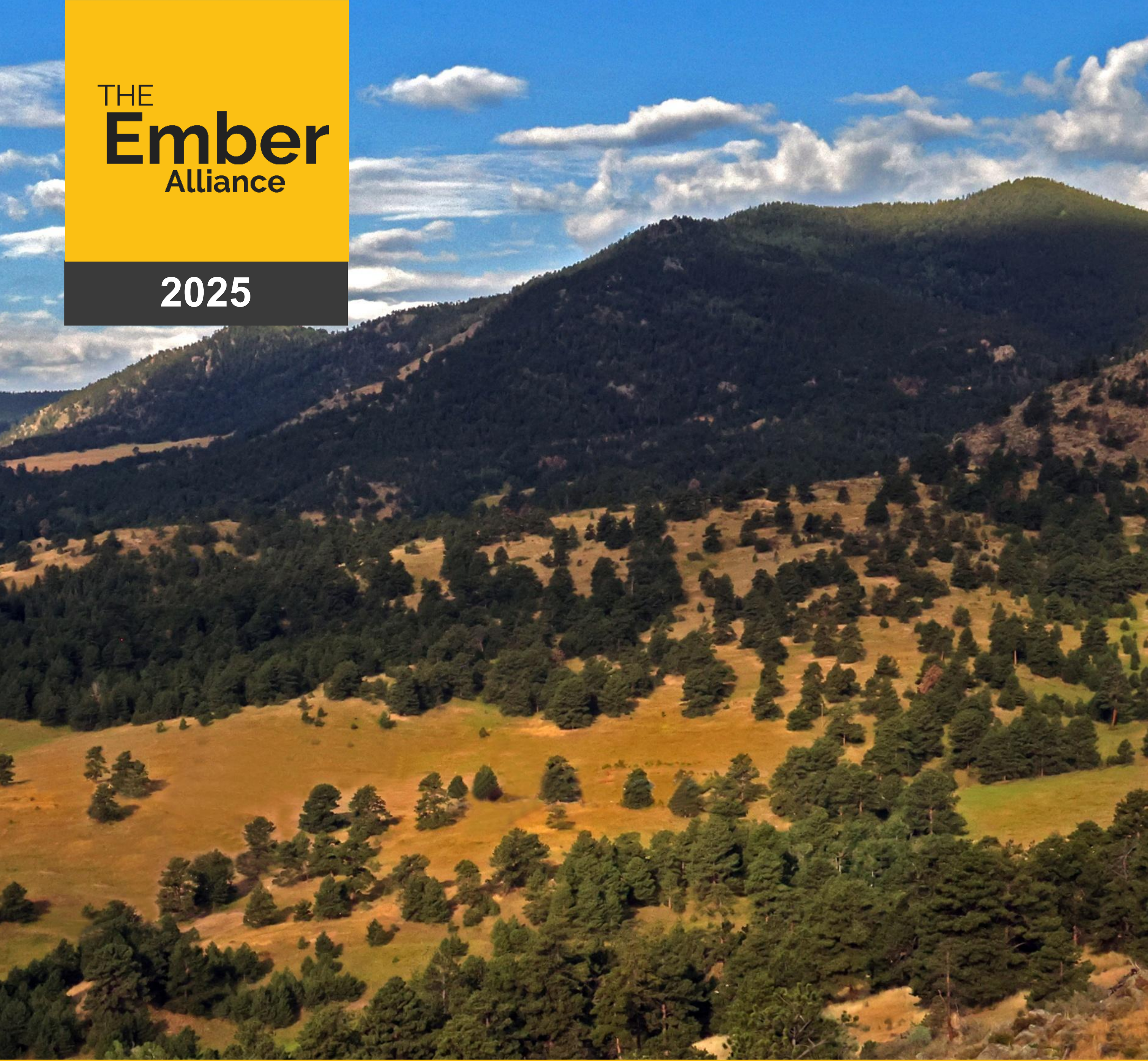
THE Ember Alliance

2025



GOLDEN GATE FIRE PROTECTION DISTRICT

Jefferson County, Colorado

Community Wildfire Protection Plan

Golden Gate
Fire Protection District
Community Wildfire Protection Plan
2025

PREPARED FOR GOLDEN GATE FIRE PROTECTION DISTRICT

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Table of Contents

How to use this CWPP Document

This document is designed for everyone that lives, works, and manages land within and around GGFPD. 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 plan unit.
I want to learn about community-led action.	• Sections 3.a, 3.b, 3.d and 3.e 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 priority fuel treatment projects for this community. • Sections 4.a, and 4.b 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 modelling methodology for fire behavior and evacuation modeling, on-the-ground hazard assessments, and treatment prioritization. • Section 7 to see all referenced research and information.

Acronyms

CCWFHP	Clear Creek Watershed and Forest Health Partnership
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
FD	Fire Department
FEMA	Federal Emergency Management Agency
GGFPD	Golden Gate Fire Protection District
HIZ	Home Ignition Zone
HOA	Homeowner's Association
IIBHS	Insurance Institute for Business & Home Safety
IRPG	Incident Response Pocket Guide
JCD	Jefferson Conservation District
JCPOS	Jefferson County Parks and Open Space
JCSO	Jefferson County Sheriff's Office
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	U.S. Forest Service
VPD	Vapor pressure deficit
WUI	Wildland-Urban Interface

Refer to the **Glossary** on page 113 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**). According to the 2020 Wildfire Risk to Communities analysis by the U.S. Forest Service, homes in the district and the surrounding areas have a higher risk of fire than 98% of communities in the state of Colorado (USFS, 2021a). Wildfire planning and an up-to-date CWPP for the Golden Gate community are essential to ensure wildfire preparedness and boost community resilience. Assessments and discussions during the planning process and the outputs thereof assist fire protection districts with fire operations in the event of 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 Golden Gate Fire Protection District (GGFPD) is a Special District organized under Colorado Revised Statutes Title 32 to provide fire protection for the community of Golden Gate. For this CWPP, the following terminology will be used:

- "GGFPD" will be used to represent the entire fire service providing department for this special district.
- "The district" may be used generally to represent the physical GGFPD boundary with important distinctions:
  - The "GGFPD Title 32 boundary" represents the district's physical tax boundary defined under Colorado Revised Statutes Title 32.
  - The "GGFPD response area" represents the physical boundary within which GGFPD will be the responding agency to service calls. Note: Highway 6 falls under Golden Fire Department's response area and is not the responsibility of GGFPD.

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

(Disclaimer: the boundaries presented are subject to change during the standard 5-year period this CWPP is active.)

The district is located west of Denver in the foothills of Colorado's Front Range (

Figure 1.a.2). Its Title 32 boundary encompasses 48 square miles with a response area of 63 square miles. The district falls within Jefferson County and is the ancestral lands of the Ute and Cheyenne First Nations.

For planning purposes and to conduct relative risk assessments, the district was divided into 11 smaller regions called plan units (**Figure 1.a.3**). These plan units are: Centennial Cone OS, Douglas Mountain, Drew Hill / Geneva Glen, Guy Hill, Lower Canyon, Lower Crawford Gulch, Mt Galbraith OS, Robinson Hill, Upper Canyon, Upper Crawford Gulch, and White Ranch OS. The three plan units that contain the "OS" designation primarily contain Jefferson County Parks & Open Space lands.

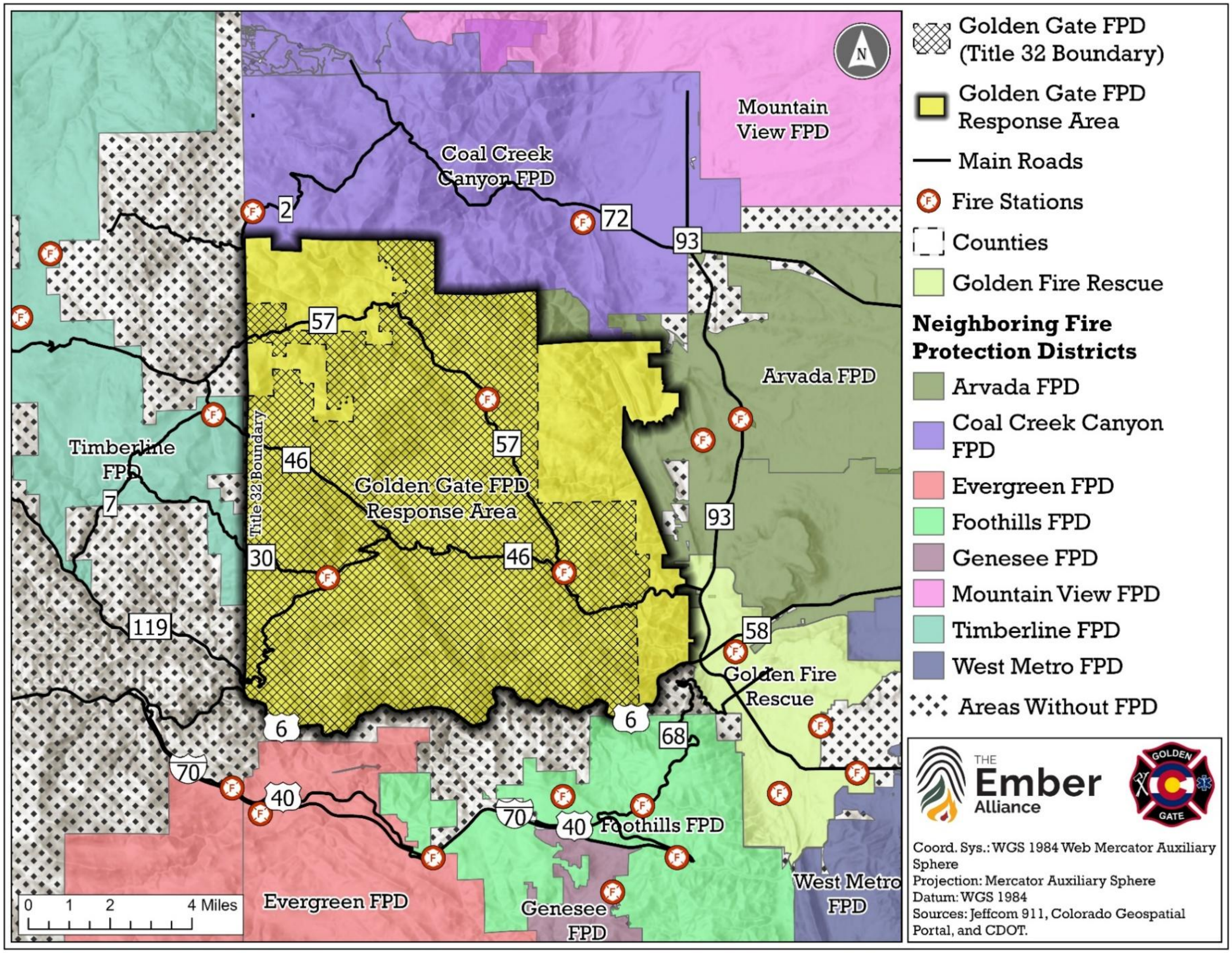


Figure 1.a.2 *Boundary of GGFPD in Jefferson County with Fire Stations and bordering Fire Protection Districts. Note: Highway 6 falls under Golden Fire Department's response area and is NOT the responsibility of GGFPD. Source: Jeffco 911, Colorado Geospatial Portal and CDOT.*

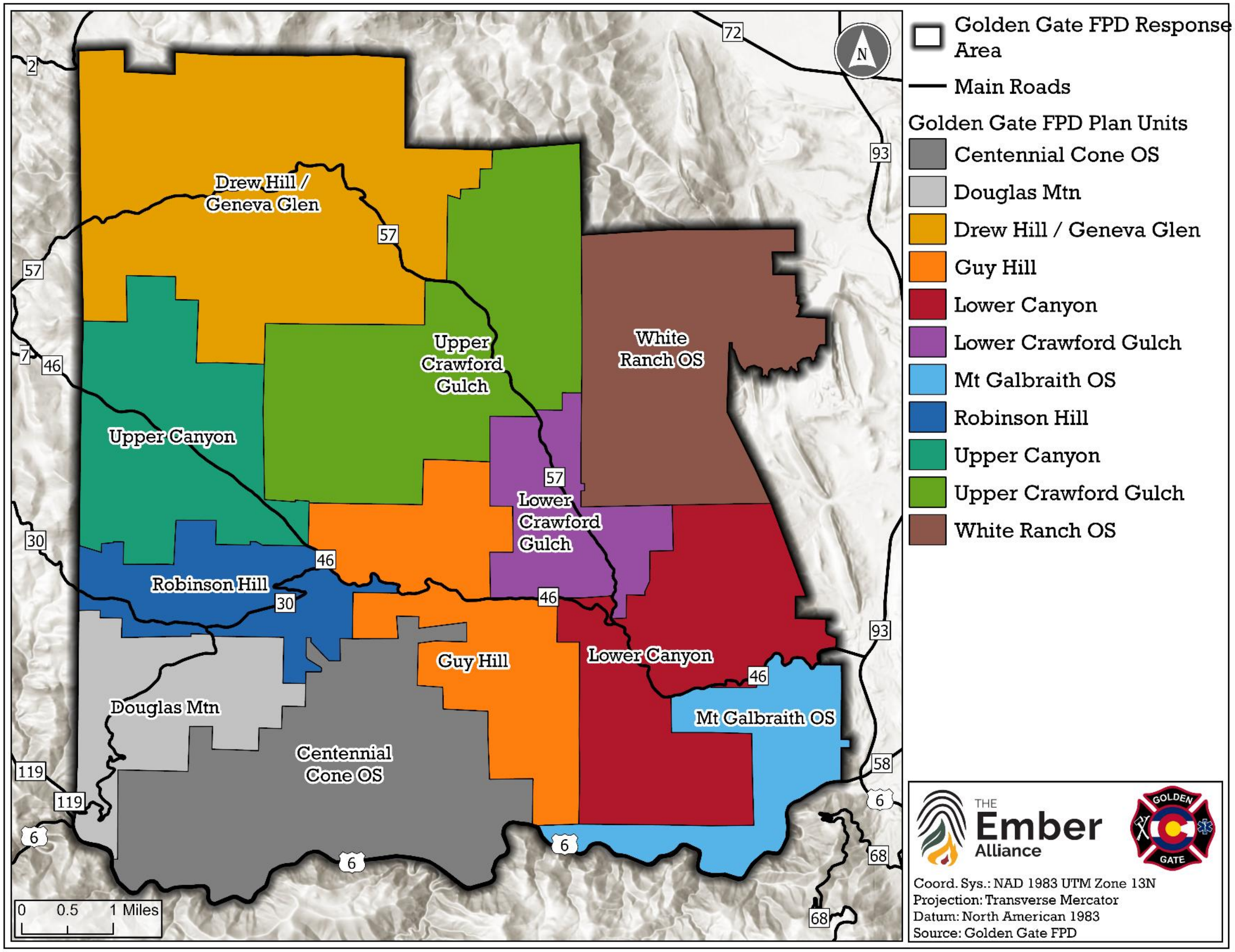


Figure 1.a.3 *GGFPD divided into 11 total plan units. The three plan units primarily made up of Jefferson County Open Space are designated by "OS". Source: GGFPD*

This 2025 CWPP for the GGFPD is a robust and holistic CWPP that 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, recommendations for property owners, prioritization of mitigation activities, and implementation recommendations. This document is a tool for GGFPD, land managers, the Golden Gate community, and residents to prioritize projects that will make the district a safer and more resilient community to wildfire. The objectives of this project are to:

- Engage community members during the CWPP process to ensure local needs and concerns are addressed.
- Produce a living, actionable CWPP based on analyses of fuel hazards, burn probability, evacuation routes, and community values across the district.
- Provide recommendations, including prioritization of projects, for reducing fire hazards, hardening homes, and increasing evacuation safety.
- Create strategic and tactical maps and evacuation pre-plans to increase community preparedness and safety of firefighters and residents.
- Set the stage for planning and implementation by GGFPD, partners, and residents to mitigate hazards and promote community preparedness.

Complex interactions among wildland fuels, weather, and topography determine how wildfires behave and spread. Many aspects of wildfires are predictable based on scientific research of the physical processes driving fire. Much of the work in this CWPP is grounded in this scientific research and computer models of wildfire behavior, complemented by local knowledge, calibrated fuel conditions, and identified local risk gathered through partner and community engagement. 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 and concepts).

View south along Crawford Gulch Road in GGFPD. 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 the district 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 how to protect the lives of firefighters engaged in protecting your community.

Even if you do not have a structure or development on your property, you can take steps to protect your assets, including the value of your property, as 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—collective efforts can have wide-ranging implications from life safety to homeowner insurance coverage. 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 develop and entrap residents and first responders during wildfires.

This CWPP is a call to action to do your part to continue making the district a beautiful and safe community. This CWPP was tailored to your community's unique needs to complement larger scale, county-wide CWPPs. Land management partners and GGFPD 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 the Golden Gate Canyon community.

1.b. Community and Partner Engagement

Collaboration is an essential part of CWPPs. Community engagement and 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 GGFPD to write this CWPP. The Ember Alliance and representatives from GGFPD engaged partners from across the district, neighboring districts, and across the county to develop the recommendations set forth in this CWPP. They incorporated lessons learned from recent, challenging wildfire seasons in Colorado and considered valuable insights shared by subject matter experts (SMEs), community members, and other partners.

Recommendations in this CWPP also consider overlapping and related plans and prioritization processes in the area, including: 2024 Jefferson County CWPP Update, 2024 Jefferson County Comprehensive Emergency Management Plan Evacuation Annex, 2025 Gilpin County CWPP update, Jefferson County Open Space Forest Health Plan, Colorado Forest Action Plan, and the Upper Clear Creek Watershed Association Pre-Wildfire Planning Study.

The Ember Alliance and GGFPD would like to thank the following partners for their time and effort in developing content, providing data and feedback, and contributing to planning implementation for this CWPP:

- Clear Creek Watershed and Forest Health Partnership (CCWFHP)
- Colorado Division of Fire Prevention and Control (DFPC)
- Colorado Parks and Wildlife (CPW)
- Colorado State Forest Service (CSFS)
- Denver Water
- Golden Fire Department
- Golden Gate Community Members, Mary Ramstetter
- Golden Gate Advisory Committee Community Representatives
- Jefferson Conservation District (JCD)
- Jefferson County Parks & Open Space (JCPOS)
- Jefferson County Sheriff's Office (JCSO)
- United Power
- Xcel Energy

The Ember Alliance and GGFPD conducted extensive community and partner engagement activities to gain a better understanding of the community's current knowledge of wildfires, assess their concerns and needs, and learn about ongoing mitigation work. Engagement included:

- Regular advisory committee meetings throughout the CWPP process
- Community kickoff meeting (virtual) in winter of 2024 to introduce the CWPP process and encourage community participation throughout the process
- Mid-project community workshop in-person at the Golden Gate Grange Community Center in the spring of 2025 to gather critical insight into overall community values that were incorporated into recommendations and priorities for the 2025 CWPP
- Fuel treatment project identification and prioritization meeting in-person at the Golden Gate Grange Community Center on April 28, 2025
- Final community meeting (virtual) in the fall of 2025 to share findings and recommendations from the CWPP creation process

Additional outreach was conducted by the Golden Gate community members on the advisory committee to identify locations of community assets and compile community concerns and bring them to the CWPP advisory committee throughout the process.

*Community engagement and partner input were fundamental aspects of this CWPP. Thank you for helping us create a locally relevant and actional CWPP to meet your needs! The **top photo** is from the project prioritization meeting with the Advisory Committee and additional partners; the **left photo** is of GGFPD volunteer firefighters, community reps, and project partners setting up for the Mid-Project Community Workshop; the **bottom photo** is during the Community Workshop on March 31, 2025*

Source: The Ember Alliance

1.c. Accomplishments Since Previous CWPP

Golden Gate Fire Protection District

- Established their Wildland Fire Mitigation Division as a result of this CWPP process
    - This division will help guide homeowners with mitigation work, slash management, and provide the community with education and resources on wildfire risk and risk mitigation best practices.

Colorado State Forest Service

- Boulder field office completed unspecified mitigation work within Golden Gate Canyon State Park

Jefferson County

- Jefferson County completed their county-wide CWPP update in 2024.

Jefferson County Parks & Open Space

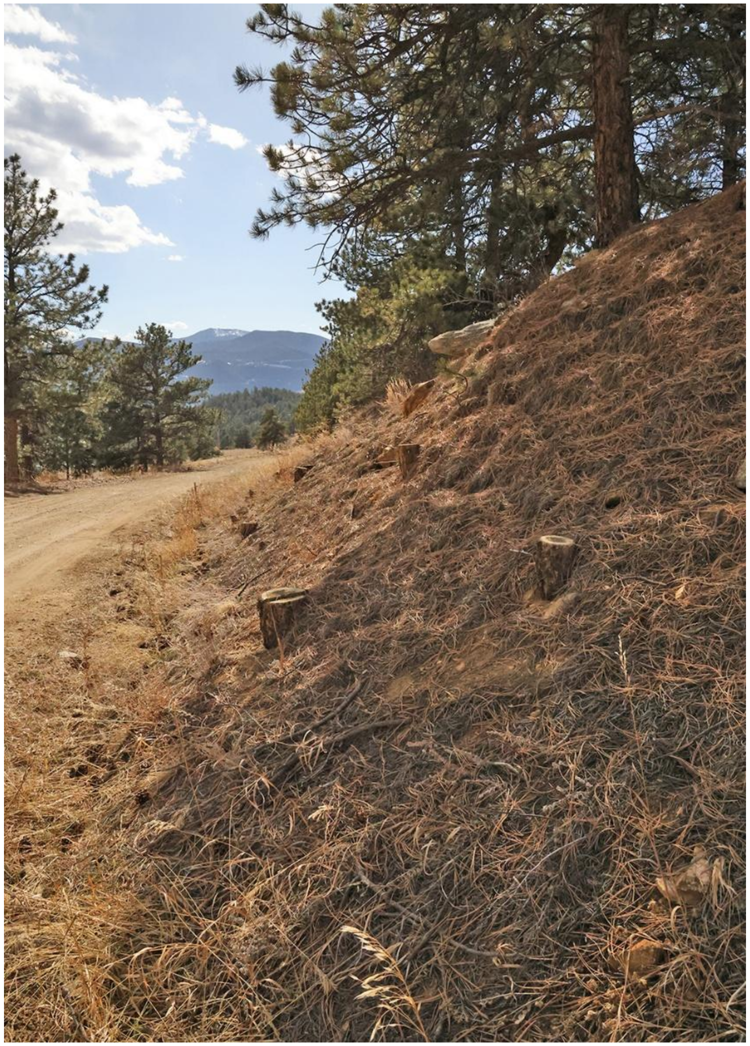
- Jefferson County Open Space completed:
    - 15 acres of ponderosa pine thinning at White Ranch Park near Sawmill Campground in 2023.
    - 9 acres of roadside treatment at Centennial Cone Park in 2020.

