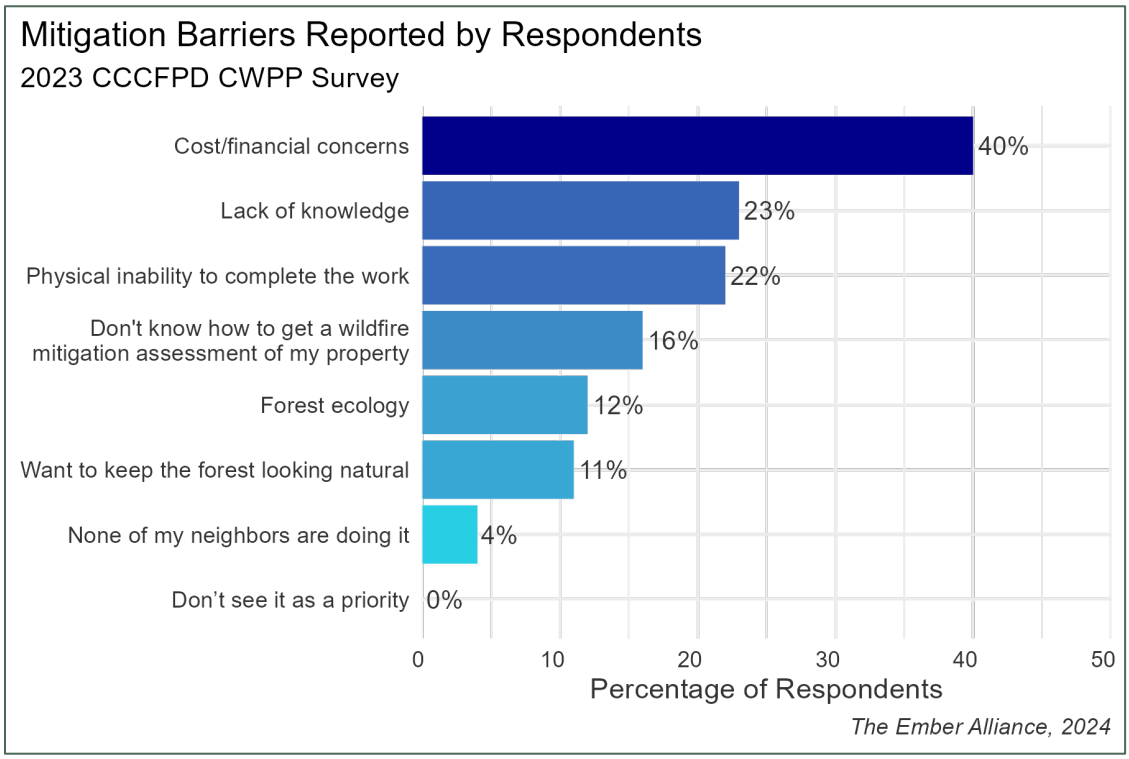


Figure C.8. *Barriers to wildfire mitigation actions reported by CCC CWPP Community Survey respondents (n=190).*

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

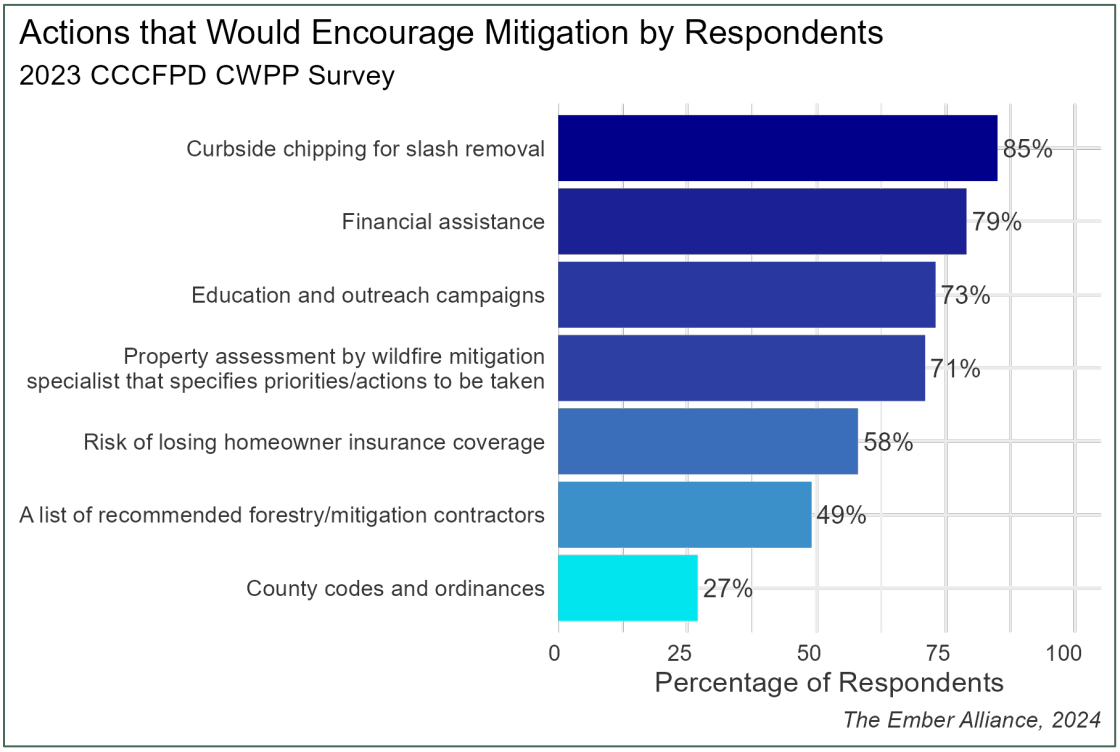


Figure C.9. *Factors that would encourage CCC CWPP Community Survey respondents to perform wildfire mitigation actions (n=243).*