Jefferson County Sheriff's Office

- Jefferson County Sheriff's office launched their Wildland Fire Management Program
    - The program's goal is to establish a holistic program to protect the residents of Jefferson County from catastrophic wildfire threats.
    - Their budget request was approved by the Jefferson County Board of Commissioners and hiring of staff has begun.

Community and Community Organizations

- The Golden Gate Grange Community Center:
    - Provides Firewise education for canyon residents.
    - Conducts the annual Jefferson County Canyon clean up.
    - Represented the community for the Together JeffCo community meeting.
- Golden Gate Auxiliary of Colorado:
    - Established in 2014 as a 501c3 to raise funds in support of the Volunteer Firefighters of Golden Gate Fire Protection District.
    - Golden Gate Auxiliary has provided funding for special equipment needs, training and support of firefighters during incidents.
- Mitigation work completed by residents on private property (see images below)



Examples of mitigation work performed by homeowners within GGFPD. ***Above:*** *Roadside treatment completed in Douglas Mountain plan unit.* ***Upper Right:*** *Mitigation work on ponderosa pine woodland performed in the Upper Crawford Gulch plan unit.* ***Right:*** *Property in the Drew Hill plan unit that has been mitigated over the last few years.*

Source: Golden Gate Community Members

The transformation and risk reduction of a property in GGFPD through mitigation work. ***Above:*** *Property in Crawford Gulch before mitigation work.* ***Upper Right and Right:*** *The same property after thinning of ponderosa pine forest.*

Source: Golden Gate Community Members

2. Golden Gate Fire Protection District: Background

2.a. General Description

Within the Front Range of the Rocky Mountains west of Denver, GGFPD's Title 32 boundary encompasses 48 square miles with a response area covering 63 square miles. GGFPD lies within Jefferson County with elevations ranging from 6000 feet near the intersection of Golden Gate Canyon Road and Colorado Highway 93 to nearly 9800 feet on the peak of Centralia Mountain. The district is bordered by Coal Creek Canyon FPD, Timberline FPD, Foothills FPD, Evergreen FPD, Arvada FPD, and Golden Fire Department. GGFPD has mutual aid agreements with Golden, Timberline, and Arvada Fire Departments and is party to the Jefferson County mutual aid agreement.

Numerous highly valued community resources and assets (HVRAs) were identified within and around the district, including community centers, water treatment facilities, communication towers, weather stations, campgrounds, recreational areas, and historic sites (***Figure 2.a.1***). These HVRAs, their locations, and exposure to wildfire risk were taken into consideration during the fuel treatment project identification and prioritization process.

A variety of publicly owned lands are scattered throughout the district, ranging from state and county parks to county managed conservation areas. These lands cover approximately 38% of the total land area within the Title 32 boundary and 50% of GGFPD's response area. (**Figure 2.a.2**). Golden Gate State Park and the Ralston Creek State Wildlife Area are managed by Colorado Parks and Wildlife and are in the district's northwest corner. Jefferson County parks within the district are managed by Jefferson County Parks & Open Space (JCPOS) and include White Ranch Park in the northeast, Mount Galbraith in the southeast corner, Centennial Cone Park in the southwest region, and Clear Creek Canyon Park along the southern border of the district. Also managed by JCPOS within the district are the Douglas Mountain, Coal Creek Canyon, and Guy Gulch Study Areas. In addition, multiple conservation easements on previously privately owned properties exist.

The community of Golden Gate is unincorporated and governed by Jefferson County. Within the Golden Gate community, services typically provided by city governments are provided by special districts, with GGFPD as the established fire protection service provider.

History

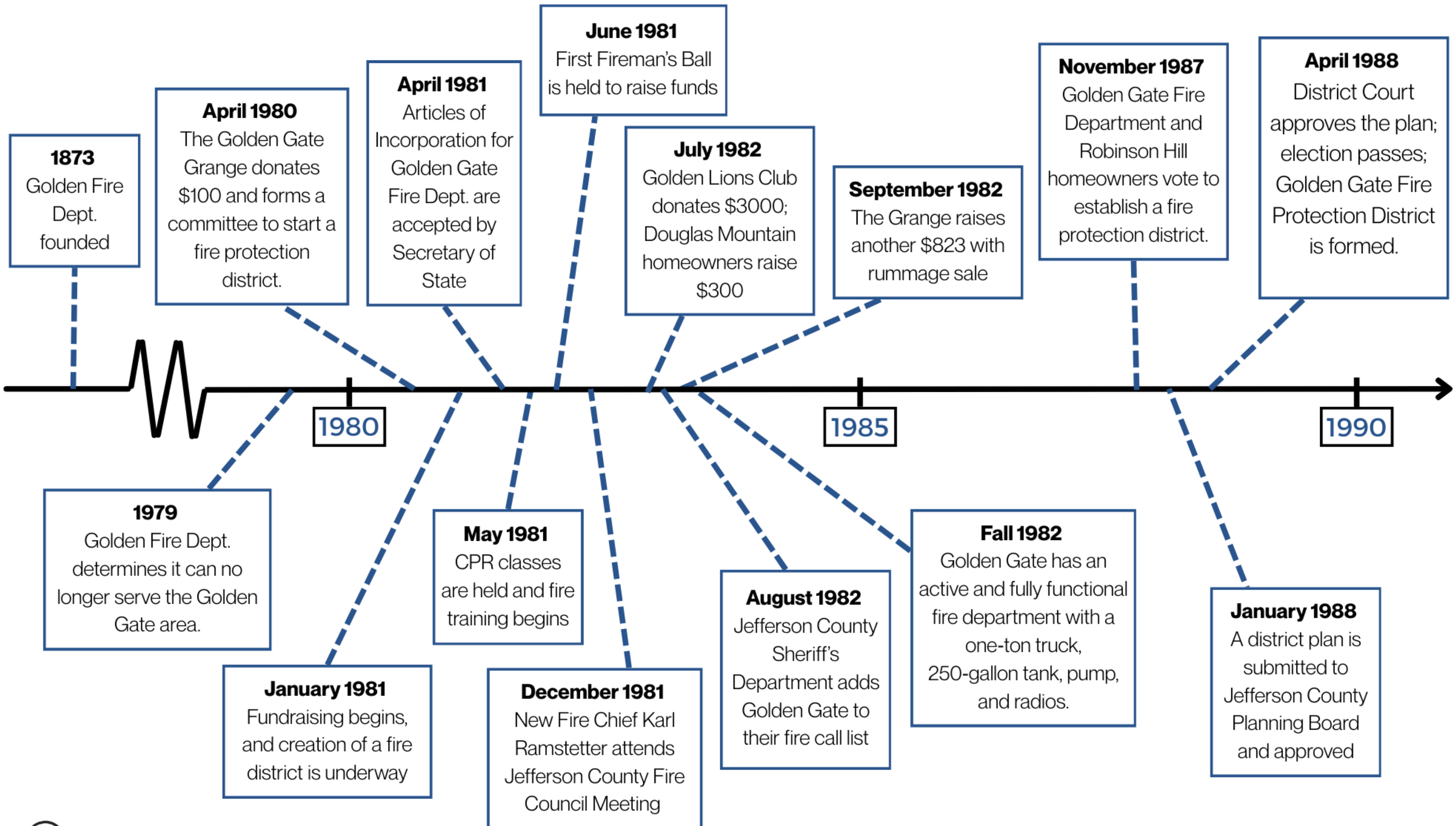
Golden Gate Canyon has a rich heritage reaching back well over a thousand years. Prehistoric sites excavated in the Van Bibber drainage revealed the presence of Woodland Occupation, 600-1000 A.D.

Historic Native American tribes, chiefly Arapahoe, migrated through the region with historic campsites having been found throughout. Arapahoe travois trail left the prairie through the original Indian Gulch, used the backs of the mountains to reach Guy Gulch, crossed into the Elk Creek drainage and turned northwest to follow Smith Hill Road to the junction with Clear Creek. Early settlers spoke of shoeing Native American ponies and of the Native American's amusement at the wagon roads crawling through the bottoms of the canyons instead of staying to the rolling backs of the mountains

In the 1850s gold seekers poured by the thousands through Gregory's original route from the current entrance to Golden Gate Canyon to Centennial House in Guy Gulch to Black Hawk. The canyon opening became Golden's Gate City, founded by Tom Golden. His name remains connected to prominent features within GGFP, such as Golden Gate Canyon, Golden Gate Park and Mt. Tom.

Most roads in the district were named for early settlers. The five one-room grade schools took the names of their locations and served as community centers. Belcher Hill School still sits on private land near the junction of Crawford Gulch and Belcher Hill Roads. The Guy Hill School as well as one of the Pearce family cabins have been moved to the History Park along Clear Creek in the city of Golden.

Establishment of Golden Gate FPD



The Ember Alliance

Sources: The Golden Gate Grange, Terri Costeldia

Landscape

The GGFPD landscape is characterized by a mix of ponderosa pine forests, which are scattered throughout the district, interwoven with other vegetation types. Mixed conifer forests cover about 12% of the area and are found in higher elevations and transitional zones. A large, continuous expanse of lodgepole pine dominates the northwestern portion of the district, covering around 10% of the landscape.

Grasslands are most prominent in the southern part of the district, particularly in the south-central area, with some extending into the northeastern portion. Shrublands and Gamble oak shrublands are dispersed across the landscape. Riparian corridors, lined with hardwood species, follow streams and rivers, creating linear bands of vegetation through valleys and lower elevations.

Pinyon-juniper woodlands are limited but present, mainly in the southwestern region. Spruce-fir forests appear in small, isolated patches at higher elevations, contributing to the district's diverse forest composition.

The district falls within the Clear Creek Watershed boundary with approximately half the district within the Lower Clear Creek subbasin and half within the Ralston Creek subbasin. Water flowing in Lower Clear Creek ultimately meets up with Clear Creek while water within Ralston Creek flows into Ralston Reservoir and Arvada Reservoir. Ralston Reservoir serves as a water storage facility owned and operated by Denver Water while Arvada Reservoir provides water storage and recreation for the City of Arvada. The Ralston Creek area is of particular significance due to its higher risk of severe wildfire, debris flow, and sedimentation to water storage.

The City of Golden lies to the southeast of the district with large areas of concentrated development. Within the district, developed areas are concentrated in the southwest region or Robinson Hill plan unit. Small areas of agriculture and open water exist but account for only a minor portion of the total land cover (**Figure 2.a.3**). Black bear, elk, mountain lion, moose and mule deer are some of the large wildlife found in the district.

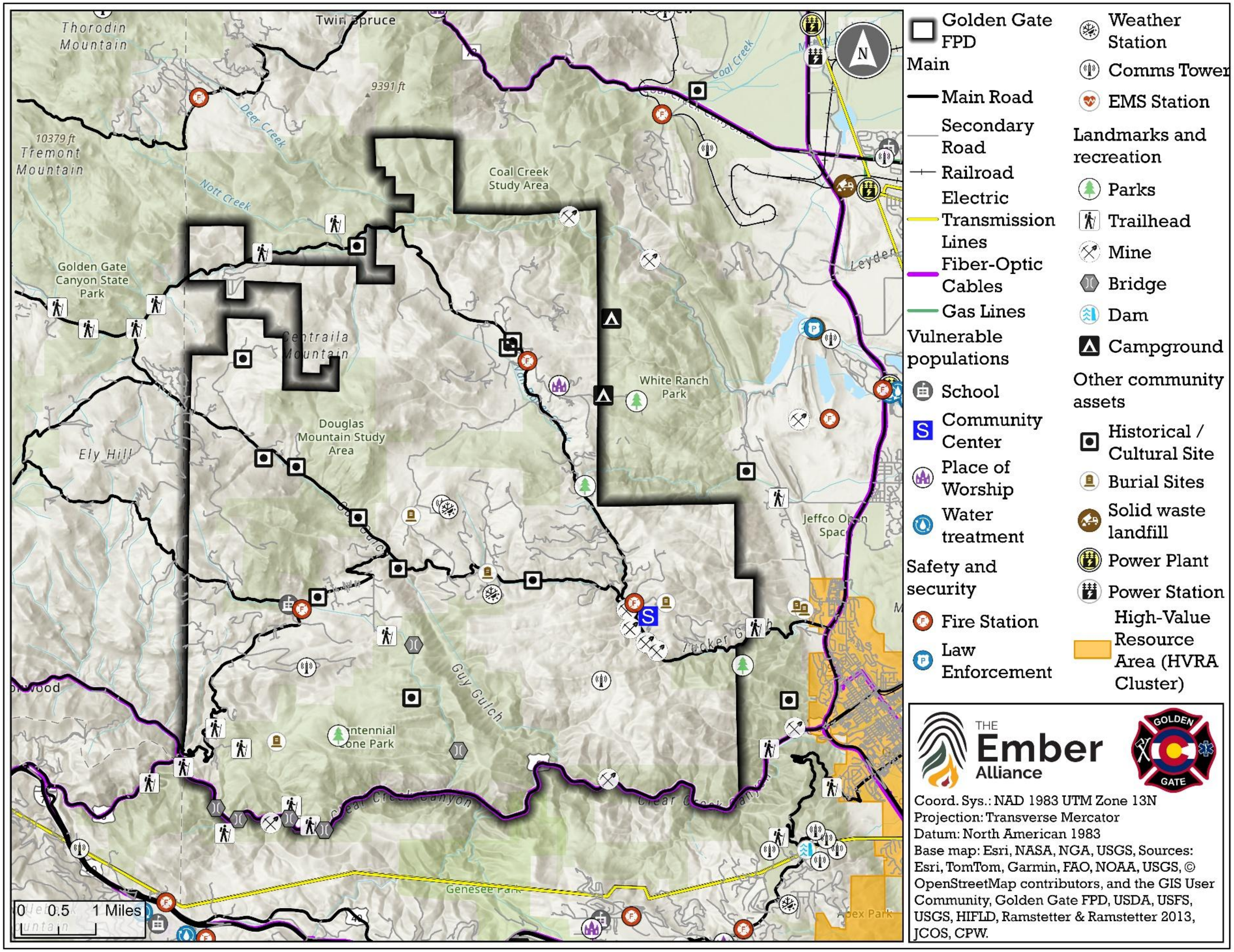


Figure 2.a.1. Non-residential values within and around GGFPD. Sources: Golden Gate FPD, USDA, USFS, USGS, HIFLD, Ramstetter, JCPOS, CPW.

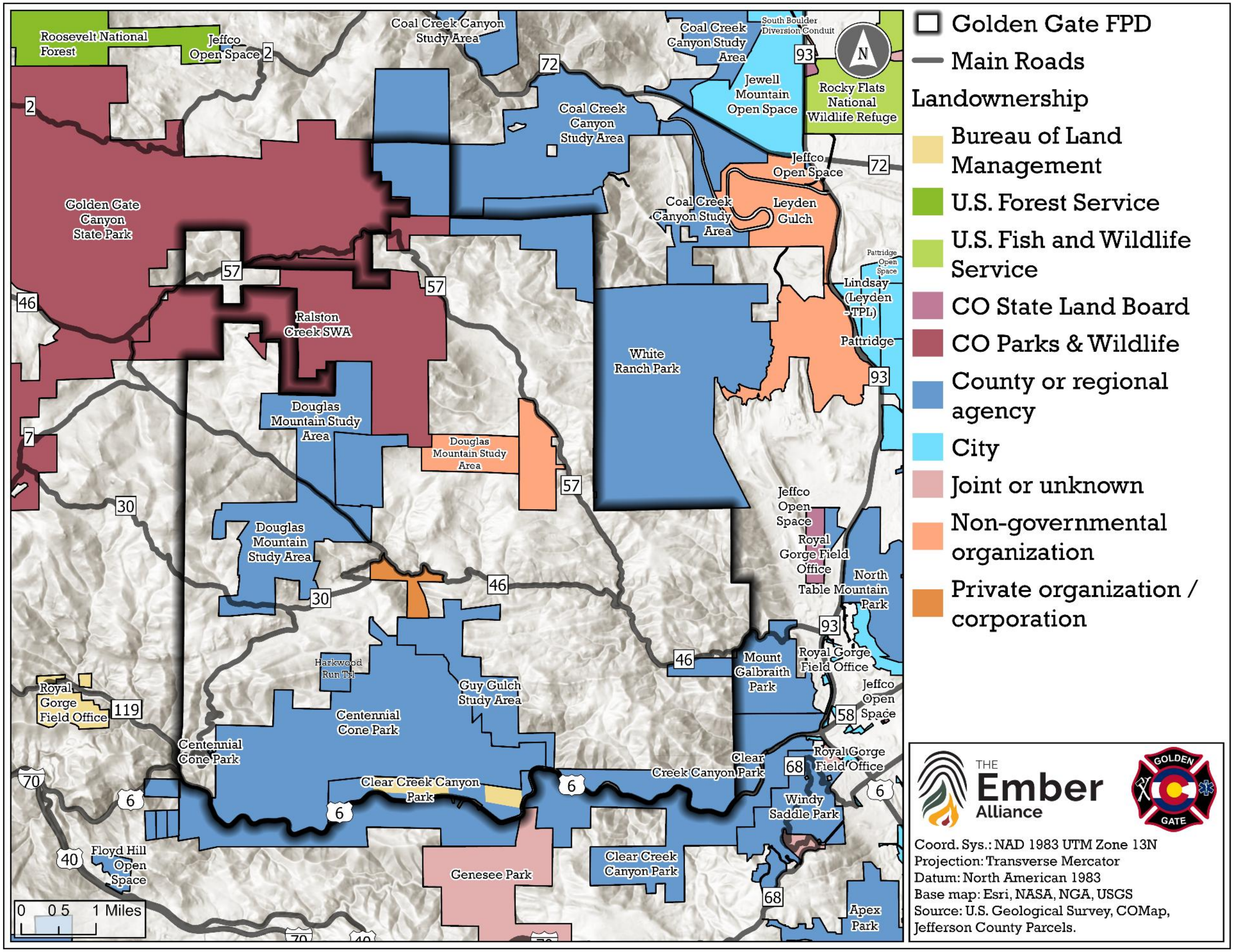


Figure 2.a.2. *Publicly owned land across GGFPD. Source: U.S. Geological Survey Protected Area Database.*

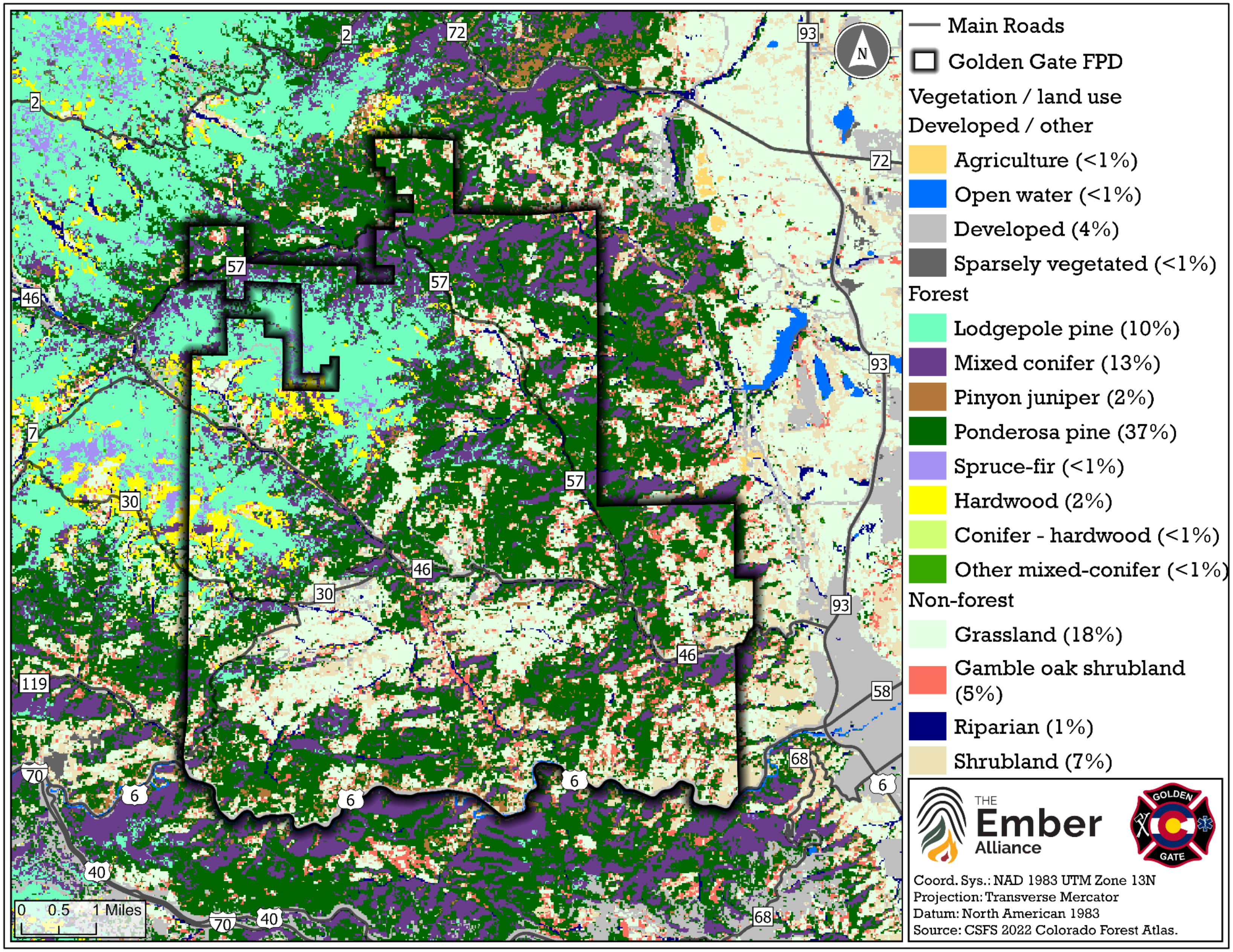


Figure 2.a.3. *Map of vegetation across GGFPD. Major vegetation types include ponderosa pine, mixed conifer, and lodgepole pine. Source: Colorado State Forest Service, Colorado Forest Atlas 2022.*

2.b. District Capacity

GGFPD is an all-volunteer department apart from the Fire Chief who is part-time. On their force are 25 volunteers, all of whom are structure and wildland trained. Within their 63 square mile response area, GGFPD protects close to 800 structures, serving 475 households and approximately 1200 residents. The average response time within the district is 16 minutes from the time of call to arrival on scene. GGFPD has 3 stations throughout the district with the following apparatus:

Overall District Resources	
Apparatus	**Quantity**
Type 1 Engine	1
Type 3 Engine	2
Type 6 Engine	2
Tactical Tender	1
Utility Task Vehicle (UTV)	2
Utility Vehicles	3
Cistern	2

Fire Station #81: (32360 Robinson Hill Road)
Centered in the southern portion of the Robinson Hill Plan Unit, this station primarily serves the western edge of the district.

Station 81 Resources	
Apparatus	**Quantity**
Type 3 engine	1
Type 6 engine	1
UTV	1
Utility Vehicle	1
Cistern	1

GGFPD Fire Station #81. Photo Credit: GGFPD

Fire Station #82: (7181 Crawford Gulch Road)

Centrally located within the Upper Crawford Gulch Plan Unit, this station serves the eastern and central region of the district.

Station 82 Resources	
Apparatus	**Quantity**
Type 1 engine	1
Type 3 engine	1
UTV	1
Utility Vehicle	1
Cistern	1

Station #82 within GGFPD. Photo Credit: GGFPD

Fire Station #83: (25231 Golden Gate Canyon Rd)
Next to the Golden Gate Grange community center in the southeast corner of the Lower Crawford Gulch Plan Unit, station 83 serves the southeastern region of the district.

Station 83 Resources	
Apparatus	**Quantity**
Type 6 engine	1
Tactical tender	1

GGFPD Station #83. Photo Credit: GGFPD

Mutual Aid Agreements: GGFPD maintains mutual aid agreements with Golden FD, Timberline FD and Arvada FD, and is party to the Jefferson County mutual aid agreement.

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 2020 Cameron Peak Fire, which destroyed 469 structures; the 2020 East Troublesome Fire, which destroyed at least 366 structures; and the 2021 Marshall Fire, which destroyed over 1,000 structures. (See **Appendix A**: Introduction to Wildfire Behavior and Terminology for a discussion about how wildfire 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 (Mowry and Johnston, 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 (**Error! Reference source not found.**). The WUI is o ften 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 wildland-urban occluded refers to places where wildland vegetation is surrounded by the built environment (Johnston, 2018).

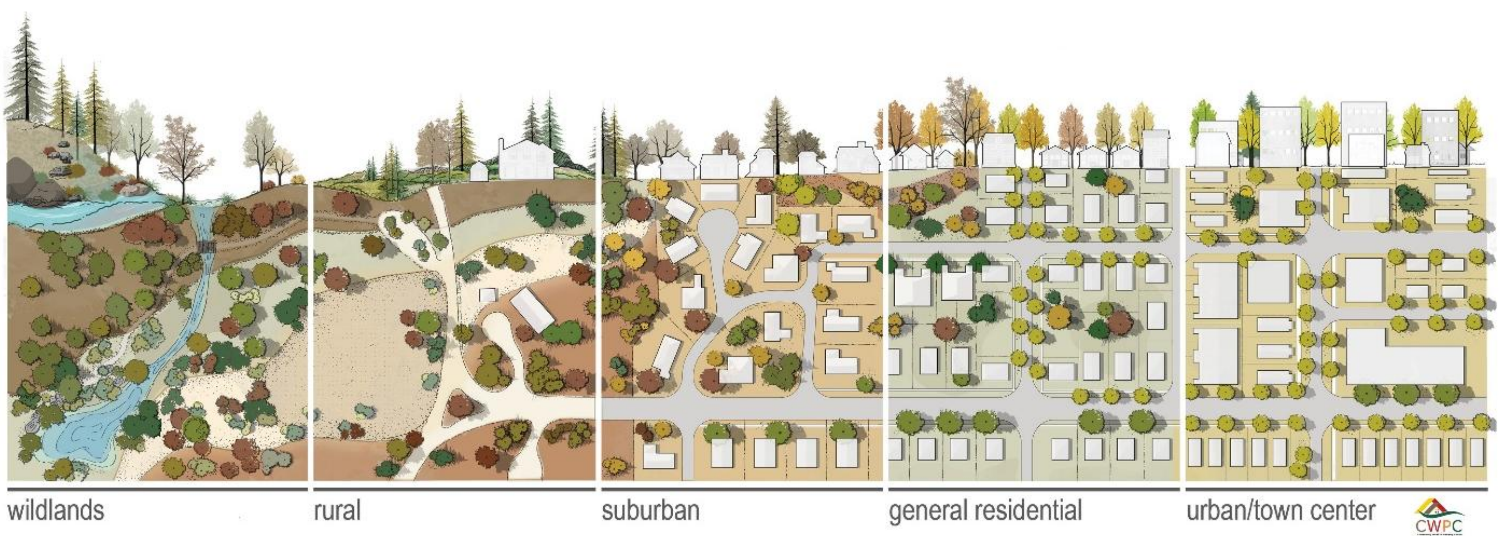


***Figure 2.c.1**. The wildland-urban interface exists along a continuum of wildland to urban densities. Source: Community Wildfire Planning Center.*

When delineating the Golden Gate CWPP WUI boundary, both the Jefferson County and Gilpin County CWPPs were referenced for their WUI definitions. As 100% of the district falls within Jefferson County's WUI definition, the Golden Gate CWPP WUI boundary delineation began with the district boundary and was expanded to include potential operational delineations (PODs) boundaries that extend outside of the district. This allows the Golden Gate CWPP WUI to capture not just populated areas but also portions of the landscape where fires could originate and spread into the community. Proactive and strategic management along POD boundaries and within PODs can protect lives and property in the district, including protecting primary evacuation routes. (

Figure 2.c.2; see methodology in **Appendix B**: Community Risk Assessment and Modeling Methodology).

Over the past 50 years, immigration to the mountains west of Denver increased the number of occupied structures 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.

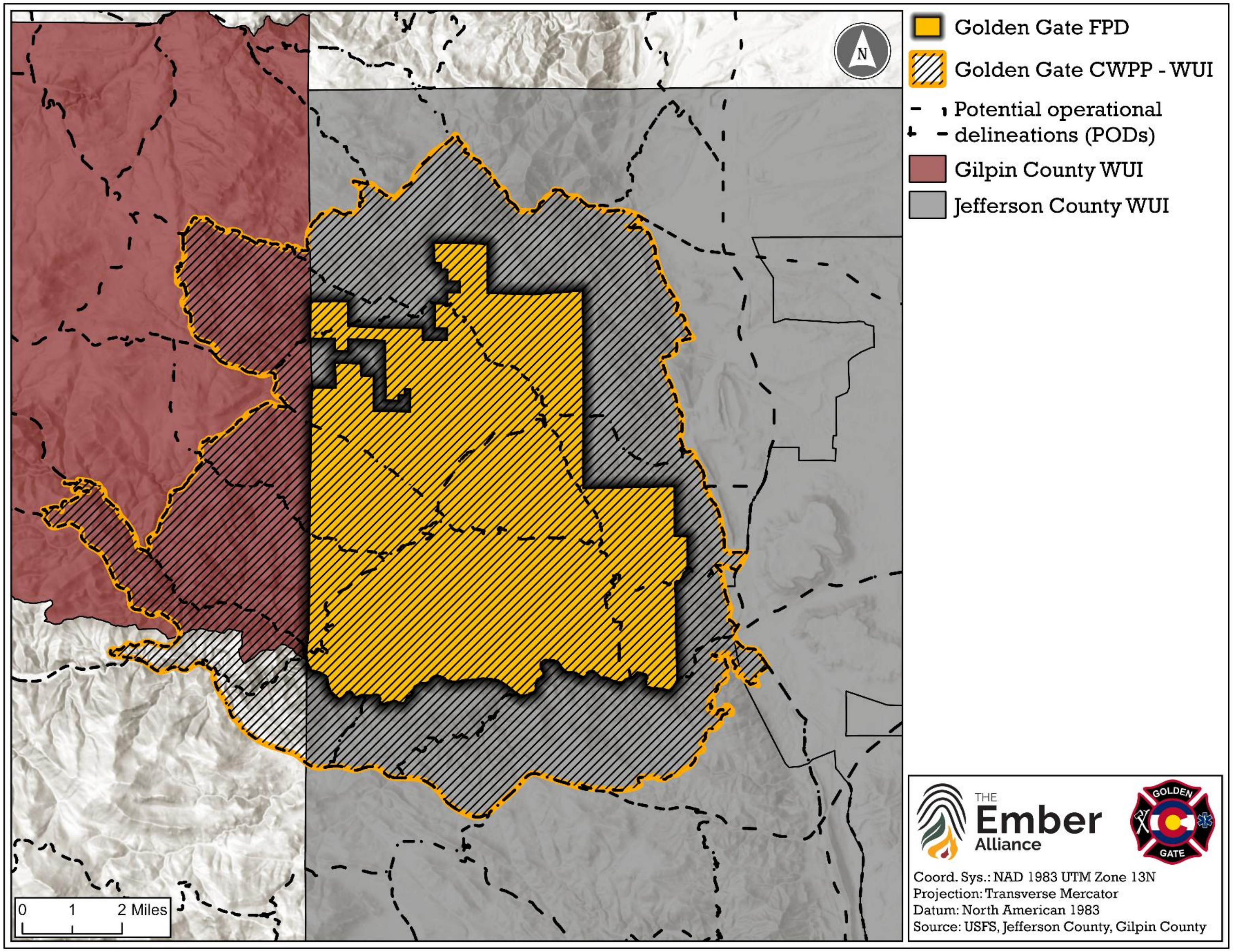


Figure 2.c.2. *All residents of GGFPD live in the wildland-urban interface and/or intermix as defined by the Jefferson County CWPP and are exposed to elevated wildfire risk. The WUI boundary for this CWPP includes all GGFPD, the surrounding landscape that could transmit wildland fire into GGFPD, and the area along important evacuation routes (see methodology in* ***Appendix B****: Community Risk Assessment and Modeling Methodology).*

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

Frequent wildfires significantly shaped Colorado's Front Range before the era of fire suppression. Whether started by Indigenous peoples or naturally, 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 farming, 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-adapted and fire-resilient ecosystems that existed before.

Significant wildfire incidents since 1970 are very limited within the district, with only two wildfires in recent memory, Indian Gulch and Goltra. To get a complete idea of wildfire history, the focus needs to be larger than the district alone. (**Figure 2.e.2**) shows wildfires in areas surrounding the district from 1970 onward. These fires are a good illustration of the type and size of potential significant wildfires that can occur within the district. There have been 28 large wildfires in the last 50 years (defined by NWCG's Incident Management Situation Report (IMSR) as greater than 100 acres in timber fuel models or 300 acres in grass fuel models). These wildfires begin with the Murphy Gulch fire in October 1978, west of Johns Manville World Headquarters, and end with the most recent Quarry fire in 2024, just a handful of miles south of the district.

Along the Front Range there have been many large catastrophic wildfires. The first large wildfire was the Hayman fire in 2002, and for over 20 years this remained the most destructive wildfire in the area, and the state, until the Cameron Peak and East Troublesome fires in 2020. In 2024 alone, the Front Range had three large fires: the Alexander Mountain and Stone Canyon fires in Boulder County and the Quarry fire in Jefferson County.

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).

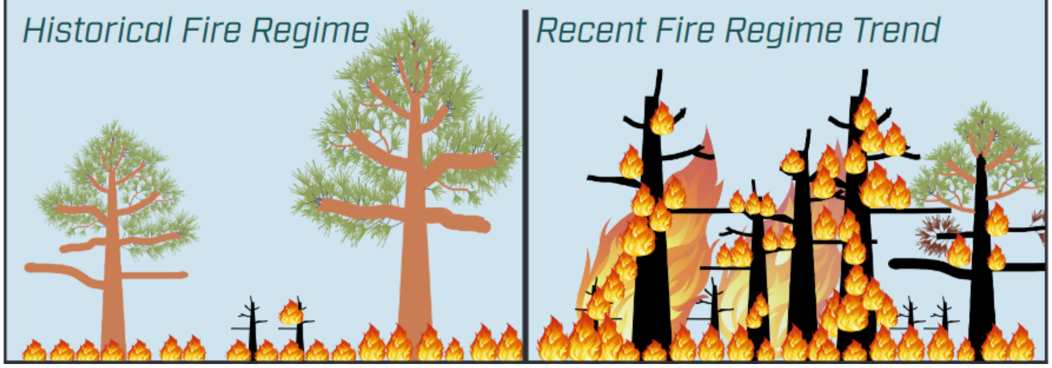
Although catastrophic wildfires are typically associated with warmer "fire season" months from May-September, high winds and dry fuels that persist into the winter can create conditions that quickly drive fire across the landscape. This was demonstrated by the Marshall Fire that occurred in late December, 2022-early January, 2023 in Boulder County, making destructive wildfires a year-round risk for communities including GGFPD.

Ponderosa Pine Mixed Conifer (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)

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

Ponderosa pine mixed conifer forests are fire dependent. Historically, fire burned across the forest floor, controlling tree regeneration, hardening mature trees, and leaving 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.

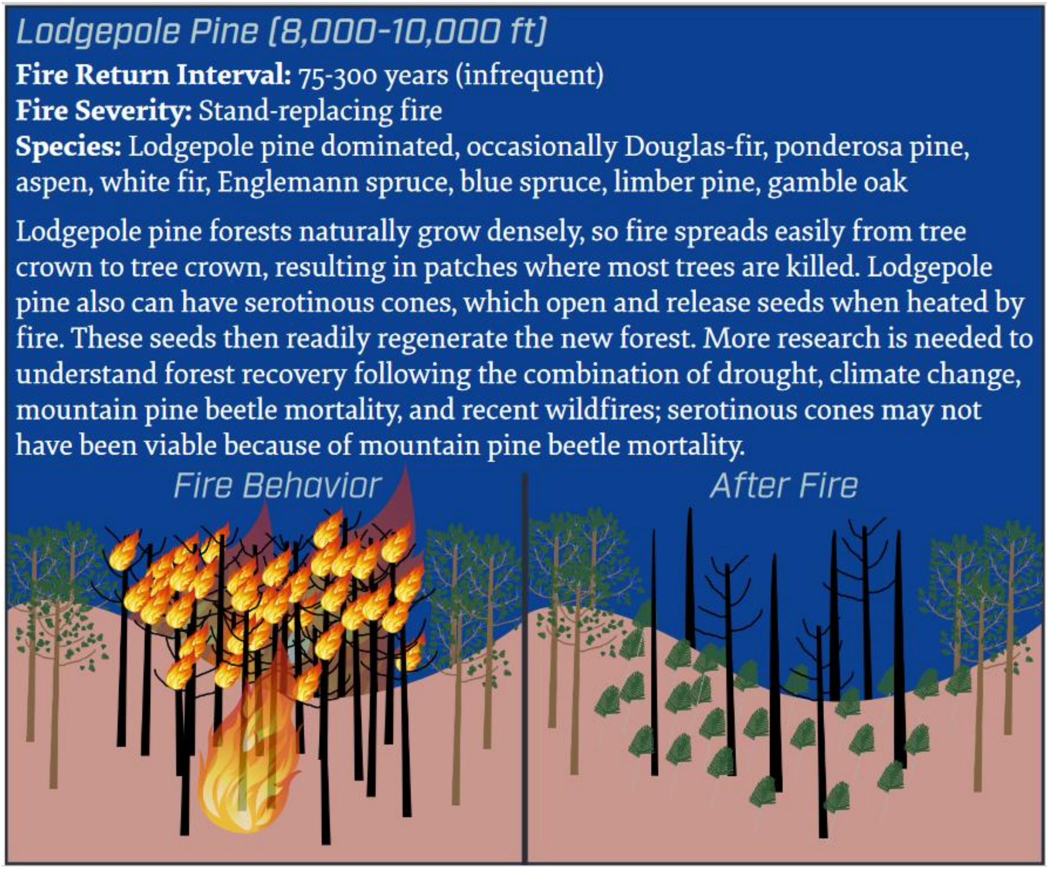


Douglas-fir Mixed Conifer (6,000-9,500 ft)

Fire Return Interval: 20 to >100 years (semi-frequent)
Fire Severity: Moderate-severity with patches of stand-replacing fire
Species: Douglas-fir, ponderosa pine, lodgepole, aspen, white fir, occasional spruce, limber pine, gamble oak

Douglas-fir mixed conifer forests contain a diversity of tree species, many of which are not as fire tolerant as species in ponderosa pine mixed conifer forests. These forests also tend to be cooler and wetter than lower elevation ponderosa pine forests, and as a result do not burn as frequently. These forests are naturally denser than lower elevation forests, and when fire burns in these areas, patches of stand-replacing fire can be common.

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..*



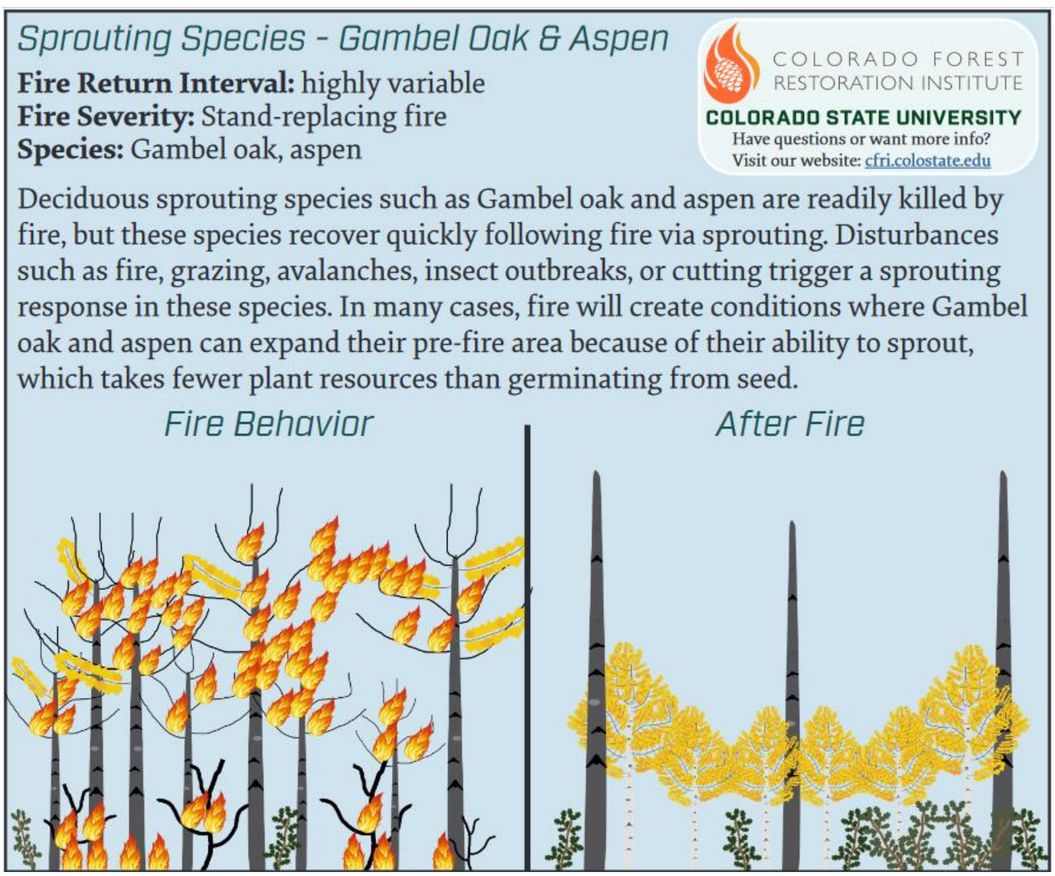


***Figure 2.e.1**. (Continued). Other forests experienced more infrequent but high-severity wildfires in the past, and this fire behavior persists today. Source: Colorado Forest Restoration Institute.*

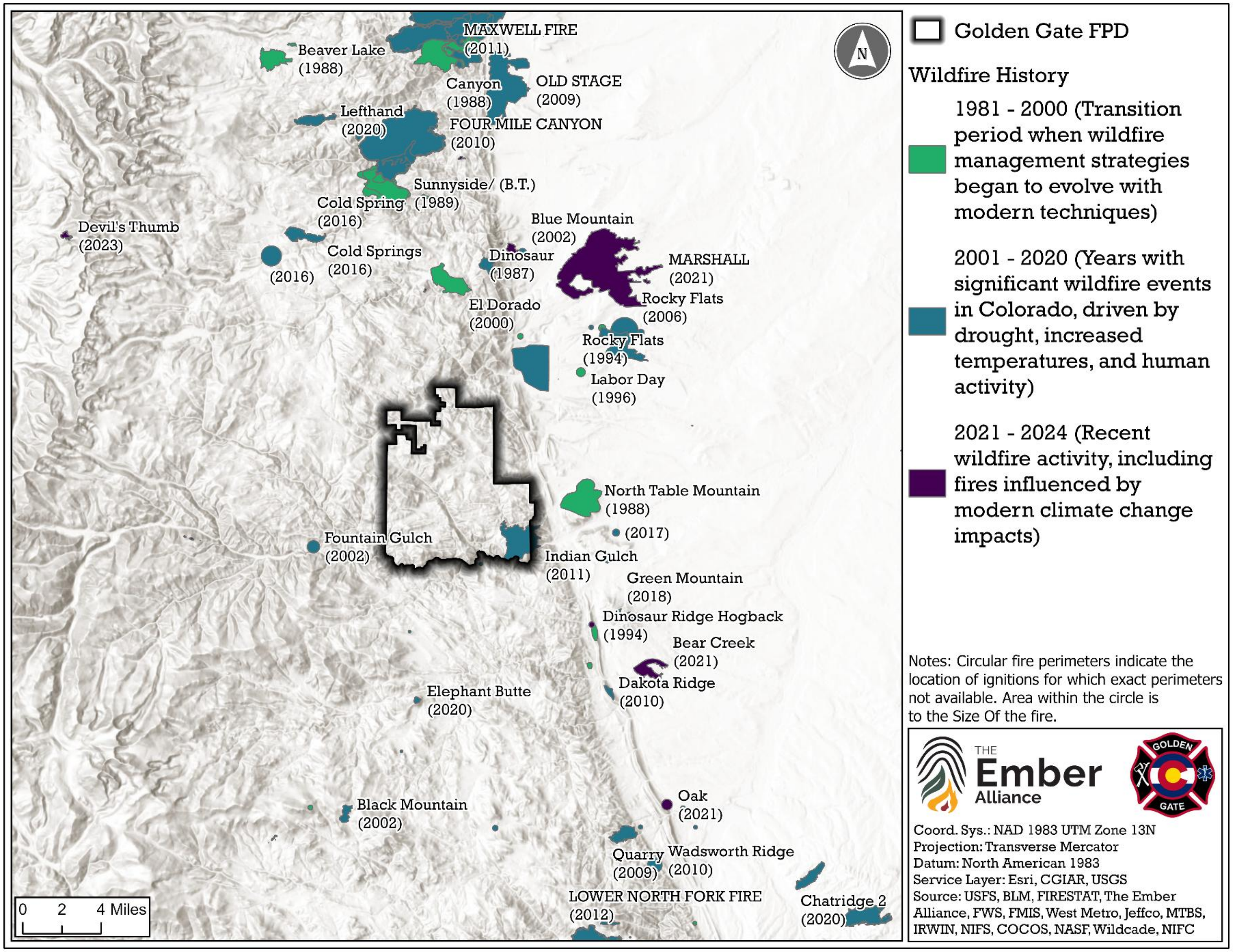


Figure 2.e.2 *Many significant wildfires have burned around GGFPD. While fires within GGFPD have been small to date, there is significant potential for large fire growth under hot, dry, and windy conditions. Source: USFS, BLM, FIRESTAT, The Ember Alliance, FWS, FMIS, West Metro, Jeffco, MTBS, IRWIN, NIFS, COCOS, NASF, Wildcade, NIFC.*

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

All areas within GGFPD 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. Implementing recommendations in this CWPP will go a long way towards helping the district become a fire adapted community.**

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 fire behavior analyses at a landscape scale to assess relative risk across the entire district.