10. Do you have an evacuation plan? Check all that apply:

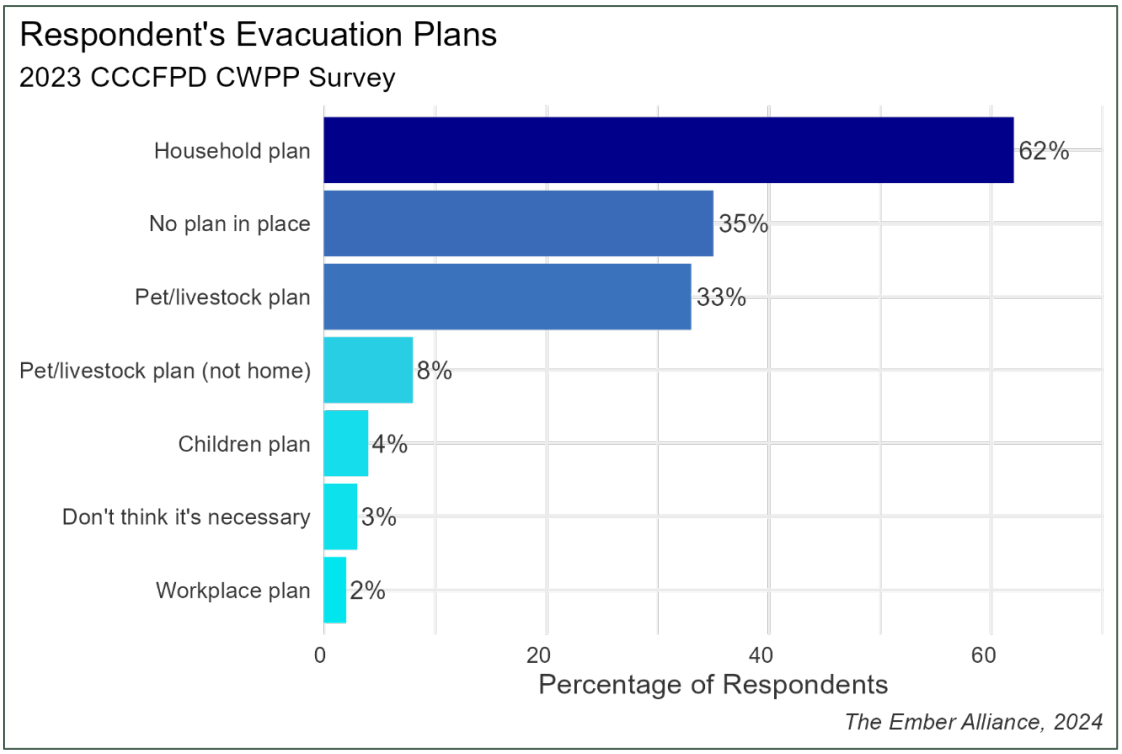


Figure C.10. *Wildfire evacuation planning status of CCC CWPP Community Survey respondents (n=244).*

11. Have you and your family practiced evacuating your home within 15 minutes or less?

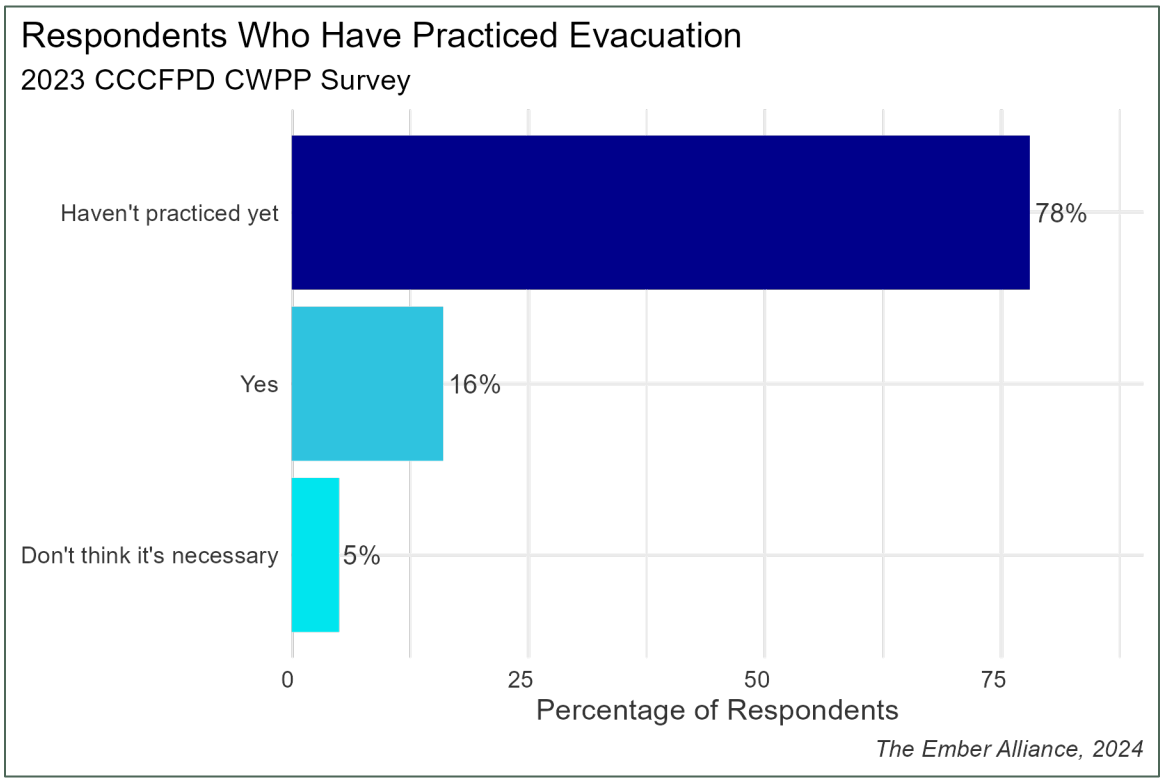


Figure C.11. *CCC CWPP Community Survey respondents who have practiced at 15 minute or less wildfire evacuation (n=243).*

12. If you are renting out your house (short-term or long-term) do you have a method of communicating a mandatory evacuation order to renters?