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

See **Appendix B**: Community Risk Assessment and Modeling Methodology for details on fire behavior modeling used for this CWPP.

Potential Fire Behavior

Topography and fuel conditions are highly variable across the district (**Figure 2.f.1**), and this variation, plus alignment between wind patterns and topography, help explain the patterns of potential fire behavior. 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 extreme fire weather conditions—hot, dry, and windy conditions – 84% percent of the district is at risk of high to extreme fire behavior (**Figure 2.f.2**). 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 difficult, if not impossible, to control until winds subside and fuel conditions—such as type, density, arrangement, and moisture content—change.. Fire growth could be extensive across the district if wildland firefighters cannot engage due to dangerous conditions from extreme fire behavior and if wildland fire moves rapidly through shrublands and grasslands. Wildfires burning on hot, dry, and windy days could spread across large portions of Golden Gate. Potential fire growth and spread are strongly affected by the initial location of a fire ignition, wind speed and direction, topography, and fuels in the pathway of the fire. Under extreme fire weather with conditions fueling fires exhibiting long flame lengths and abundant ember production, fires could even spread across major roads in Golden Gate.

The potential for extreme fire behavior within the GGFPD is widespread across the district, with the highest concentration in the northern region where there are dense forests on steep slopes with lots of ladder fuels or fuels that can connect surface fuels to the canopy above. Moderate fire behavior is observed in scattered patches throughout the district, due to lower fuel densities and flatter terrain, where fires are more likely to burn as creeping surface fires. However, due to many trees with lower crown base height, torching in more open ponderosa stands is still a high possibility in trees with low hanging limbs. Open grassy areas and sparsely vegetated regions across the district could experience fast-moving surface fires, particularly during high-wind events. The mix of forest types and housing developments in the district poses additional risks, as homes and other structures can act as additional fuel sources, intensifying fire behavior and contributing to ember cast and potential structure-to-structure ignitions. The areas with expected moderate fire behavior can still experience extreme fire behavior during extreme drought and high wind events.

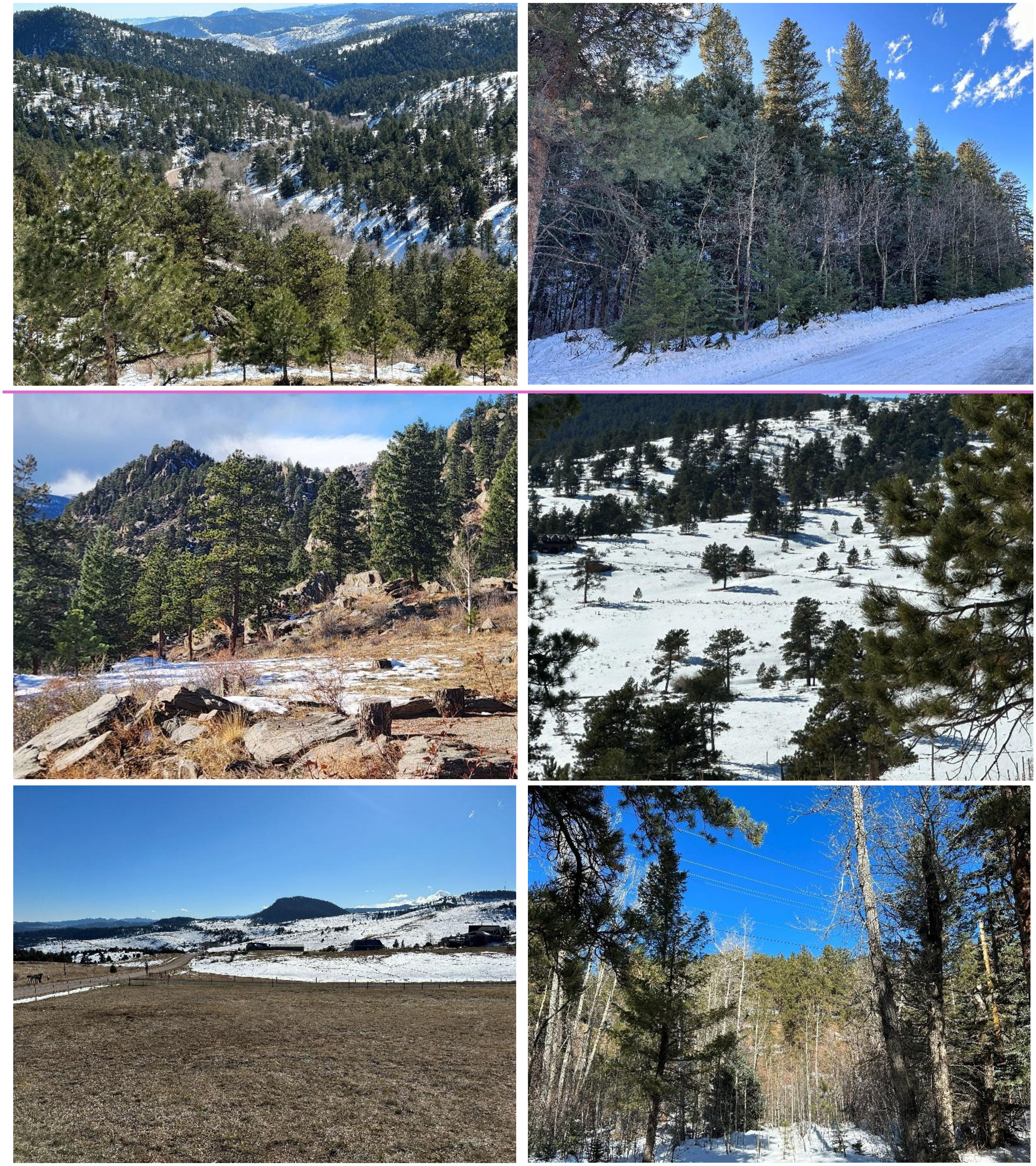


Figure 2.f.1 *Fuel loads are variable across GGFPD, ranging from dense forests with abundant ladder fuels (top), to open forests with moderately spaced trees and few ladder fuels (middle right), to grasslands and agricultural lands with scattered trees (bottom left). Fuel type and fuel loads greatly influence fire behavior, intensity, and rate of spread. Photo credit: The Ember Alliance*

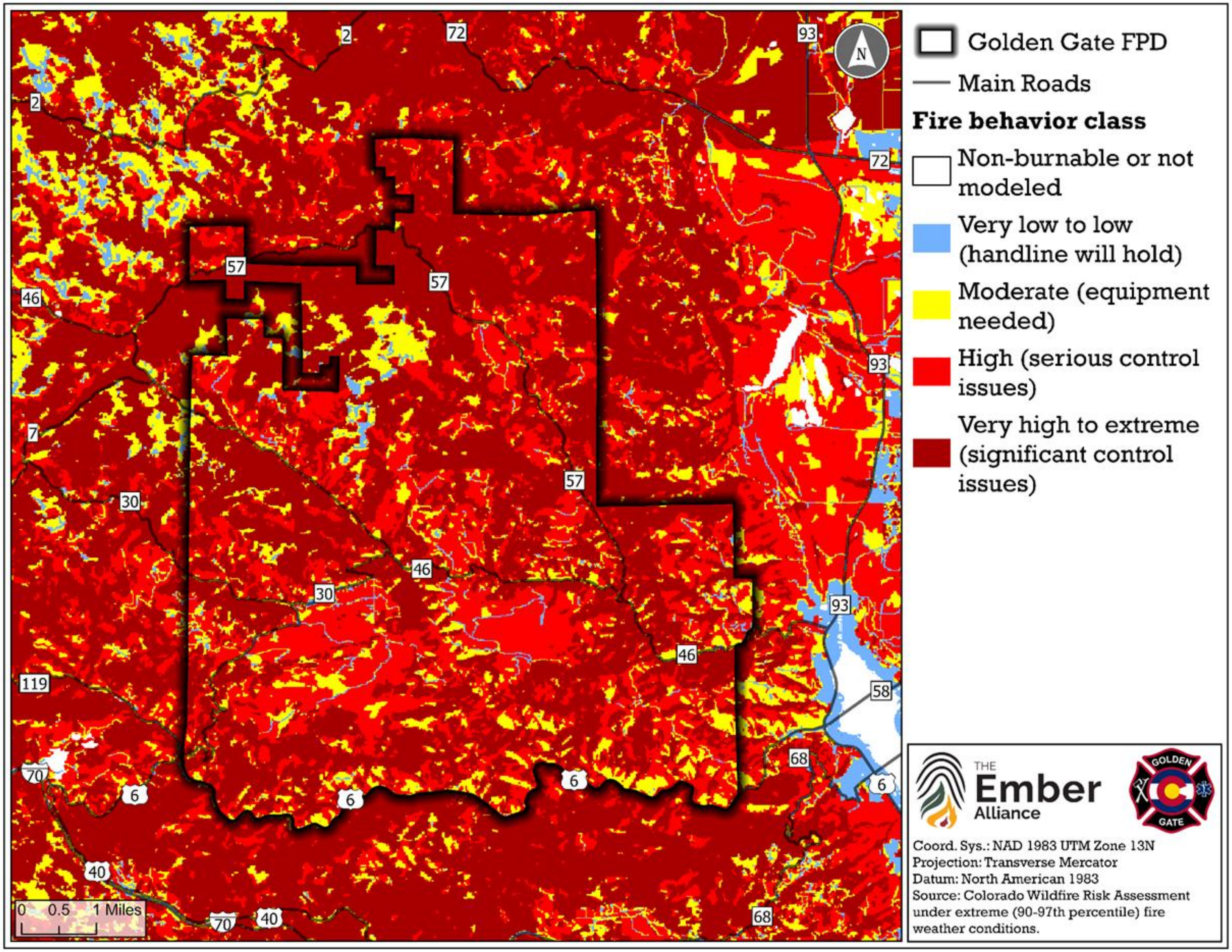


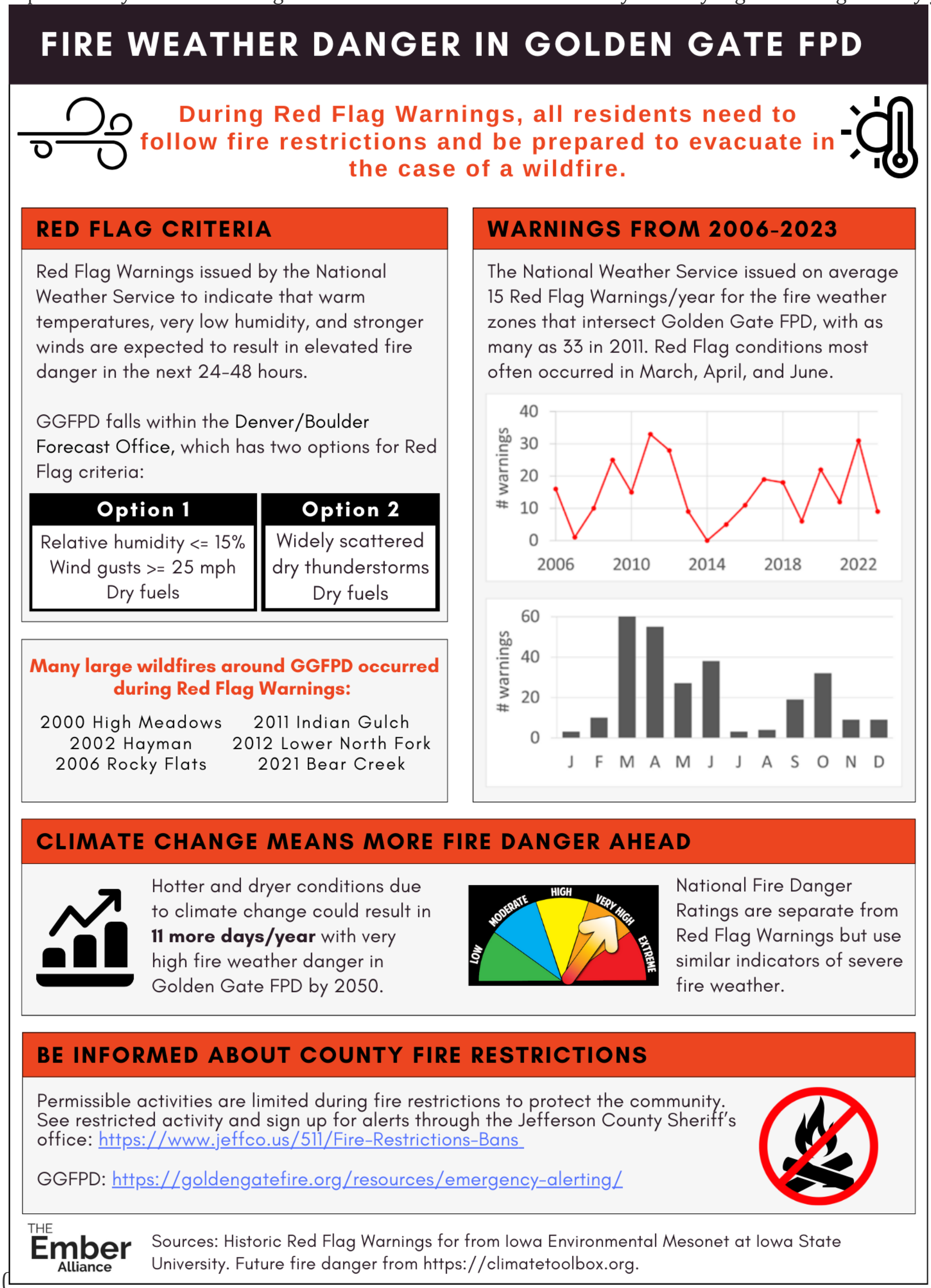
Figure 2.f.2 *Under extreme fire weather conditions—conditions that often occur throughout the summer in GGFPD—84% percent of GGFPD is at risk of high to extreme fire behavior. High to extreme fire behavior is more likely to produce embers that ignite additional fires away from the main fire and ignite homes. Such fires are extremely challenging if not impossible to control until winds die down and fuel moistures increase. (See* ***Appendix B****: Community Risk Assessment and Modeling Methodology for a description of fire behavior modeling for this CWPP.*

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 2023 Colorado All Lands (COAL) wildfire assessment from the U.S. Forest Service, the district has some of the highest burn probability in the state of Colorado.

High burn probabilities occur in much of the district due to the potential for rapid rates of fire spread across steep, complex terrain covered in dense coniferous forests or areas with abundant ladder fuels. These characteristics make much of the district highly susceptible to wildfire under extreme fire weather conditions (**Figure 2.f.3**).

Another metric of the likelihood of wildfires is the frequency of days with weather conducive to large-scale fire growth. The district frequently experiences days with weather conducive to large-scale fire growth. Factors such as low humidity, high temperatures, steep terrain, and strong winds contribute to this risk. 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 highly variable from year to year due to regional weather patterns and weather anomalies such as El Niño and La Niña. On average, the district experiences 15 days per year of weather conditions that qualify as red flag warnings, with annual counts up to 33 days. Climate change could result in at least 11 more days of very high fire danger every year by



2050 (**Figure *2.f.4***).

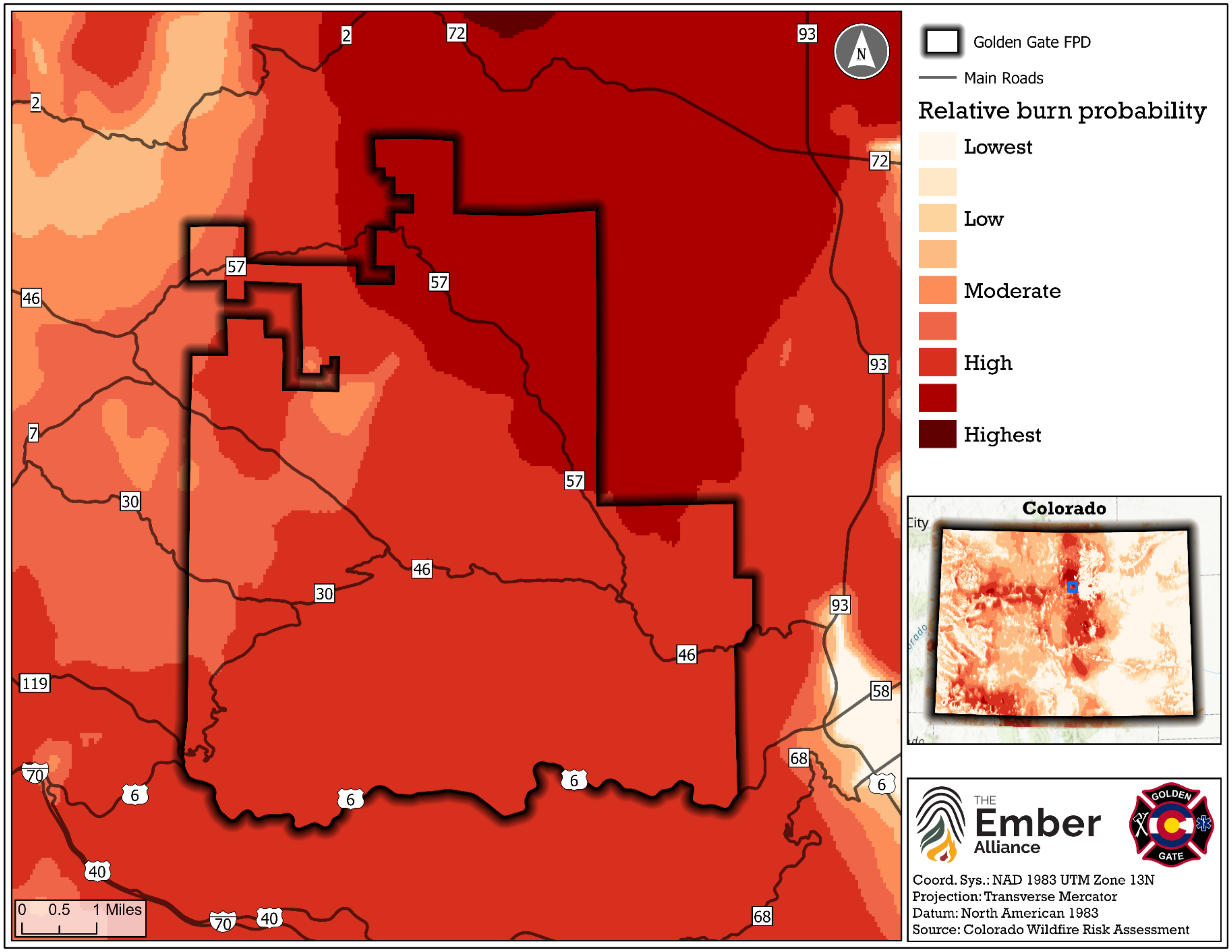


*Figure 2.f.3 Most of GGFPD falls into the high burn probability category relative to the state of Colorado. Predictions are based on simulations under high to extreme fire weather conditions. Source: Colorado Wildfire Risk Assessment (CO-WRA). (See **Appendix B**: Community Risk Assessment and Modeling Methodology for a description of fire behavior modeling for this CWPP.)*

FIRE WEATHER DANGER IN GOLDEN GATE FPD

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 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.

GGFPD falls within the Denver/Boulder Forecast Office, which has two options for Red Flag criteria:

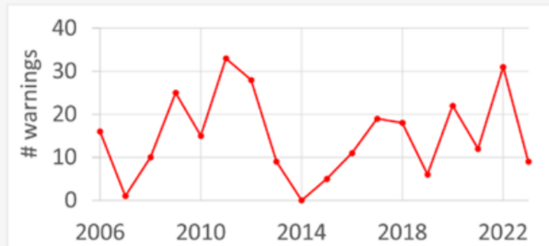
Option 1	Option 2
Relative humidity <= 15% Wind gusts >= 25 mph Dry fuels	Widely scattered dry thunderstorms Dry fuels

Many large wildfires around GGFPD occurred during Red Flag Warnings:

2000 High Meadows
2002 Hayman
2006 Rocky Flats
2011 Indian Gulch
2012 Lower North Fork
2021 Bear Creek

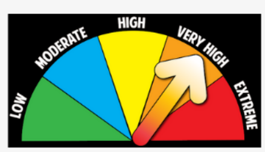
WARNINGS FROM 2006-2023

The National Weather Service issued on average 15 Red Flag Warnings/year for the fire weather zones that intersect Golden Gate FPD, with as many as 33 in 2011. Red Flag conditions most often occurred in March, April, and June.