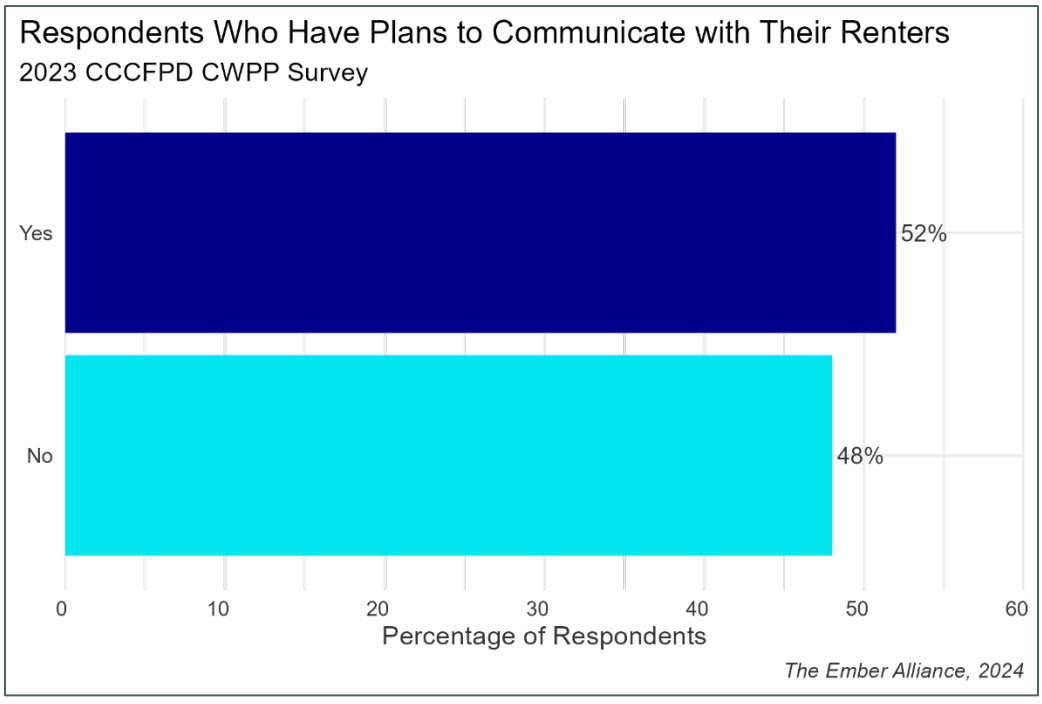


Figure C.12. *CCC CWPP Community Survey respondent wildfire evacuation planning status (n=25).*

13. Are you familiar with the four main evacuation routes out of Coal Creek Canyon?

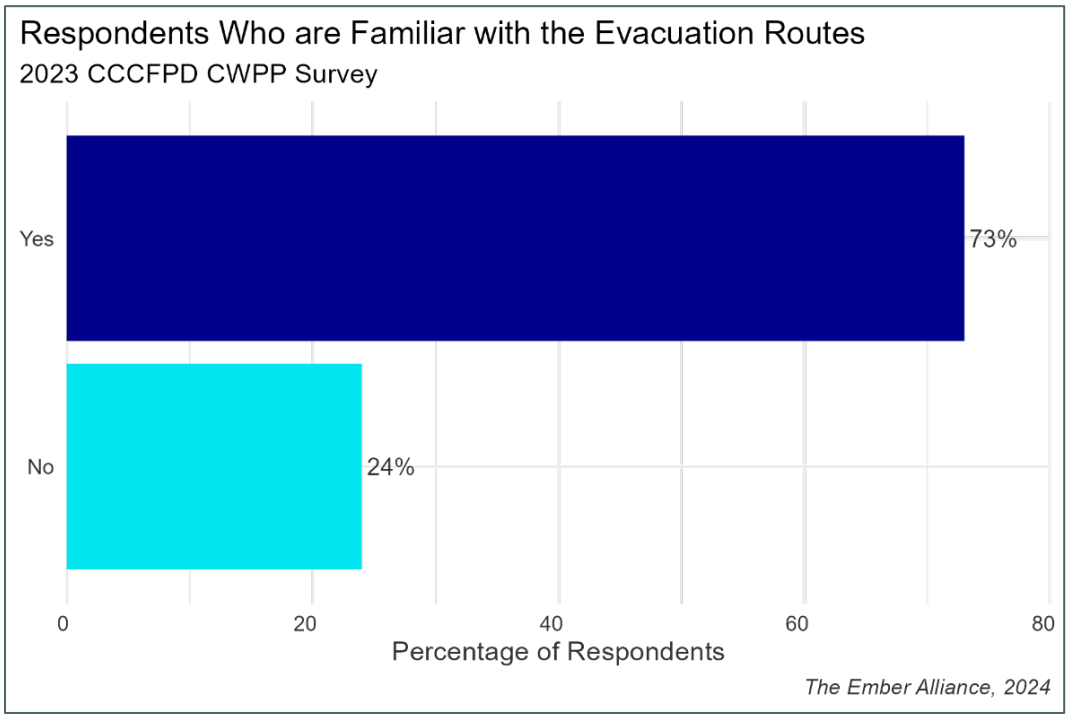


Figure C.13. *CCC CWPP Community Survey respondent familiarity with all four evacuation routes out of Coal Creek Canyon (n=239).*

14. Have you prepared a written list of items to take and a "go bag" for evacuation?

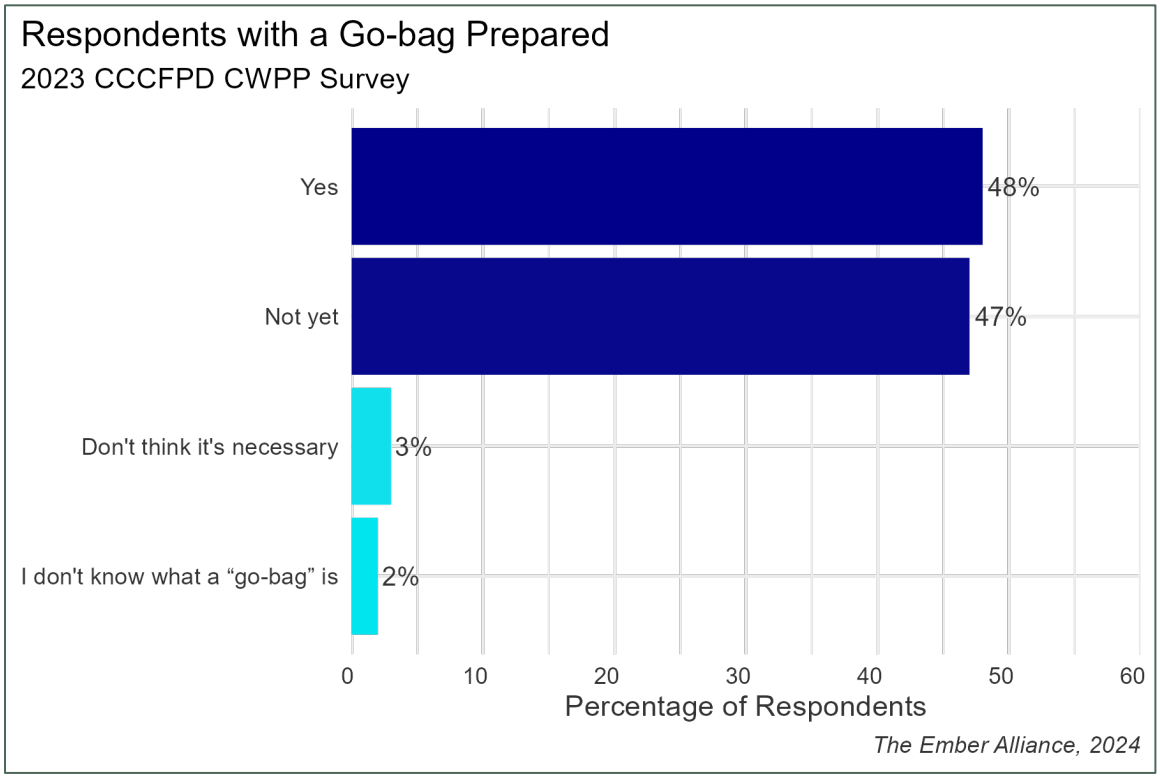


Figure C.14. *Go-bag preparation of CCC CWPP Community Survey respondents (n=243).*

15. Have you signed up for the emergency alert system for your county to receive notifications during wildfire incidents? Boulder County: Everbridge BoCo Alert System
16. Have you signed up for the emergency alert system for your county to receive notifications during wildfire incidents? Gilpin County: Hyper-Reach
17. Have you signed up for the emergency alert system for your county to receive notifications during wildfire incidents? Jefferson County: LookoutAlert (replaced CodeRED on 6/30/22)