CLIMATE CHANGE MEANS MORE FIRE DANGER AHEAD

Hotter and dryer conditions due to climate change could result in **11 more days/year** with very high fire weather danger in Golden Gate FPD 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. See restricted activity and sign up for alerts through the Jefferson County Sheriff's office: https://www.jeffco.us/511/Fire-Restrictions-Bans

GGFPD: https://goldengatefire.org/resources/emergency-alerting/

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.4 *GGFPD experiences on average 15 days with weather conditions that qualify as Red Flag Warnings. Climate change could further increase the number of Red Flag Warning days to 26 per year by 2050. 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 create non-survivable conditions along roadways, which is of particular concern in the district where there are few points of egress for an evacuation. Under extreme fire weather conditions, 46% of roads modeled in the district's Title 32 area have at least one section of that road that could experience non-survivable conditions. When considering stretches of road, 41% of the total road length within the district is considered potentially non-survivable. (**Figure 2.f.5**). Evacuation preparedness is of the utmost importance for residents in neighborhoods with hazardous conditions along roadways (see **Evacuation Preparedness**).

Several non-residential highly valued resources and assets (HVRA) within GGFPD could be exposed to damaging wildfire and its effects, including historic sites, recreational areas, critical infrastructure, and municipal drinking water supplies (**Figure 2.f.6**).

The district is home to significant historical structures, including remnants of historic mining settlements that highlight the area's rich gold rush history. The Centennial House, an important example of early mountain homesteads, and the Historic Tallman Homestead, which reflects the region's pioneer-era settlement, are both located within the district. Guy Hill School, a preserved one-room schoolhouse, also stands as a notable historic landmark representing early education in the area.

Recreational and community assets at risk include Golden Gate Canyon State Park, a major outdoor destination known for its trails, campgrounds, and preserved historic structures. The park provides critical wildlife habitat and is a significant public resource for outdoor recreation. Other natural and open space areas within the district include Centennial Cone Park, Clear Creek Canyon Park, and the Douglas Mountain Study Area, all of which contribute to regional conservation and public access to nature.

Additional values at risk include critical infrastructure such as communication towers and fire stations, all of which are essential for community safety and emergency response. The district also contains vital transportation corridors, including Golden Gate Canyon Road, which serves as a primary evacuation and emergency access route during wildfire events. This road is important not only as an evacuation route for Golden Gate residents but residents of Gilpin County as well.

On days with extreme fire weather conditions, 58% of homes within title 32 area could experience damaging radiant heat from burning vegetation, and 100% of homes within the district could be exposed to embers from burning vegetation, regardless of vegetation in the immediate vicinity of the home (**Figure 2.f.7** and **Figure 2.f.8**).

Impacts of wildfires do not end once the flames are extinguished. Intense rainfall events can result in flash floods, erosion, sediment delivery and debris flow the first few years following a wildfire (Neary et al., 2005). High-intensity wildfire can alter soil chemistry, reducing the ability of soils to naturally attenuate runoff from these types of rainfall events. It is very possible that a large storm in the years following a high-intensity wildfire in the district could result in detrimental effects to high value water resources, including erosion and increased sedimentation. Within the district, Ralston Creek is at risk for high severity fires and is critical for municipal drinking water supplies, providing water to both Ralston Reservoir and Arvada Reservoir.

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 including water supplies, 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.

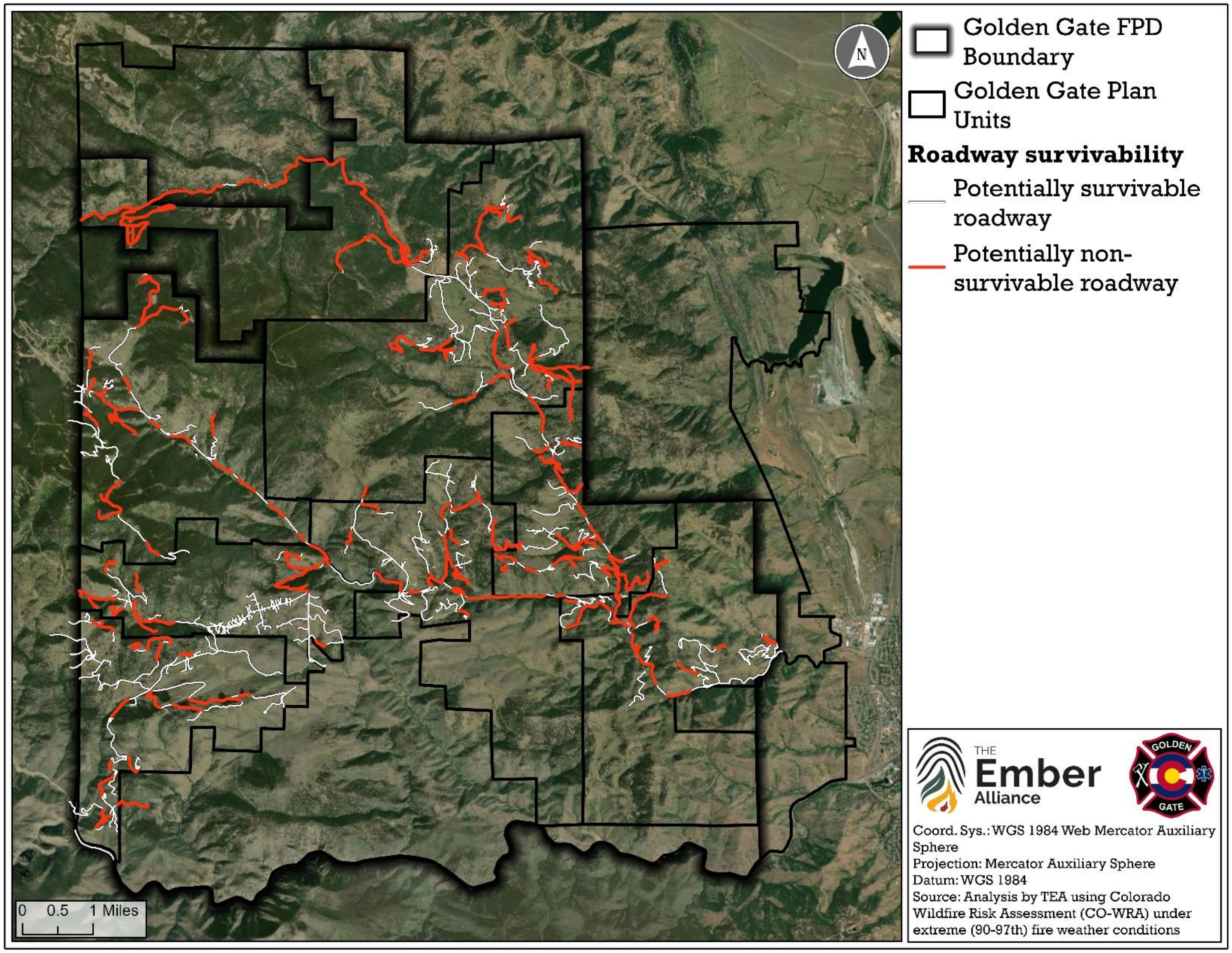


Figure 2.f.5 *Under extreme fire weather conditions, 41% of total road length modeled in GGFPD could experience potentially non-survivable conditions during wildfires (i.e., flame lengths over 8 feet). Source: Analysis by TEA using Colorado Wildfire Risk Assessment (CO-WRA).*

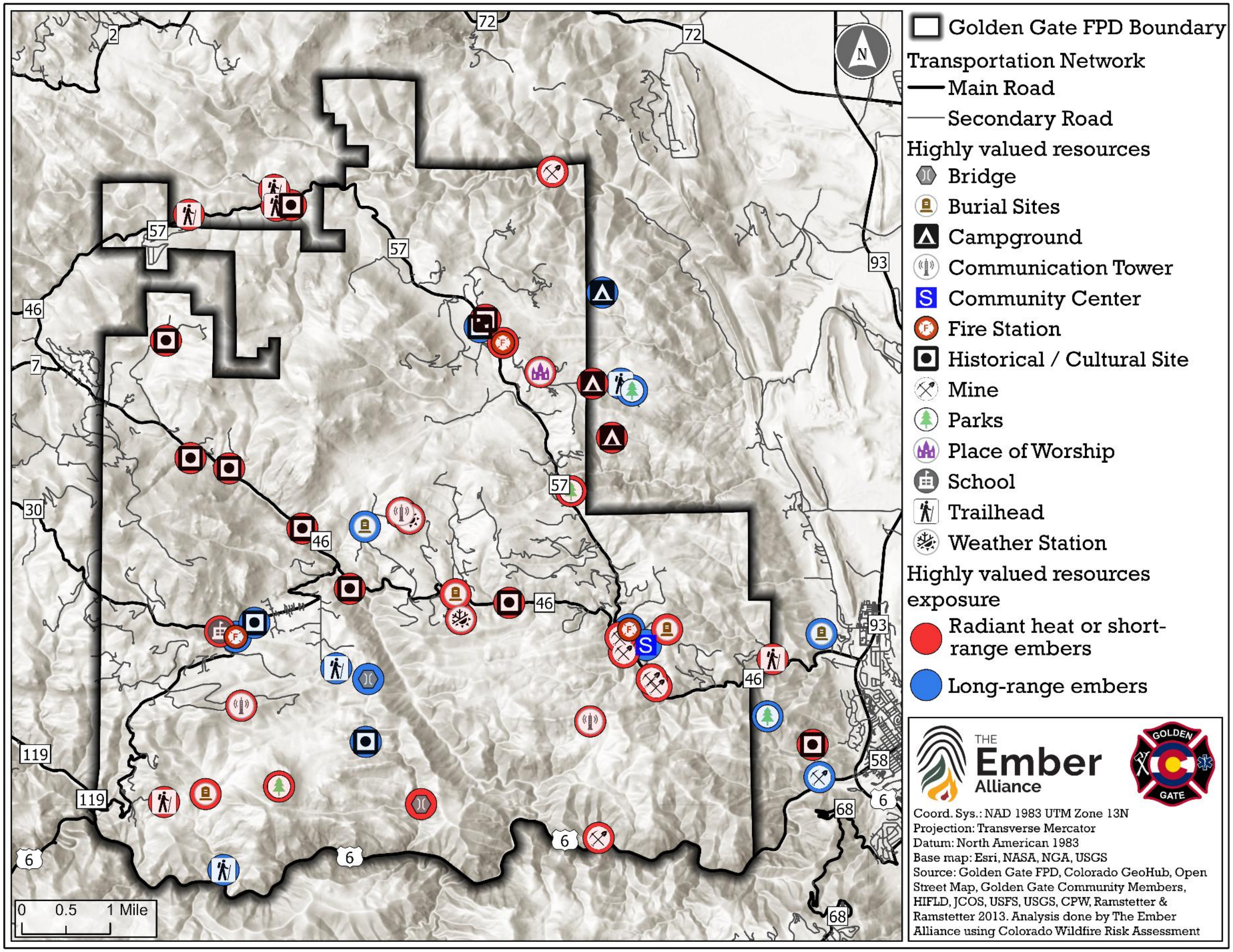


Figure 2.f.6 *The exposure of community identified highly valued resources and assets (HVRAs) to radiant heat, short and long-range embers. Sources: GGFPD, USDA, USFS, USGS, HIFLD, Ramstetter & Ramstetter 2013, JCPOS, CPW. Exposure analysis performed by TEA.*

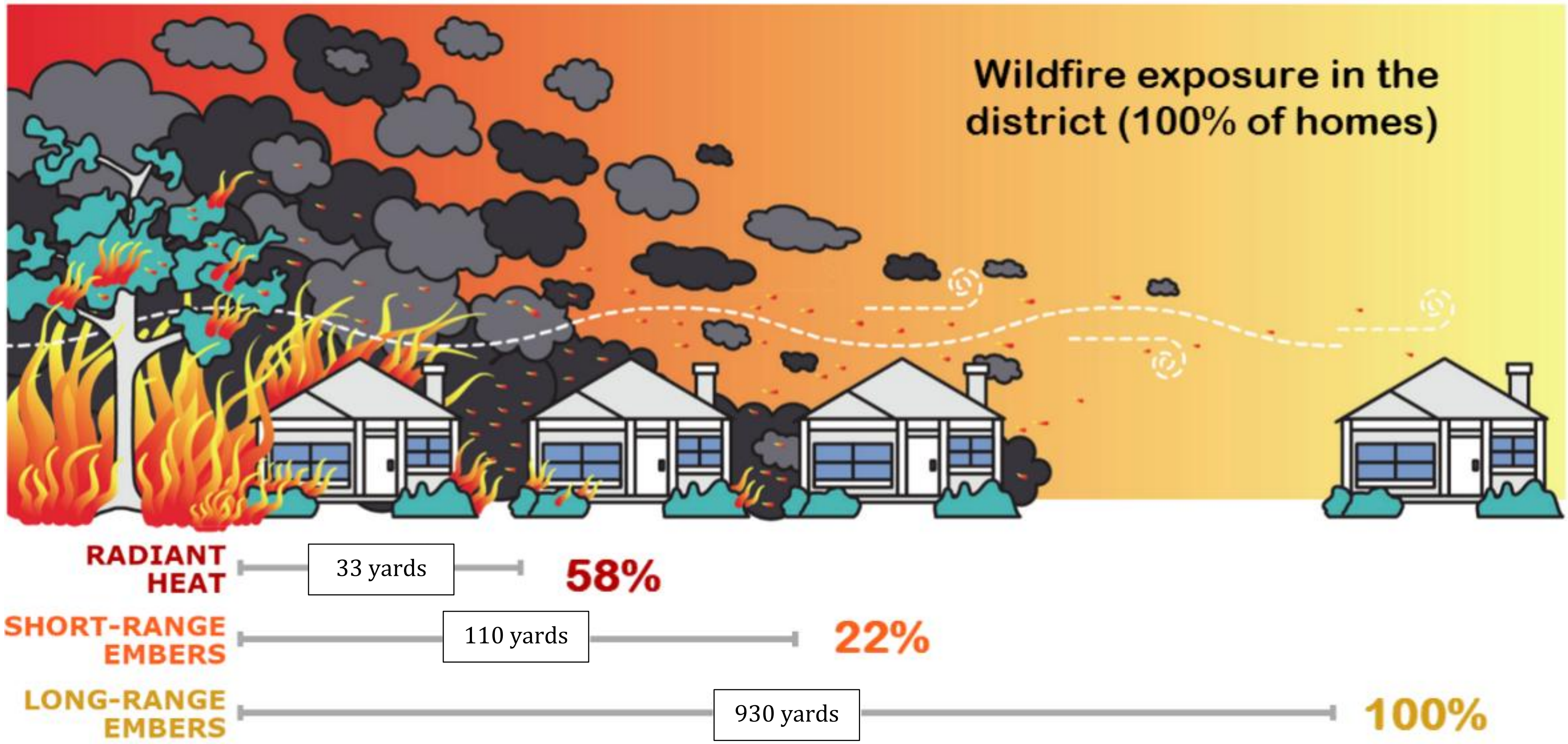


Figure 2.f.7 *Percentage of homes and campers in GGFPD title 32 area with different types of exposure to wildfire under extreme fire weather conditions. Radiant heat from burning vegetation can ignite nearby homes, and embers emitted from burning vegetation or other homes can travel long distances and ignite vegetation and homes away from the main fire. Analysis based on research by Beverly et al., (2010) (see* ***Appendix B****: Community Risk Assessment and Modeling Methodology for details). Image modified from Reducing Brushfires Risks by the Victorian Auditor-General's Office*

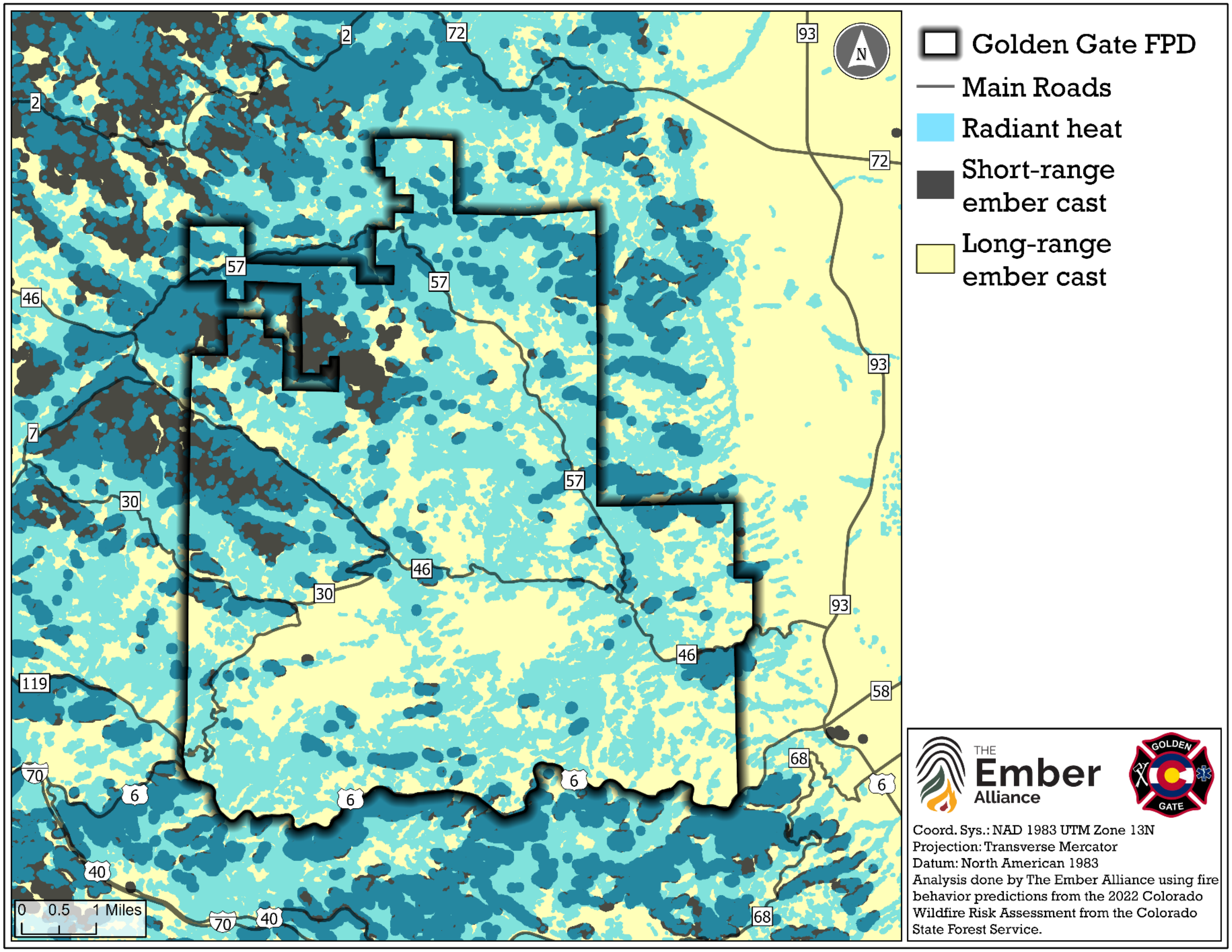


Figure 2.f.8 *Predicted ember cast showing areas that are likely to be exposed to radiant heat, short and long-range embers from burning vegetation modeling under extreme fire weather. Source: Analysis by TEA using the Colorado Wildfire Risk Assessment (CO-WRA) from USFS*

Beneficial Fire

Keep in mind that not all wildfire is damaging and destructive. Many ecosystems along the Colorado Front Range have been shaped by wildfire for centuries, and some ecosystems are dependent upon frequent, low-intensity fires. 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 the district 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.9**)

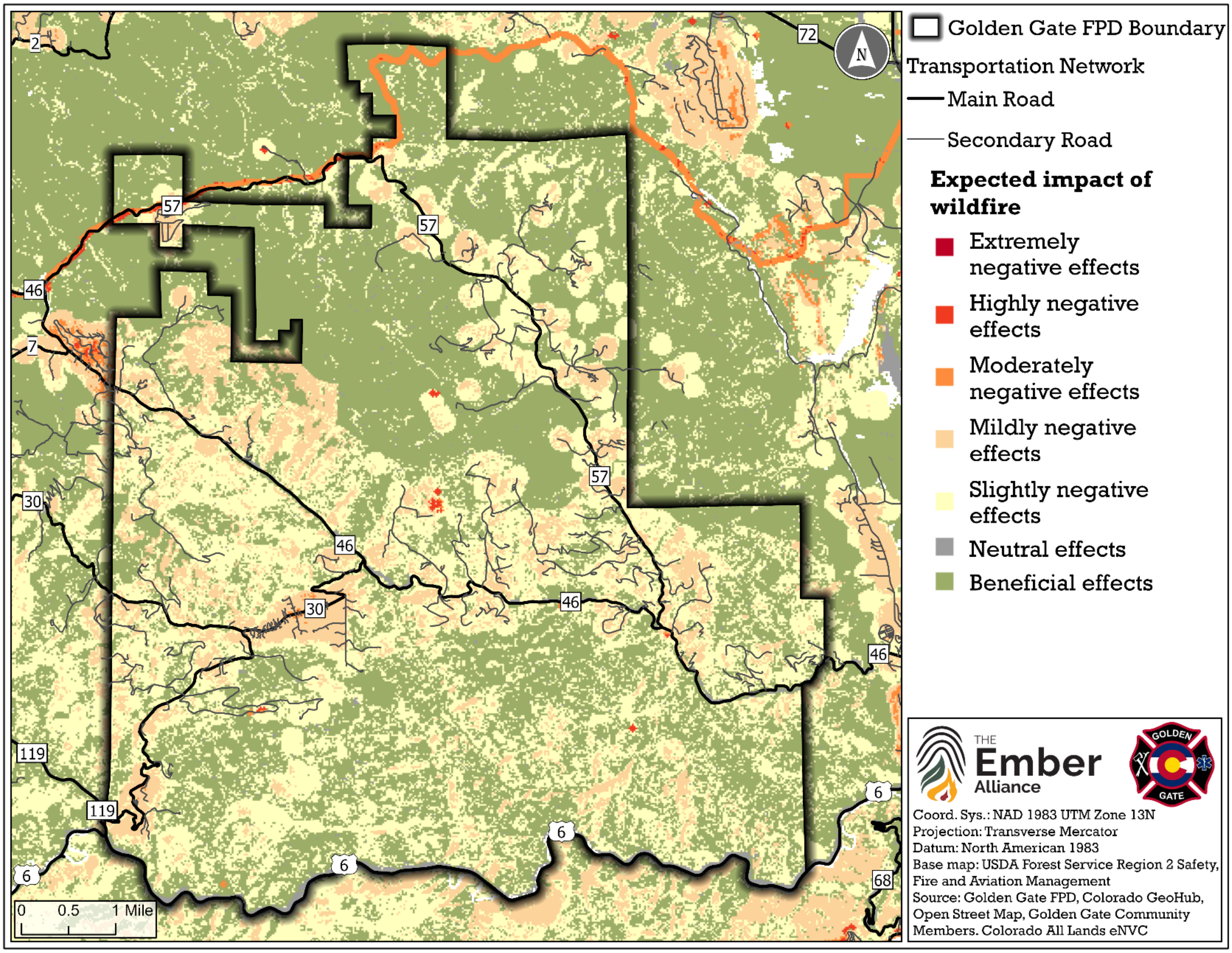


Figure 2.f.9. *According to an analysis by the U.S. Forest Service for the state of Colorado, wildfire and/or broadcast prescribed burning could benefit portions of GGFPD by restoring ecological conditions and reducing fuel loads. Beneficial fire is more likely in areas without homes and where expected 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 GGFPD

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 were important suppression tactical features during the Cameron Peak Fire because they reduced the potential for extreme fire behavior in strategic locations (Avitt 2021). Fuel treatments can also create and maintain healthy, restored forests based on historic 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 type, 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.

Public land managers and private residents in and around the district have conducted fuel treatments to reduce wildfire risk and restore ecosystem health (**Figure 2.g.1**) (Note: this dataset may not be all encompassing of individual actions). Some of these acres have been treated more than once. For example, some areas were thinned and then experienced a prescribed burn. Fuel treatments can comprise a variety of efforts including vegetative thinning, pile burning, and broadcast burning. Thinning efforts, often involving hand thinning, chipping, mulching, and lop-and-scatter techniques, can reduce tree density and ladder fuels to lower the risk of crown fires. Pile burning has managed woody debris left from thinning operations, while broadcast burning has been used to reduce surface fuels and restore ecological balance.

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). Even so, a variety of factors should be assessed and considered before determining whether broadcast prescribed burning is the best method to achieve fuel reduction goals, including current fuel loads, topography, and proximity to structures. As mentioned above, fire, including prescribed burning, can be beneficial in areas without homes and where expected fire behavior is moderate.

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.

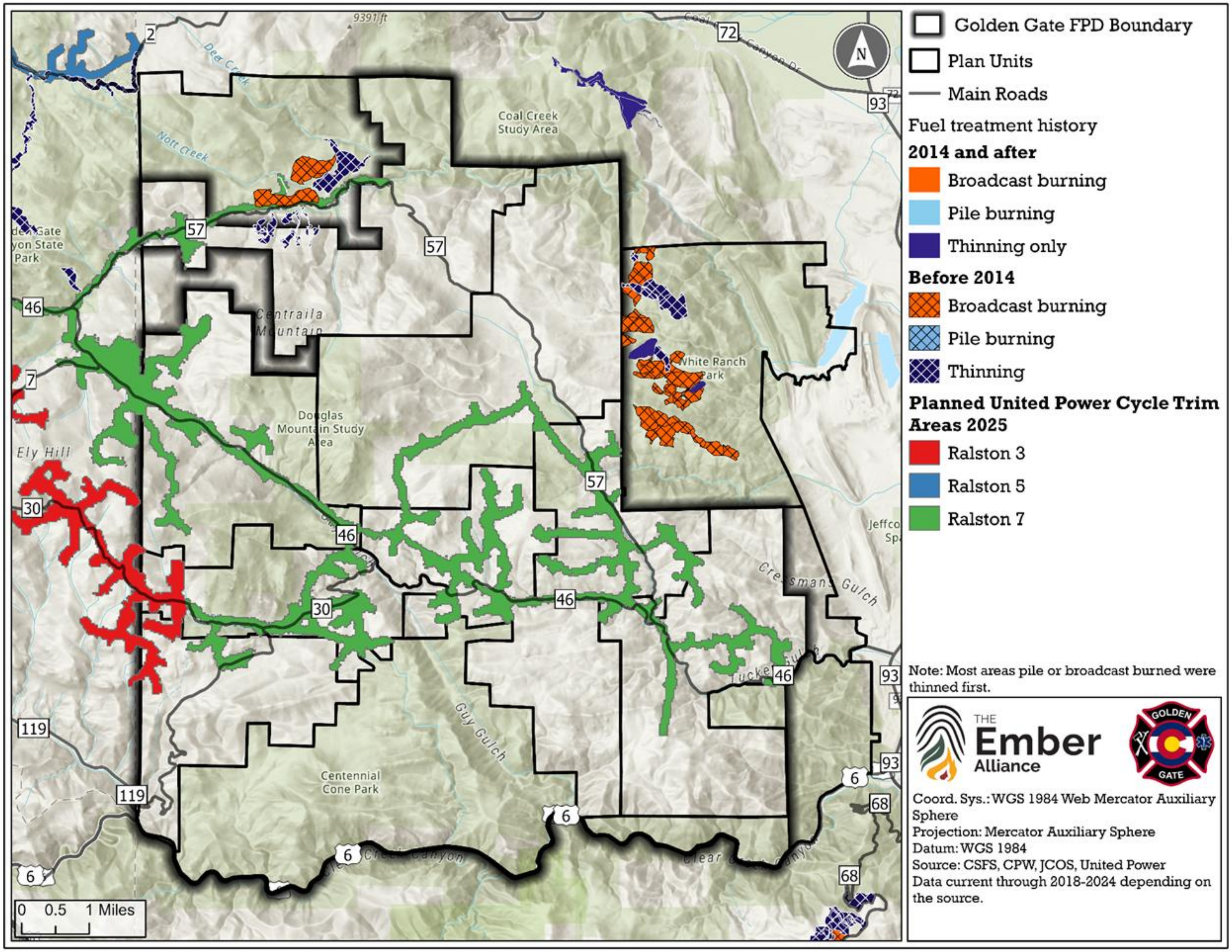


Figure 2.g.1. *Locations of forest management treatments in and around GGFPD from 2014-2025. Note: this dataset may not be all-encompassing of individual action. Sources: CSFS, CPW, JCOS, United Power.*

3. Becoming a Fire Adapted Community

Thus far, this CWPP has provided context surrounding the district, identified the wildfire risk within GGFPD and outlined the potential consequences to the community. Now, in this section, we begin to provide recommendations on how to address, reduce, and/or mitigate that risk. To start, GGFPD, community organizations, and residents are encouraged to adopt the Fire Adapted Communities (FAC) framework to approach wildfire risk comprehensively across multiple scales. Defined by the National Wildfire Coordinating Group (NWCG) 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**).

Your community's CWPP is the first step towards fire adaptation and increased fire resiliency. By illustrating your community's wildfire risk, engaging residents, developing collaborative relationships amongst project partners, and outlining existing opportunities and priority activities for risk mitigation, this process lays the foundation for on-the-ground action and an ongoing commitment to risk mitigation at all levels. GGFPD and public land managers have an important role to play in implementing the recommendations and priority projects in this CWPP as outlined in both this section and **Section 4.**

Equally important, individual homeowners and community organizations also play a vital role in addressing shared wildfire risk. 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). Action and community-building centered around mitigation have reduced wildfire risk and increased community resilience across the mountain west with mitigation work performed by residents able to spur mitigation efforts by their neighbors (Brenkert-Smith et al., 2013).

This section of the CWPP provides homeowners with recommendations and resources for mitigating wildfire risk and enhancing emergency preparedness. It also outlines how residents and community organizations can support the fire department and other project partners in this mission and vice versa.

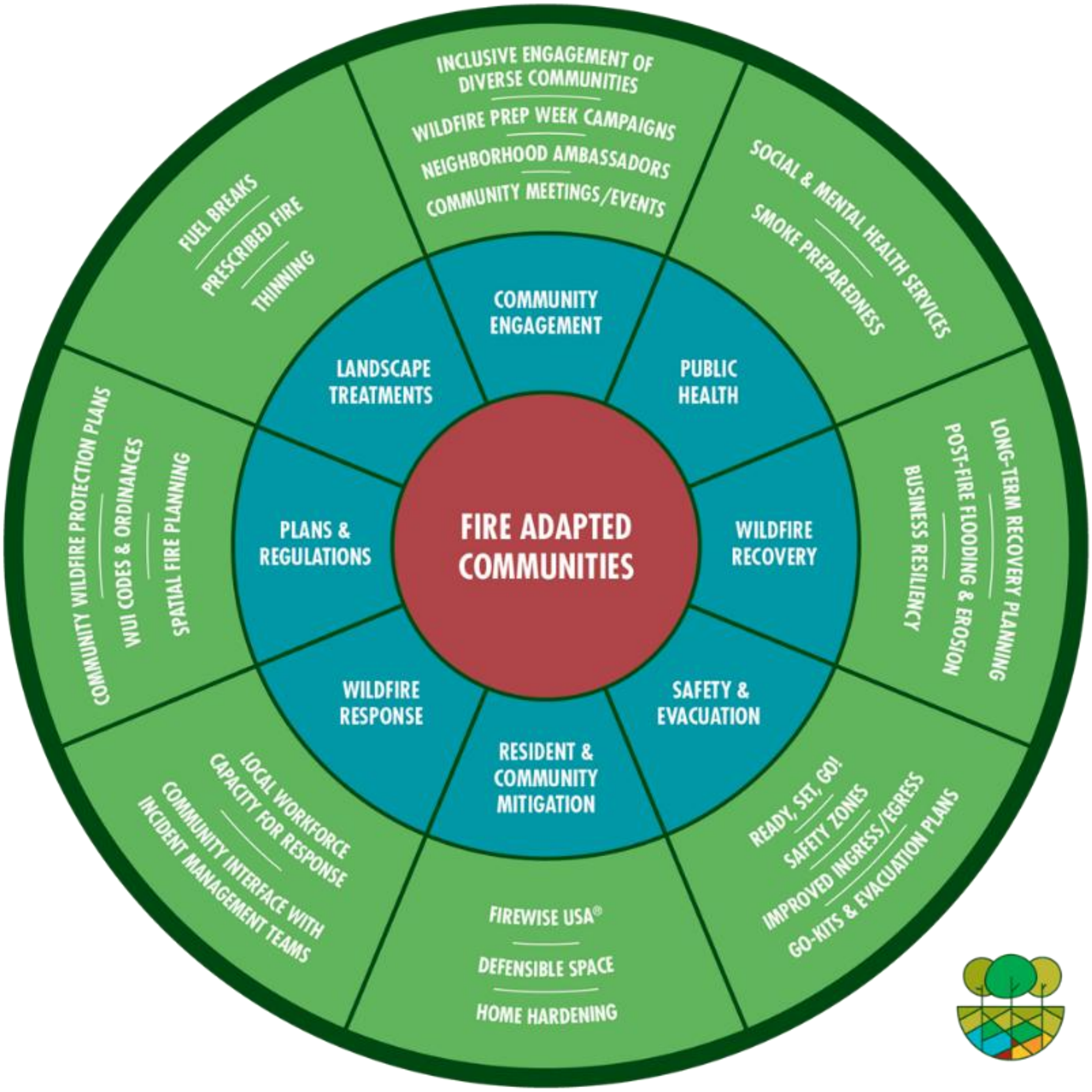


Figure 3.1. *The Fire Adapted Communities graphic provides specific programs and activities that communities can take to reduce their wildfire risk and increase their resilience. Source: Fire Adapted Community Learning Network*

3.a. Recommendations for Residents

Mitigate the Home Ignition Zone

During catastrophic wildfires, property loss happens primarily due to conditions in the **home ignition zone** (HIZ). The home ignition zone includes your home and other structures (e.g., barns, 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).

While home-to-home ignition risk is lower in the district than in higher-density WUI neighborhoods, risk of ignition from other structures on the same property and neighboring homes in higher density areas are still a concern as these can cause substantial property loss. Residents can increase their homes' chances of survival during wildfire if they create effective defensible space around all structures on their property and work together as a community to mitigate shared wildfire risk in overlapping HIZs.

Defensible space is the area around a building where vegetation, debris, and other types of combustible fuels have been treated, cleared, or reduced to slow the spread of fire and reduce exposure to radiant heat and direct flame. 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 structural ignitability 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).

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.

Wildfire Risk Reduction Requirements in the District

See 2025 Colorado Wildfire Resiliency Code for guidance and refer to the most up to date state and local codes as they are updated and issued

Defensible Space

Defensible space creates a buffer between your home and fuels that could ignite during wildland fire (e.g. grass, trees, and shrubs) by progressively reducing the density of fuels the closer to your home. 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 the different zones in the following way:

- **Zone 1** (HIZ 1): 0 to 5 feet from the home
  - Some organizations call this zone the "non-combustible zone"
- **Zone 2** (HIZ 2): 5 to 30 feet from the home
  - This is the "lean, clean, and green zone".
- **Zone 3** (HIZ 3): 30 to 100 feet from the home (**Figure 3.a.1**)

! **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 structure on their property, including campers/RVs, detached garages, storage buildings, barns, and others. RVs are highly flammable and can emit embers that might ignite nearby homes and vegetation. Removing all vegetation under and around campers in HIZ 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). Firewood and above ground propane tanks should be placed at least 30 feet away from primary structures and all flammable vegetation within 10ft of tanks removed (CSFS The Home Ignition Zone).

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. **Section3.d** includes specific defensible space recommendations by forest type for zone 3.

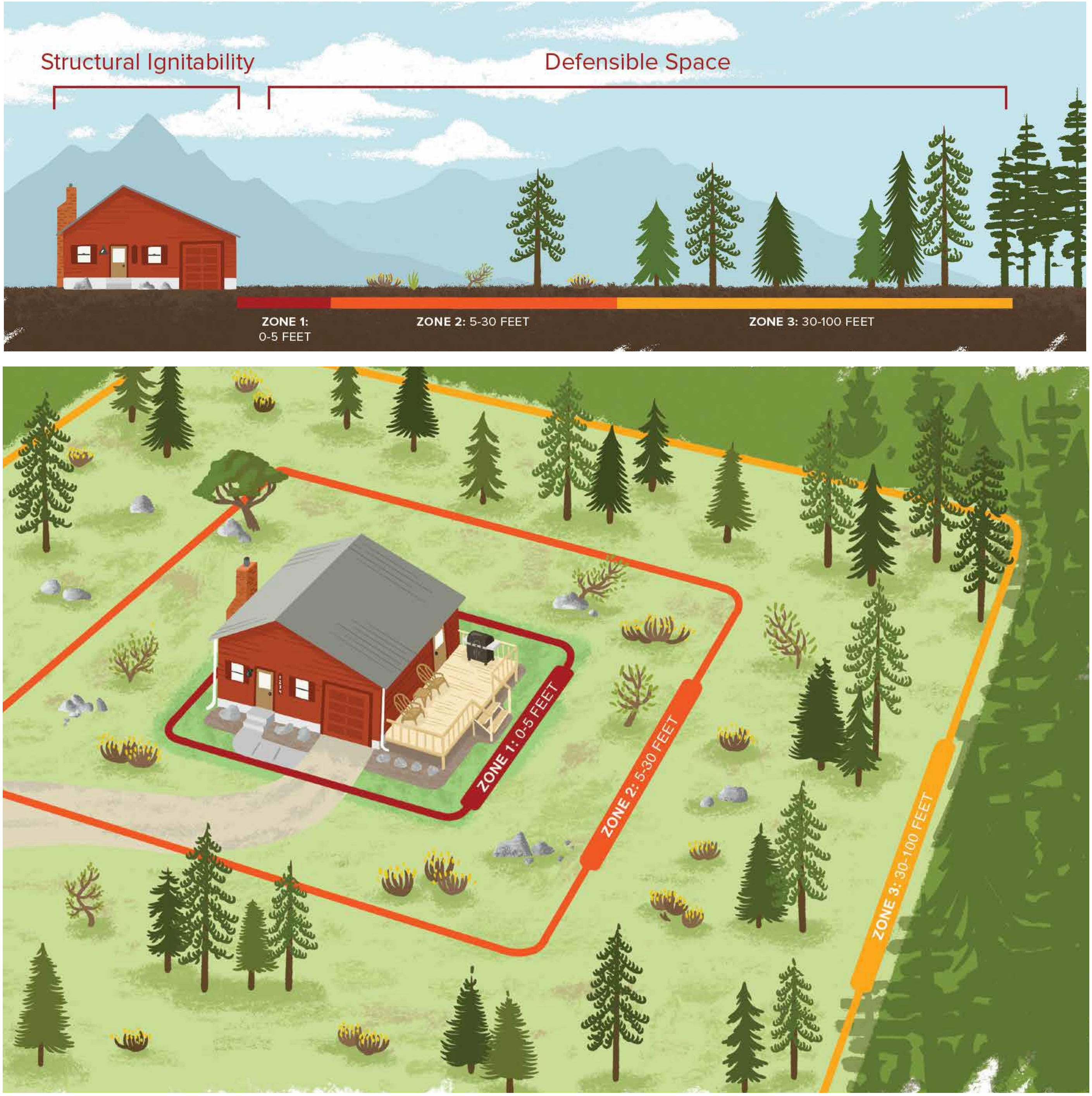


Figure 3.a.1. *Home ignition zones recommended by the Colorado State Forest Service. Using ignition-resistant building materials and removing burnable fuel around primary structures, outbuildings such as sheds, and campers / RVs is crucial for increasing your home's chance of standing strong during a 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 4.c.*** *includes specific recommendations for zone 3 by forest type.*

Zone 1: 0 to 5 feet from your home – The non-combustible 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.3** for how to measure crown spacing. • Favor the retention of aspen trees because this species naturally has high fuel moisture, no low branches, and smooth bark, 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, this zone should be larger due to the greater potential for extreme fire behavior.
Goal: Slow movement of flames, move fire to the ground, and reduce ember production.
• Store firewood and propane tanks at least 30 feet away and uphill from your home and away from flammable vegetation. Store even farther away if your home is on a slope. • Move campers / RVs, boats, detached garages, storage buildings, barns, and other large structures at least 50 feet away from your home. • Mow or trim grasses to a maximum height of 6 inches. Grasses can be taller in zone 3 than zone 2 because of the greater distance from your home, but shorter grass is always better for reducing potential flame lengths and therefore radiant heat exposure. • 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, and smooth bark, 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.3** 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.c**

*Spacing recommendations are a general guideline and should be increased for properties on steeper slopes. Reach out to GGFPD, CSFS, 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. Source: 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).

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

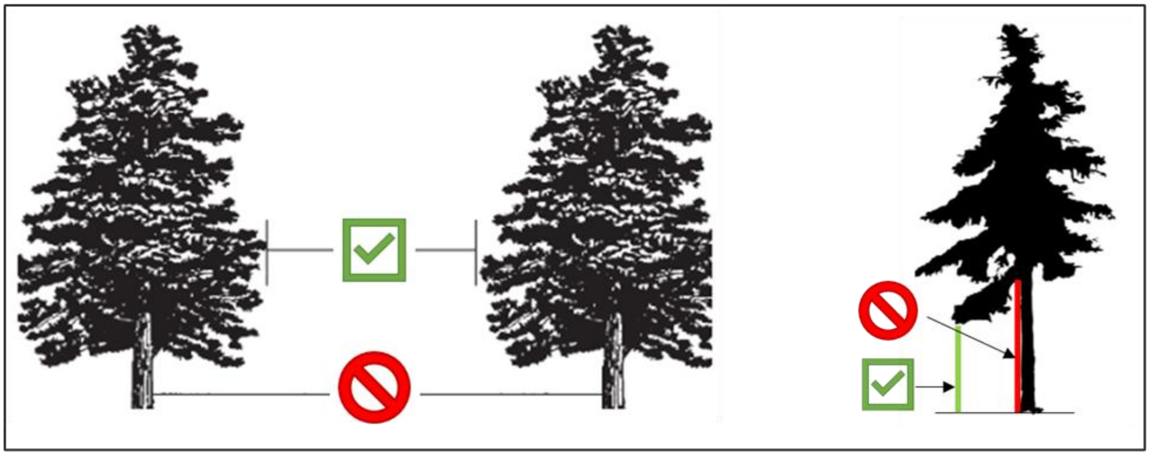


***Figure 3.a.2.** Spacing between tree crowns is measured from the edge of tree crown to tree crown, NOT from tree stem to tree stem (left). Height of limbs above the ground is measured from the ground to the lowest point of the limb, NOT from where the limb attaches to the tree (right).*

Some homeowners in the WUI are concerned that removing trees will destroy the forest or diminish the beauty and value of their property. On the contrary, many overly dense ponderosa pine stands are considered unhealthy by forestry professionals and have diverged greatly from the open, resilient forests historically maintained by frequent, lower-intensity wildfires (**Figure 2.e.1**). Regarding aesthetics and property value, the greatest threat is not mitigation work, but the devastation of a high-severity wildfire, which can scorch the landscape and wipe out entire stands of vegetation.

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, healthy ecosystems with lower fire risk in the years to come. Removing trees can open incredible views of mountains, rivers, and rock formations, and attract wildlife to forests with lower tree densities and a greater abundance of understory plants. By reducing fuel loads and creating more space between trees, you improve the likelihood that your home and your neighbors' homes will withstand wildfire, while also making conditions safer for wildland firefighters protecting your community.

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.