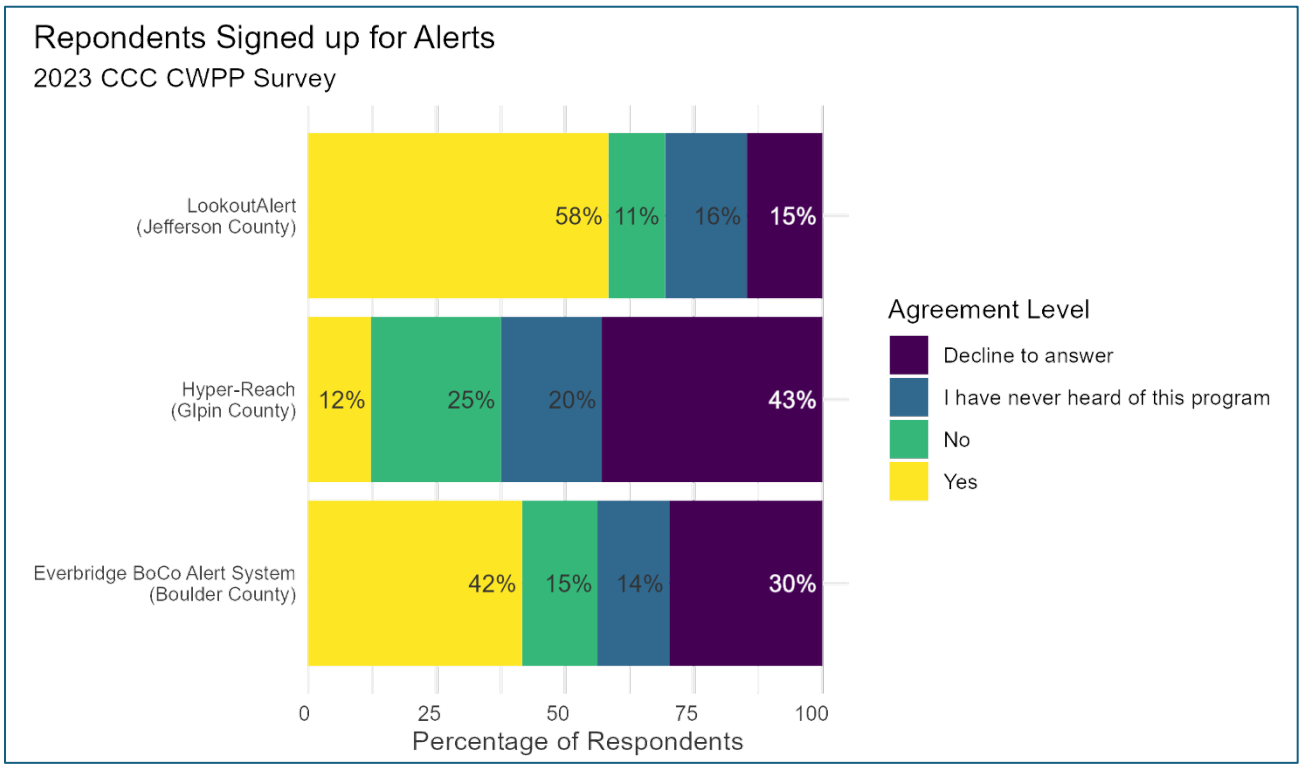


Figure C.15. *CCC CWPP Community Survey respondents signed up for Boulder, Gilpin, and Jefferson County emergency alert systems (n=239). Twelve-percent of respondents had not heard of or not signed up for any of the alert systems.*

18. If there were an evacuation in the community because of wildfire, how concerned are you about the following issues?

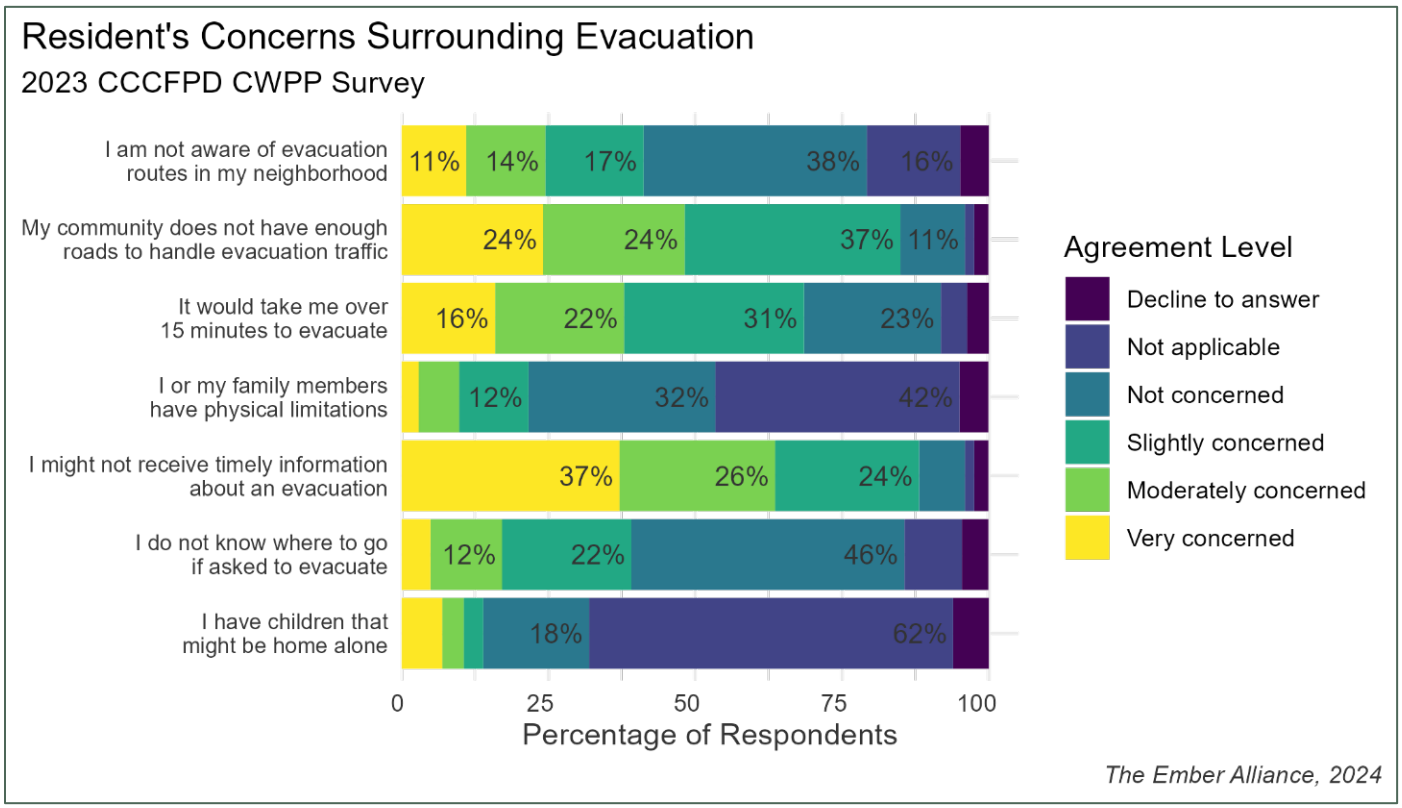


Figure C.16. *Evacuation-related concerns of CCC CWPP Community Survey respondents (n=245). Answers ordered as they appeared in survey.*

19. Where have you found or received wildfire information? Check all that apply:

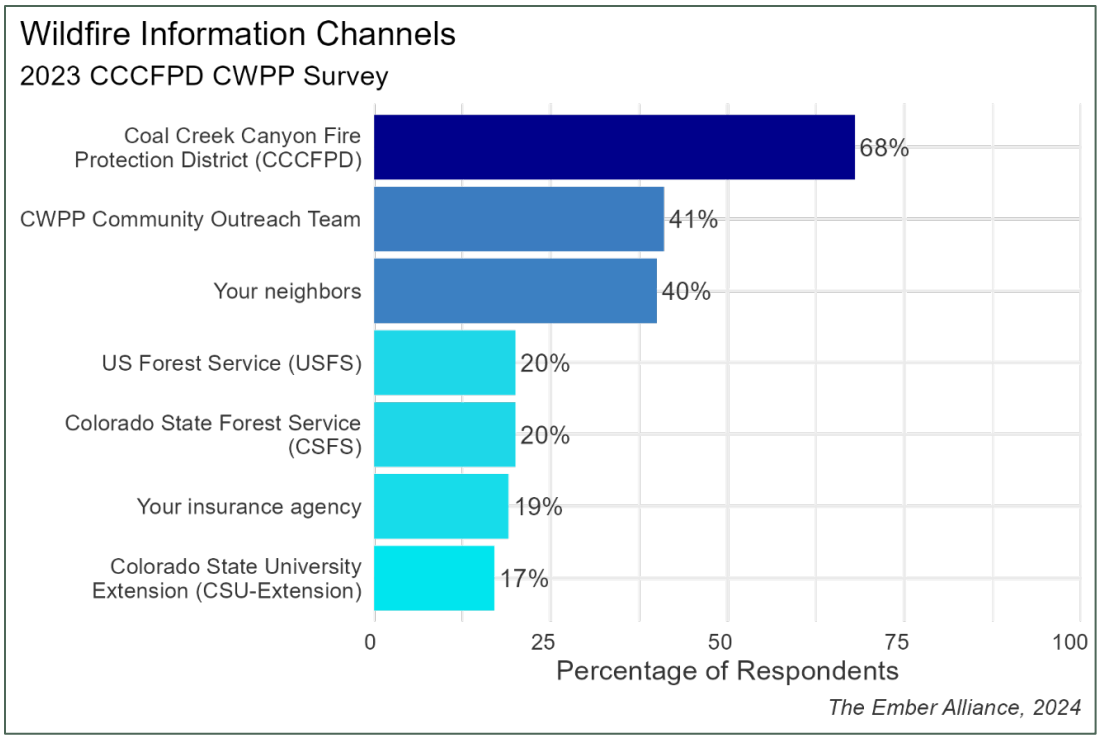


Figure C.17. *Wildfire information channels used by CCC CWPP Community Survey respondents (n=236).*

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

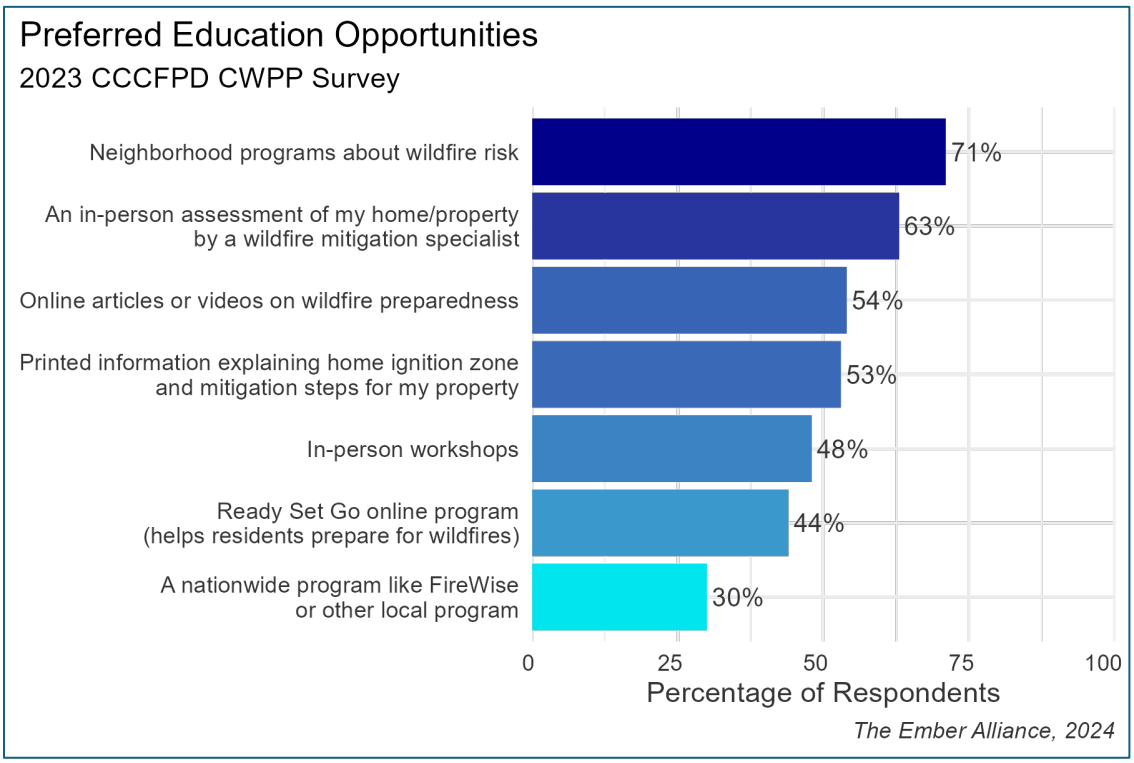


Figure C.18. *Preferred education opportunities of CCC CWPP Community Survey respondents (n=235).*