Linked Defensible Space

The home ignition zone of individual homes can overlap that of their neighbors, with wildfire hazards on one property threatening adjacent properties. Additionally, many properties within GGFPD contain multiple large structures. Flaming structures can emit significant radiant heat and embers, endangering homes and structures near them. Nearly all homes in the district (77%) could be exposed to short-range ember cast from at least one neighboring home (

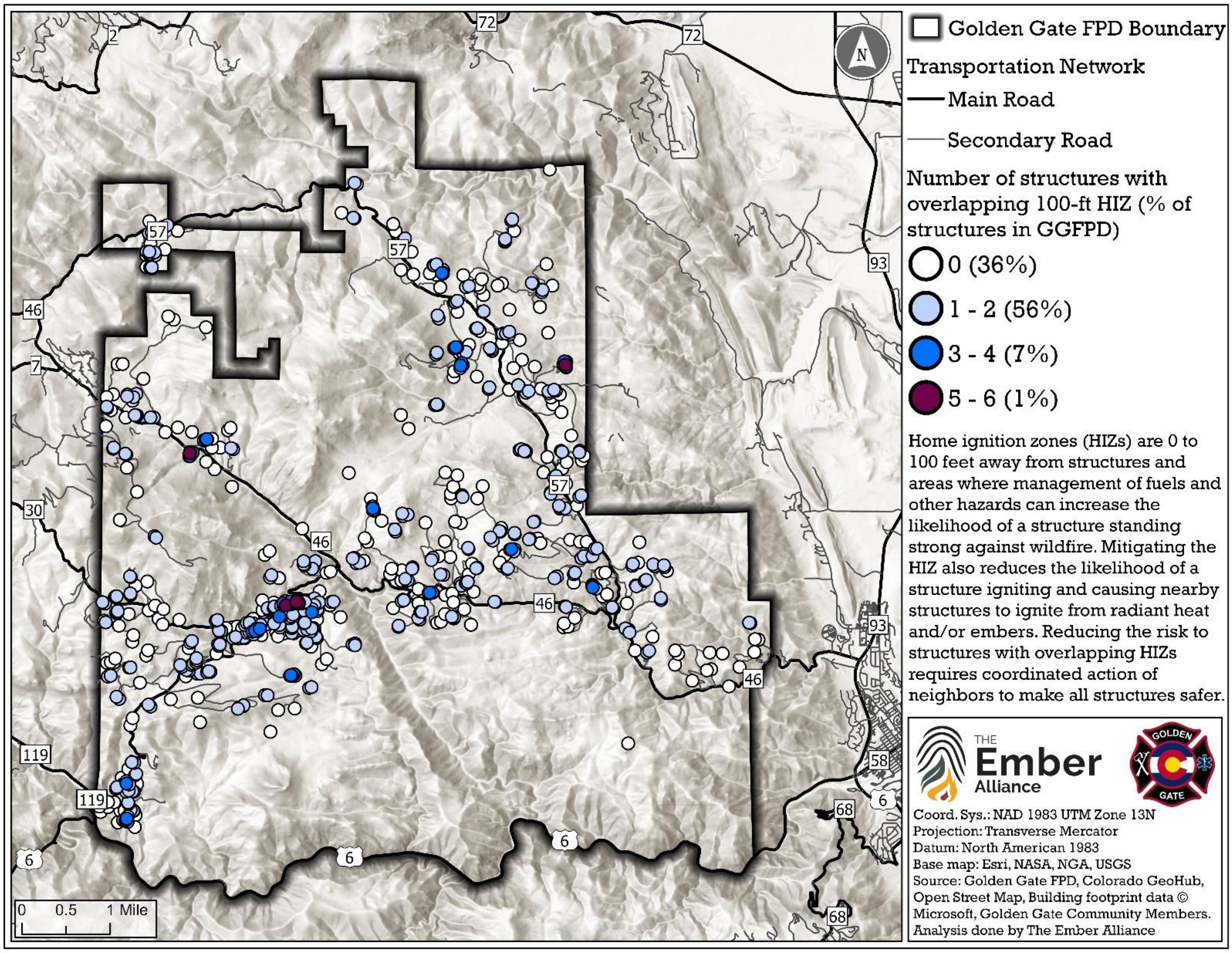


Figure 3.a.3).

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.

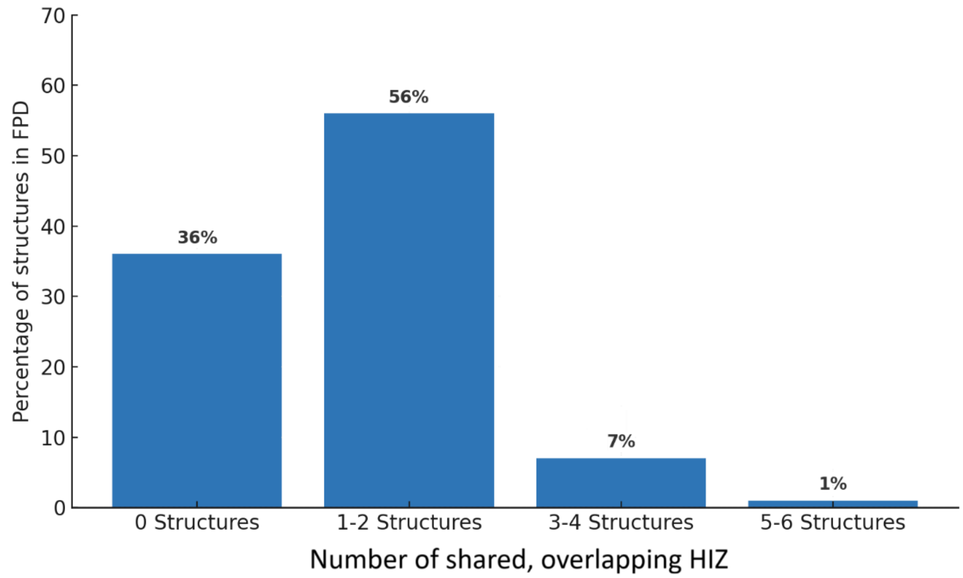
> *"Broadcast burning, mechanical thinning, and other treatments are proven to mitigate wildfire risk, but they are even more effective when we work together to integrate treatments across the landscape, across borders and ownerships"*
> (Avitt, 2021). – James White, the Rocky Mountain Region Cooperative Fire Specialist.

Keeping this in mind, defensible space projects that transcend property lines and ownership boundaries are better candidates for grant funding due to their 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 the GGFPD Wildland Fire Mitigation Division to help educate your community about the benefits of defensible space and home hardening.
- ✓ Apply for grants that support fuels mitigation for multi-homeowner projects (see **Section 3.e. Funding Opportunities**).



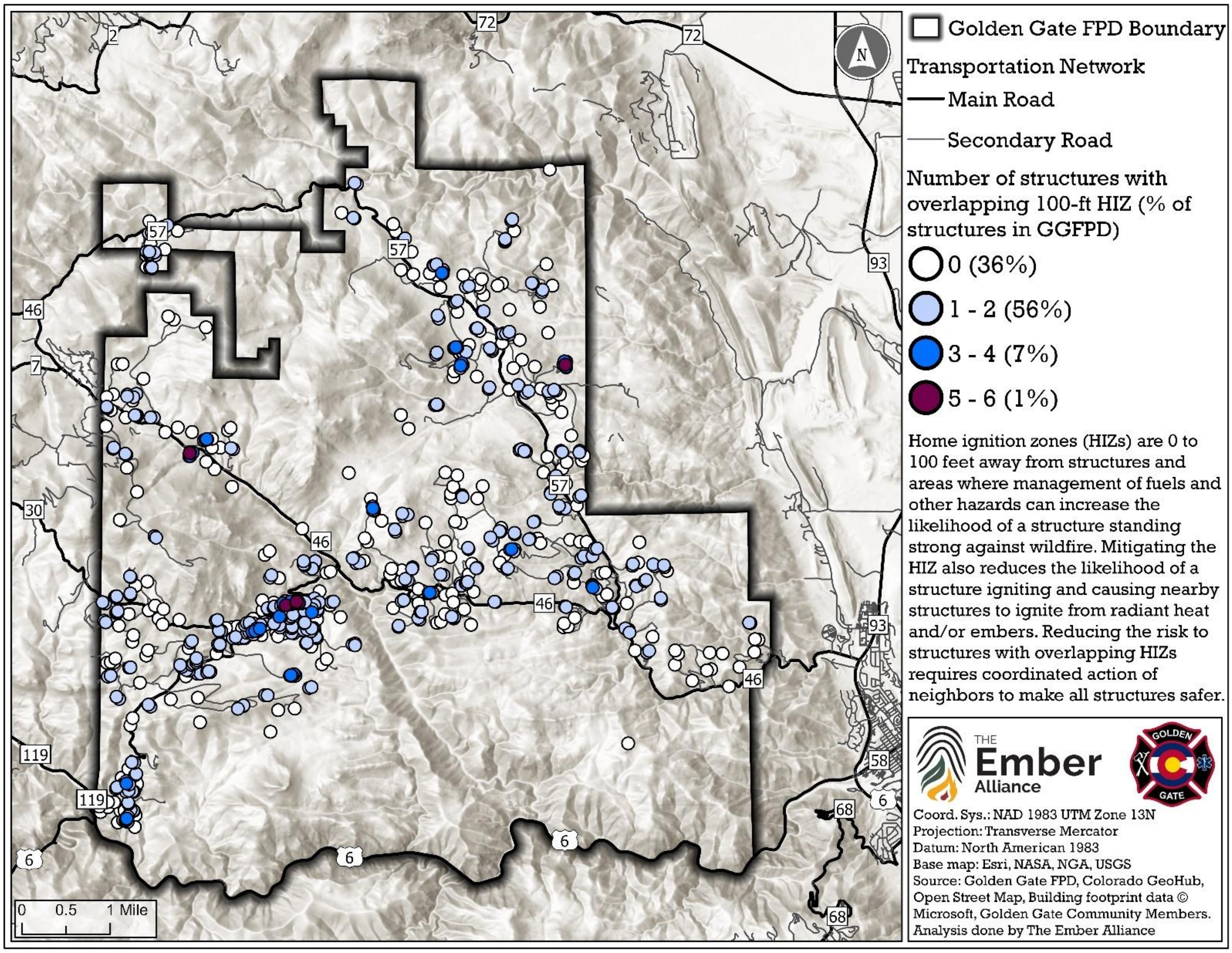
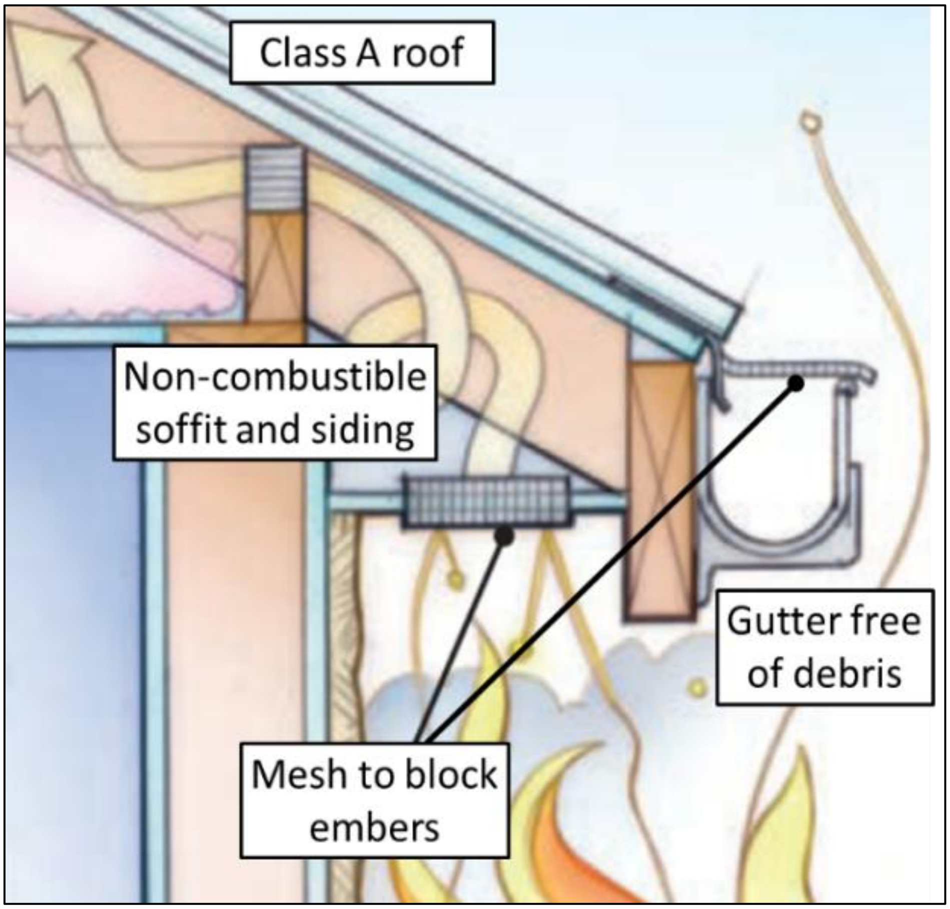


Figure 3.a.3. *64% of structures within GGFPD have overlapping HIZs with at least one other structure, opening them up to higher risk of short-range embers from other structures. Source: Analysis performed by TEA*

Home Hardening

Buildings cannot be made fireproof, but home hardening and well-maintained defensible space greatly reduce structural ignitability and improve your home's chances of surviving a wildfire. Research by the Insurance Institute for Business & Home Safety (IIBHS) demonstrates that home hardening is critical for reducing ignition from embers (see video of the research here). In the Marshall Fire, embers accounted for 70% of structure damage, with the remaining 30% caused by direct flame contact (Holstrom et al., 2023). Due to the long distances embers can travel ahead of a flaming front, home hardening remains the only effective defense against ember ignitions.

All homes in the district (100%) are at risk of long-range embers, and (58%) are at risk of radiant heat from burning vegetation under severe fire weather conditions (**Error! Reference source not found.**). Reducing the a bility of embers to penetrate and ignite your home is recommended for everyone in the district.



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).

Areas on the home that may accumulate debris (e.g. roofs, decks, and gutters), components that open to the exterior (e.g. vents and windows) and siding are all particularly vulnerable to embers from wildfire. Actions that prevent embers from penetrating your home can offer benefits in addition to fire protection, such as reduced maintenance costs, greater durability, and increased energy efficiency. The following are recommendations for hardening your home that provide multiple benefits:

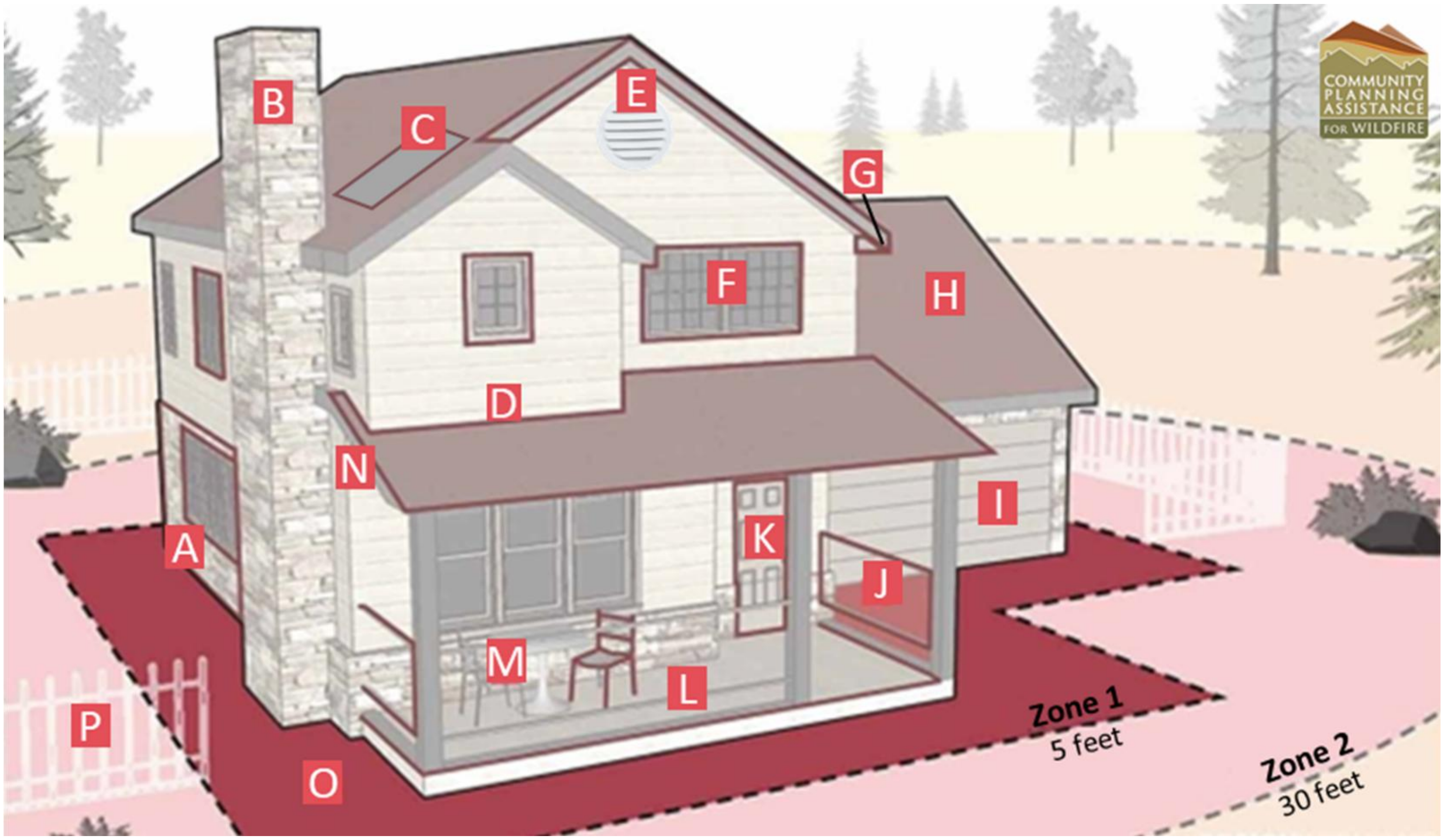
- **Roofs** should be made of noncombustible materials[1] such as composite, metal, or tile, which tend to be more durable against wind, snow, and hail as well as wildfire.

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

- **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 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 for 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** should be made of noncombustible materials and kept at least 8 feet away from the home (at least 20 feet away 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.

Hardening your entire home all at once can be expensive, however, you can start by implementing the easiest and low-cost actions first and harden your home in phases (**Figure 3.a.4**). If you replace a roof damaged by hail or remodel your home, keep home-hardening practices in mind and use ignition-resistant materials.

In January 2020, Jefferson County approved new building construction regulations for homes above 6,400 feet in elevation, and the Jefferson County Department of Development and Transportation provides a list of approved building materials to help address the high potential for home loss in the WUI. Additionally, the state provides building standards with the 2025 Colorado Wildfire Resiliency Code. New construction and replacement construction that require a building permit must comply with the new building standards. See 2025 Colorado Wildfire Resiliency Code and refer to the most up to date state and local codes as they are updated and issued



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 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, on top of, or within 5 feet of deck.

M. Use noncombustible patio future.

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.

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.4. *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.

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 Jefferson County.
- [ ] 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.

Fire-resistant landscaping in zone 1 can be aesthetically pleasing and more drought tolerant, requiring less watering during the summer. Source: Washington State University Master Gardener Program.

A property in GGFPD with exemplary home ignition zone and home hardening. Note the trees next to the house are aspen, containing a higher moisture content and exhibiting greater fire resistance. Source: The Ember Alliance

Evacuation Preparedness

Evacuation can weigh heavily on the minds of residents in the district. 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 conditions that are dangerous to evacuees. Roads that may be unpassable during a wildfire event are referred to as potentially non-survivable in this CWPP. Jefferson County Sheriff's Office calls evacuations early to get residents out of danger before roads may become potentially non-survivable.

Evacuation preparation is the responsibility of each resident in the district. The best way to get out quickly and safely during an evacuation is to be prepared. Visit the Rotary Wildfire Ready website to learn about go-bags and evacuation planning-- simple and crucial actions that can save lives.

Prepare a go-bag and 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 or large camper vehicles 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.

Signing up for local emergency notifications can also help you leave quickly. Residents should register their cell phones and email addresses through Lookout Alert—the official emergency notification system for the district[2]. See the Jefferson County Sherrif's Office website on emergency notifications for more information.

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

- ✓ 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.

Lookout Alert EMERGENCY NOTIFICATIONS

Click here to sign up for Lookout Alert

[2] Lookout Alert is the official emergency notification system for the district as of the writing of this CWPP in 2025.

Accessibility and Navigability for Firefighters

Address signs

Installing reflective address numbers can save lives by making it easier for firefighters to navigate to your home at night and under smokey conditions. Mount reflective address signs on noncombustible posts, not on stumps, trees, wooden posts, or chains across driveways. Chains across driveways might be removed during wildfire suppression activities to permit access to your property. Make sure the numbers are clearly visible from both directions on the roadway.

Driveways

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

Many driveways within GGFPD do not meet current access requirements and pose safety issues that are difficult to mitigate. Photo credit: The Ember Alliance.

Some roads in the district 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 NFPA, 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 to accommodate fire engines.

If you have locked gates that would prevent first responders from reaching your home, please notify GGFPD of gate codes or means of access before an incident.

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 typical fire season. 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.

Please reach out to GGFPD Wildland Fire Mitigation Division for advice on your specific private water resources. Many homes in the district have active fire defense systems meant to protect the home in case of a wildfire. It is important that you notify GGFPD of your specific private water resource or home defense system before an incident so they can provide you with guidance on what to do in case of an evacuation.

Before you evacuate, prepare private 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.

Signage on a resident's garage notifying GGFPD of the location to access private water resources. Made of metal, using large, reflective lettering and placed on treated wood with a noncombustible rating, this sign will be visible to responders during a wildfire incident. Photo source: TEA.

We need your help: **Locating and determining the condition of cisterns and other water resources useful to the district during a wildfire will greatly aid your volunteer firefighters in protecting your community**. Notify GGFPD of community cisterns or tanks so they can be identified prior to an emergency. Contact GGFPD when planning new cisterns to ensure their compatibility with the district's fire equipment. Please make sure to have the condition of your cisterns checked regularly. Locations of cisterns were compiled during this CWPP process through community outreach; however, this is not nearly a comprehensive list and conditions of most cisterns are unknown.