21. When would you be most likely to attend a community meeting about wildfire mitigation or the Community Wildfire Protection Plan (CWPP)? Check all that apply:

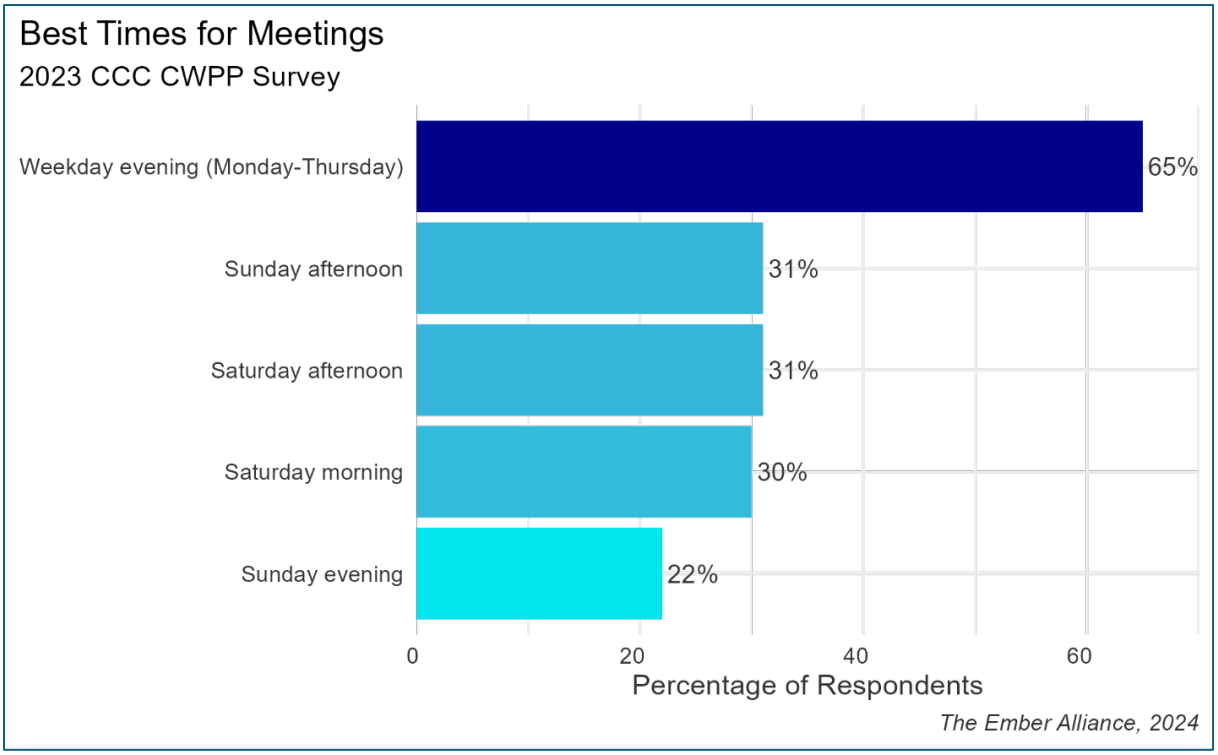


Figure C.19. *Preferred meeting times of CCC CWPP Community Survey respondents (n=228).*

22. What methods are best to communicate with you? Check all that apply:

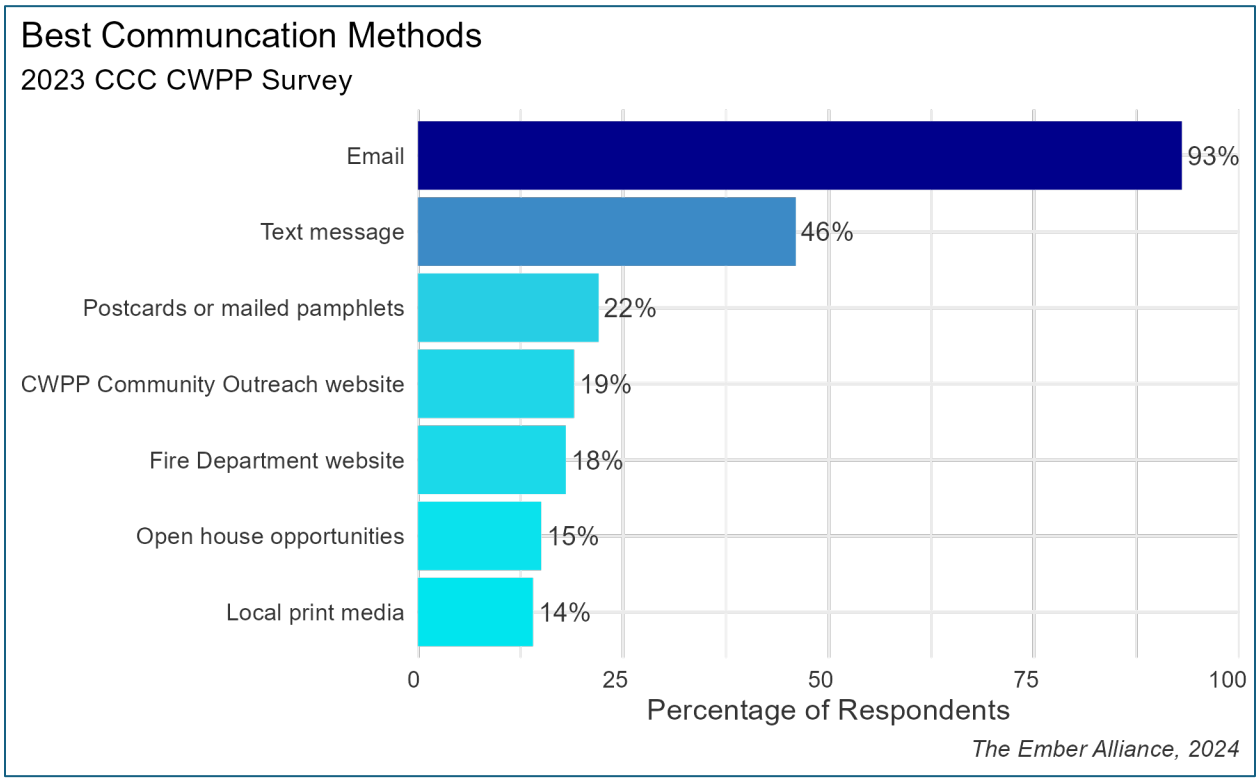


Figure C.20. *Preferred meeting times of CCC CWPP Community Survey respondents (n=242).*

23. Do you have any other thoughts or comments?
(see below)

Survey Comments

At the end of the survey, residents were given the option to add comments that revealed perspectives on wildfire that weren't shown through responses to multiple-choice or ranked questions. Multiple points of view were represented in the comments, but most respondents who chose to write in a response expressed concern for the effects of wildfire on the CCC community. The main concerns in the comments were financial cost of mitigation, evacuation, non-resident property owners and mitigation by neighbors, communication, insurance, and the fuels on surrounding public land.

Mitigation Cost

Residents indicated that they and/or their neighbors are unable to afford mitigation. Some suggested approaches that would allow community members to share resources.

"Financial assistance is needed by most residents to complete fire mitigation."

"We are very motivated to be prepared and to mitigate our land but time and financial restraints are significant."

"There must be a way to encourage one or more small businesses to focus on CCC communities. If communities can get numerous landowners to contract for defensible space work at same time, contractors could be more efficient by acquiring appropriate equipment and help bring cost down."

"My private road needs serious repairs and none of my neighbors have financial ability to help."

Evacuation

Residents have significant concerns about there being only one way in and one way out of a community.

“Crescent Lake Rd only has one mode of egress...That scares the shit out of me.”

“Most concerned over egress from Blue Mountain. Only one road.”

“I live near Hwy 72 but worry if I had to go down through the neighborhoods to get out. I think simple evacuation rout signs at junctions would be helpful. Also, a loud siren in the canyon (for evacuation only) would be helpful.”

Neighbors and Non-residents

Many residents were concerned about the fact that the owners of properties around them have not done any mitigation work. Some expressed direct concern for the short-term rental properties around them.

“I wish both of my neighbors who are full time airbnbs cared at all about this, their properties are not mitigated and the owners don't seem to care.”

“There are some properties in the Camp Eden neighborhood that terrify me as far as fires. Fuel loads are outrageous! Dead and falling trees, slash, really thick and horrible. I've tried to do what I can on my properties, but others have done NOTHING.”

“I have a lot of concern with properties that are not developed and not knowing if the owners of the properties are aware of the amount of kindling their lots are containing. We are newer to the canyon, so we don't know everyone, but it seems that many homeowners have done a lot of work to mitigate their properties, but there is a lot of property that is full of dead trees along Twin Spruce and other locations that would wipe out our community.”

Communication

Communication was a consistent concern for residents. They note that it can be difficult to get important wildfire information and that the community needs to work together to ensure everyone gets necessary notifications.

“Clear, easy to find in one place information with instructions and lists would be great for new residents.”

“I strongly believe that a community system is needed for emergency communication - phone numbers both landline and cell of all direct neighbors and others - in order to seek and offer help during evacuation, etc. This includes communications directly with CCCFPD, tri-county sheriff, etc.”

“Crescent park needs … a phone tree for warnings.”

“We need to be able to communicate the wildfire concerns to non-resident property owners.”

Insurance

Residents voiced concerns over the availability and cost of home insurance in the area and highlighted that it can be difficult to navigate.

“Federal Catastrophic wildfire insurance needs to be talked about, similar to flood insurance, mitigating insurance losses and keeping rates much lower.”

“Home insurance premiums are our number-one concern. In doing work to keep our policy, it was difficult to find information about how to get our property assessed in person.”

“We just purchased our land and are only just starting to dive into info on fire mitigation. My biggest concern at this time is home insurance, as other residents have voiced their concern at the cost of it and/or that insurance companies will not insure them.”

Fuels on Surrounding Public Lands

Residents expressed concern that others may not understand that the forest surrounding them is not as healthy as some think and highlighted that there is need for large-scale fuels mitigation.

“Concerned about downsides and missed opportunities when we focus residents so much on protecting their home which is a physical object that should be replaceable. Residents also need to hear broader messages like we live in an ecosystem where periodic fire should be expected, forest health and ecology often means much fewer trees regardless of proximity to buildings. Concerned about the common perception that interlocking, dense trees equates to a healthy forest simply because it is green and looks like a forest in Minnesota.”

“We border National Forest, with much down timber and dead trees. Can CWPP work with the Forest Service to clear some of this fuel?”

“This area is next to National Forest and we can't do a thing to mitigate that huge fuel source. I could clear cut my property and my house would still be torched.”