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 an incident and be more resilient to wildfire.

Support Your Local Fire Protection District

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

- Consider volunteering with GGFPD or the district's new Wildfire Mitigation Division
- Provide financial support in the form of monetary donations or initiate local ballot measures that provide tax revenue for GGFPD so they can respond to residents in their time of need.
- Attend events hosted by GGFPD about wildfire mitigation and emergency preparedness.
- Protecting your home from wildfire by maintaining good defensible space can also protect your local firefighters.
- Share information you learn with neighbors to build community resilience and magnify the impact of individual actions.
- Stay up to date with the latest district news by following GGFPD on Instagram or their webpage.

Volunteer firefighters with GGFPD responding to an incident in the Mt Galbraith plan unit in August 2025. Firefighters in the district deal with many challenges including steep terrain, high fuel loads, and remote response areas. Source: GGFPD

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 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, cisterns, water resources, and water systems. Reach out to GGFPD before an incident for guidance on what to do with your specific fire home defense system.
- Leave gates unlocked during evacuations for firefighters and law enforcement.
- Leave exterior lights on to increase visibility.
- When evacuating, leave a note on your front door confirming that all parties have evacuated and provide your name and phone number.

3.b. Relative Risk Ratings and Special Considerations for Plan Units

This CWPP is a useful planning document, but it will only affect real change if residents, neighbors, GGFPD, local forestry and community groups, 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 GGFPD and outlines priority recommendations for collective action to address shared risk and magnify the impact of mitigation actions by individual residents.

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 11 plan units in GGFPD by considering clusters of addresses, connectivity of roads, topographic features, land parcels, land ownership, and local knowledge of community organization.

The Ember Alliance conducted on-the-ground assessments to assess fire risk, fire suppression challenges, evacuation hazards, and home ignition zone hazards in November 2024, and combined these assessments with output from our fire behavior, community resources, and evacuation analyses. See **Appendix B**: Community Risk Assessment and Modeling Methodology for a description of hazard rating methodology. Plan unit hazard ratings are specific to GGFPD 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 GGFPD, 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 sooner 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.

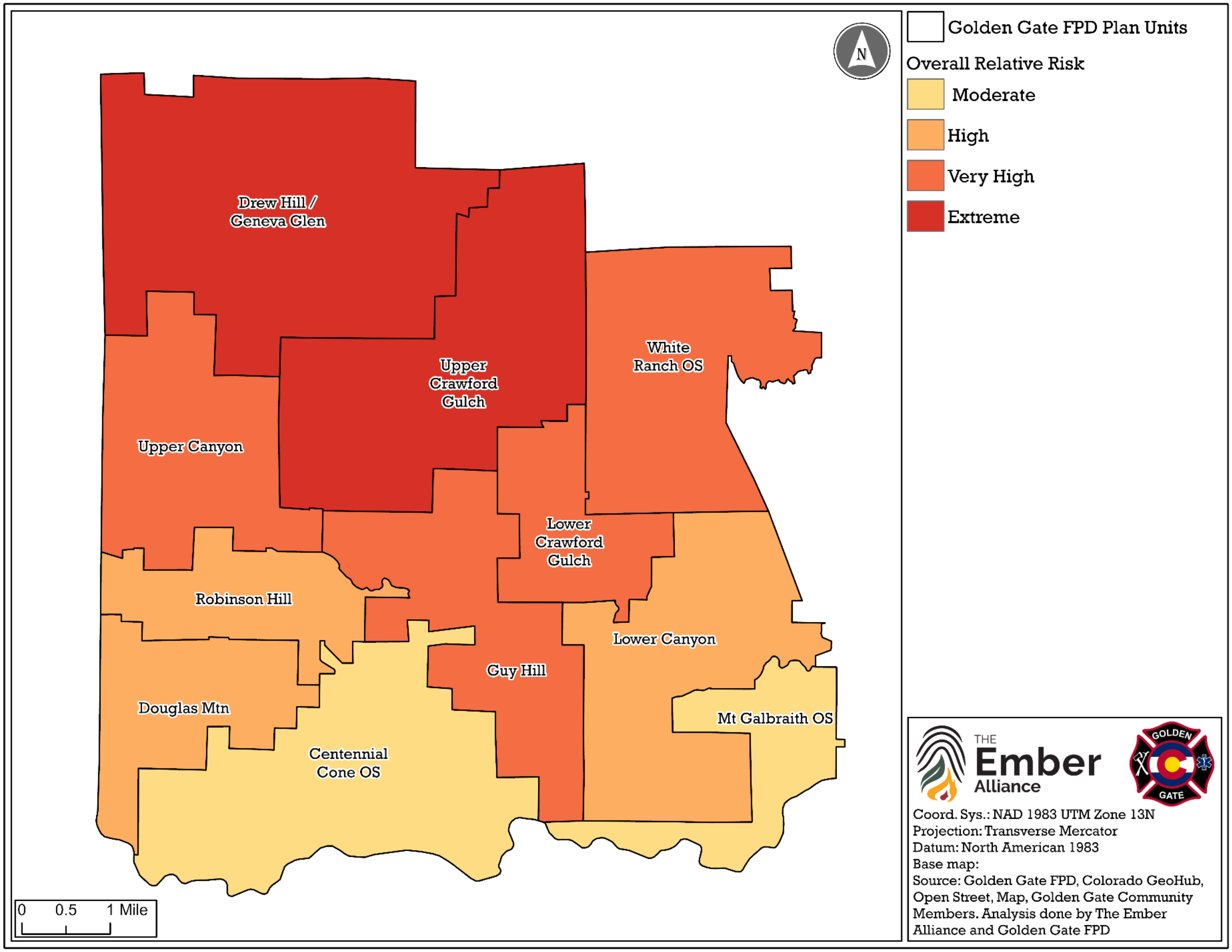


Figure 3.b.1. *Relative risk rating for plan units across GGFPD. "Moderate" risk is a relative term – most residents within GGFPD are exposed to elevated fire danger due to topography and fuels in this part of Colorado and should take recommended actions in this CWPP seriously.*

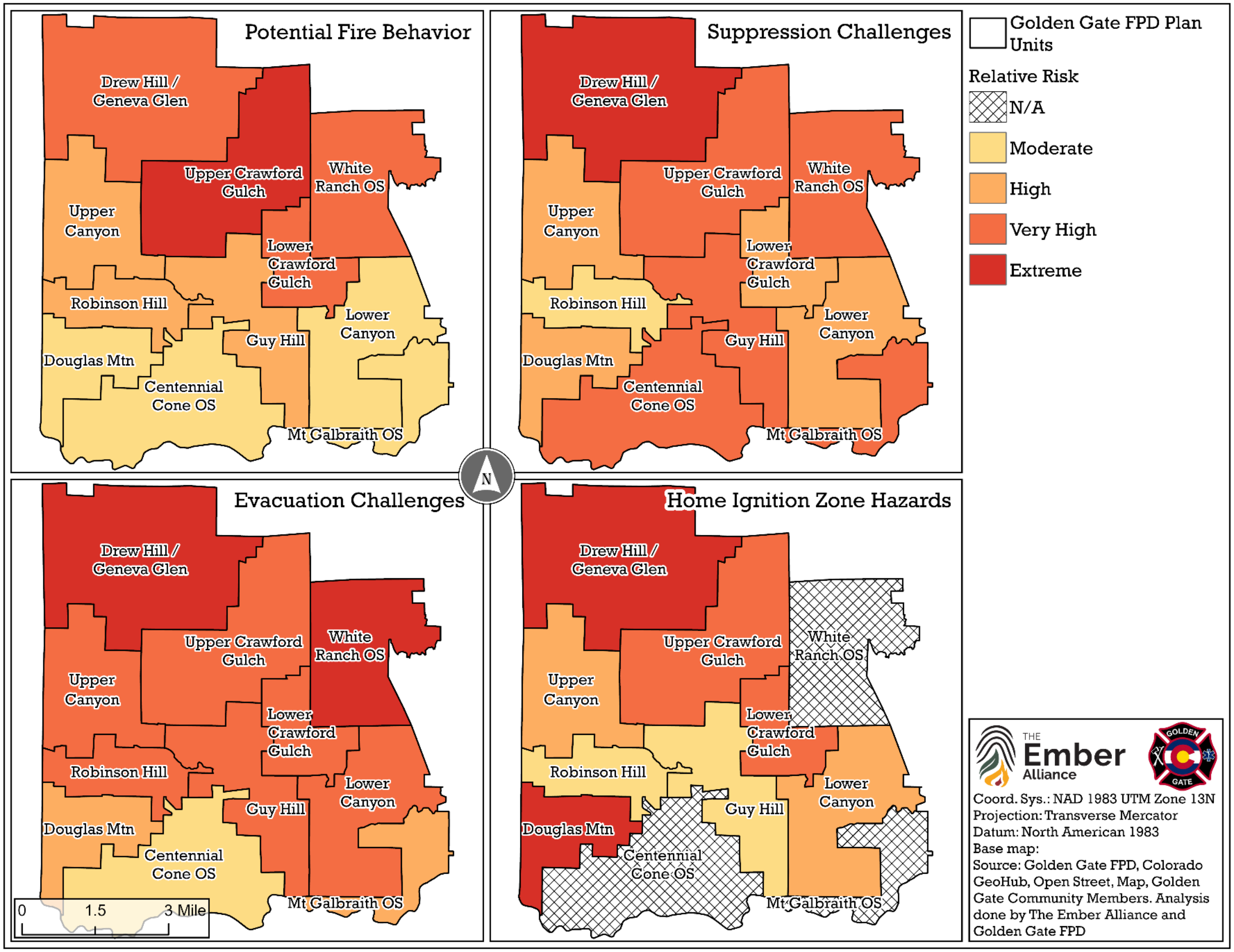


***Figure 3.b.2**. Plan unit relative risk for each component used to determine overall risk ratings in GGFPD. Potential Fire Behavior incorporates the type and probability of wildfire in the area, Evacuation Hazards includes roadway quality and estimated evacuation times, Suppression Challenges incorporates accessibility of the roads by fire engines, response time, and water sources, and Home Ignition Zone Hazards examines structure to structure ignition potential and structure exposure. See **Appendix B**: Community Risk Assessment and Modeling Methodology for complete methodology.*

Centennial Cone OS

Moderate relative risk rating

Under extreme fire weather and during a fire:

- **38%** of the area could experience very high to extreme fire behavior.
- **50%** of structures are exposed to radiant heat from burning vegetation.
- **100%** of structures are exposed to embers from burning vegetation.

Special Considerations: All land in this plan unit is owned/managed by Jefferson County Parks and Open Space. For this reason and a lack of residential houses, this open space received an N/A rating for HIZ hazards.

Drew Hill/Geneva Glen

Extreme relative risk rating

Under extreme fire weather and during a fire:

- **56%** of the area could experience very high to extreme fire behavior.
- **90%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **87%** of total road length has potentially non-survivable conditions.

Special Considerations: This plan unit contains dense forested areas and heavy fuels along roadways. The topography is complex with many steep slopes, narrow valleys, and ridges that could create unpredictable fire behavior.

Primary vegetation includes a mixture of lodgepole pine, ponderosa pine, and mixed conifer. This plan unit contains areas for hunting and other recreation as well as overhead powerlines, which could serve as additional ignition risks. A large chunk of land in this plan unit is owned by Colorado Parks and Wildlife.

Hazards in the home ignition zone: Residents in this plan unit should pay close attention to HIZ recommendations due to the topography and dense fuels in the region. Adjust HIZ recommendations for slope according to **Table 3.a-2**. Additionally, residents should implement home hardening updates if not already due to the high exposure to both embers and radiant heat. In areas of higher housing density, residents should collaborate with neighbors to ensure shared HIZs are mitigated.

Roadway accessibility and evacuation capacity: Evacuation preparedness is imperative due to the dense fuels along roadways and potentially non-survivable conditions along the main evacuation route for residents. Residents should have a go-bag prepared before an emergency. Roadside work is recommended along private roads to improve conditions during evacuations and accessibility for firefighters.

Douglas Mountain

High relative risk rating

Under extreme fire weather and during a fire:

- **36%** of the area could experience very high to extreme fire behavior.
- **64%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **20%** of total road length has potentially non-survivable conditions.

Special Considerations: The southern portion of Douglas Mountain may receive higher traffic along Hwy 6, which could pose additional ignition risks.

Hazards in the home ignition zone: Residents in this plan unit should implement HIZ recommendations and adjust for slope according to **Table 3.a-2**. Additionally, residents should implement home hardening updates if not already due to the high exposure to both embers and radiant heat. In areas of higher housing density, residents should collaborate with neighbors or organize through local HOAs to ensure shared HIZ are mitigated.

Guy Hill

Very High relative risk rating

Under extreme fire weather and during a fire:

- **43%** 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.
- **46%** of total road length has potentially non-survivable conditions.

Hazards in the home ignition zone: Residents in this plan unit should pay close attention to HIZ recommendations and adjust HIZ recommendations for slope according to **Table 3.a-2**. Additionally, residents should implement home hardening updates.

Roadway accessibility and evacuation capacity: This plan unit lies along Golden Gate Canyon Rd, a main evacuation route for the district. Residents should prepare go-bags and make arrangements for livestock ahead of an emergency. See (**Evacuation Preparedness**) for recommendations. Roadside work is recommended along private roads to increase accessibility.

Lower Canyon

High relative risk rating

Under extreme fire weather and during a fire:

- **32%** of the area could experience very high to extreme fire behavior.
- **62%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **68%** of total road length has potentially non-survivable conditions.

Hazards in the home ignition zone: Residents in this plan unit should pay close attention to HIZ recommendations and adjust HIZ recommendations for slope according to **Table 3.a-2**. Additionally, residents should implement home hardening updates.

Roadway accessibility and evacuation capacity: Residents should have a go-bag prepared before an emergency. Roadside work is recommended along private roads to improve conditions during evacuations and accessibility for firefighters.

Lower Crawford Gulch

Very High relative risk rating

Under extreme fire weather and during a fire:

- **49%** of the area could experience very high to extreme fire behavior.
- **80%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **64%** of total road length has potentially non-survivable conditions.

Hazards in the home ignition zone: Residents in this plan unit should pay close attention to HIZ recommendations and adjust HIZ recommendations for slope according to **Table 3.a-2**. Additionally, residents should implement home hardening updates.

Roadway accessibility and evacuation capacity: This plan unit lies along Golden Gate Canyon Rd, a main evacuation route for the district. Residents should prepare go-bags and make arrangements for livestock ahead of an emergency. See (**Evacuation Preparedness**) for recommendations.

Mt Galbraith OS

Moderate relative risk rating

Under extreme fire weather and during a fire:

- **23%** of the area could experience very high to extreme fire behavior.
- **100%** of structures are exposed to radiant heat from burning vegetation.
- **100%** of structures are exposed to embers from burning vegetation.
- **61%** of total road length has potentially non-survivable conditions.

Special Considerations: This plan unit makes up the southern border to the entrance of Golden Gate from the City of Golden. From a fire behavior standpoint, ignitions and wildfires in this plan unit could significantly impact and/or spread into the City of Golden. The topography is complex, with many steep slopes and topographic features that could create unpredictable fire behavior. Additionally, shrub and grass land with slopes of gamble oak and prevailing winds out of the west could contribute to fast-moving fires.

Robinson Hill

High relative risk rating

Under extreme fire weather and during a fire:

- **40%** of the area could experience very high to extreme fire behavior.
- **26%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **42%** of total road length has potentially non-survivable conditions.

Vegetation, topography, and potential fire behavior: This plan unit has a diversity of vegetation types. HIZ recommendations and priority zones will differ with vegetation, see **3.c** for guidance.

Hazards in the home ignition zone: Residents in this plan unit should pay close attention to HIZ recommendations and adjust HIZ recommendations for slope according to **Table 3.a-2**. Additionally, residents should implement home hardening updates. In areas of higher housing density, residents should collaborate with neighbors to ensure shared HIZs are mitigated. Residents in the Robinson Hill area primarily surrounded by grassland should focus on zone 1 of the HIZ, eliminating any flammable fuels within 5 feet of the home and using non-combustible siding. This can greatly reduce the risk fast moving grassland fires pose to homes in the area.

Roadway accessibility and evacuation capacity: This plan unit lies along Golden Gate Canyon Rd, a main evacuation route for the district. Residents should prepare go-bags and make arrangements for livestock ahead of an emergency. See (**Evacuation Preparedness**) for recommendations.

Upper Canyon

Very High relative risk rating

Under extreme fire weather and during a fire:

- **47%** 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.
- **43%** of total road length has potentially non-survivable conditions.

Hazards in the home ignition zone: Residents in this plan unit should pay close attention to HIZ recommendations and adjust HIZ recommendations for slope according to **Table 3.a-2**. Additionally, residents should implement home hardening updates.

Roadway accessibility and evacuation capacity: This plan unit lies along Golden Gate Canyon Rd, a main evacuation route for the district. Residents should prepare go-bags and make arrangements for livestock ahead of an emergency. See (**Evacuation Preparedness**) for recommendations.

Upper Crawford Gulch

Extreme relative risk rating

Under extreme fire weather and during a fire:

- **55%** of the area could experience very high to extreme fire behavior.
- **67%** of homes are exposed to radiant heat from burning vegetation.
- **100%** of homes are exposed to embers from burning vegetation.
- **47%** of total road length has potentially non-survivable conditions.

Hazards in the home ignition zone: Residents in this plan unit should pay close attention to HIZ recommendations and adjust HIZ recommendations for slope according to **Table 3.a-2**. Additionally, residents should implement home hardening updates.

Roadway accessibility and evacuation capacity: This plan unit lies along Crawford Gulch Road, a main evacuation route for the district. Residents should prepare go-bags and make arrangements for livestock ahead of an emergency. See (**Evacuation Preparedness**) for recommendations.

White Ranch OS

Very High relative risk rating

Under extreme fire weather and during a fire:

- **44%** of the area could experience very high to extreme fire behavior.
- **0%** of structures are exposed to radiant heat from burning vegetation.
- **100%** of structures are exposed to embers from burning vegetation.
- **100%** of total road length has potentially non-survivable conditions.

Special Considerations: All land in this plan unit is owned/managed by Jefferson County Parks and Open Space. For this reason and a lack of residential houses, this open space received an N/A rating for HIZ hazards.

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. Evenly and widely spacing trees might be reasonable in HIZ 3, but this tree arrangement would not be appropriate for restoration-style fuel treatments.

Treatments in HIZ 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 which encourages understory grasses and shrubs to grow and, in turn, can increase wildlife sightings near their home. HIZ 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 HIZ 3 and stand-scale fuel treatments and ecological restoration 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 creating defensible space so they can help you design an effective treatment specific to vegetation type, slope, and other conditions around your home.

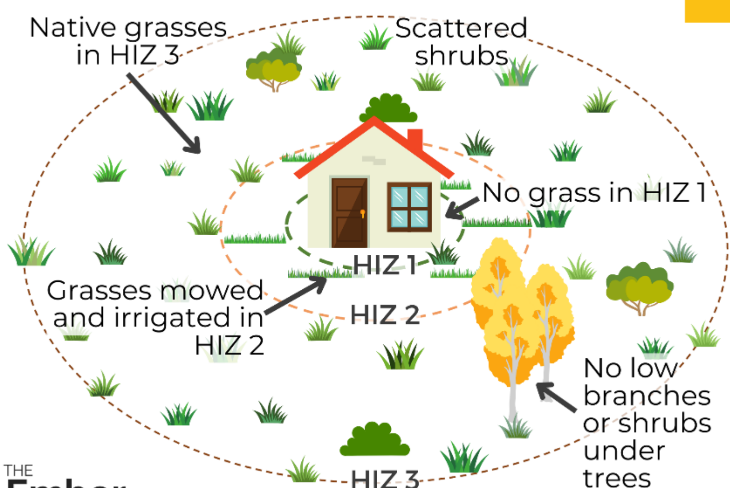
Grasslands

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

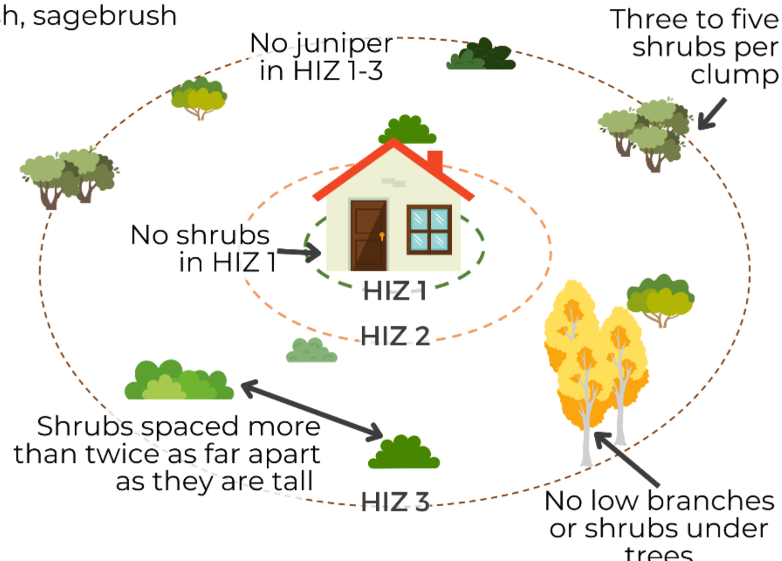
Species: Rocky mountain juniper, common juniper, Gambel oak, mountain mahogany, antelope bitterbrush, sagebrush

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

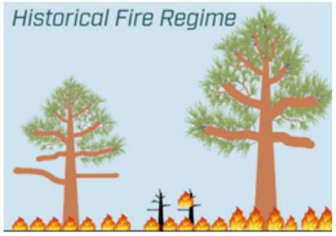
- Remove shrubs under tree canopies.
- Remove limbs below 6-10 feet on scattered trees.
- Remove common junipers, which are highly flammable.
- Thin clumps of shrubs down to three to five shrubs/clump. Favor leaving large, old, Gambel oaks for biodiversity.
- Use mastication, mowing, herbicide, and prescribed 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.

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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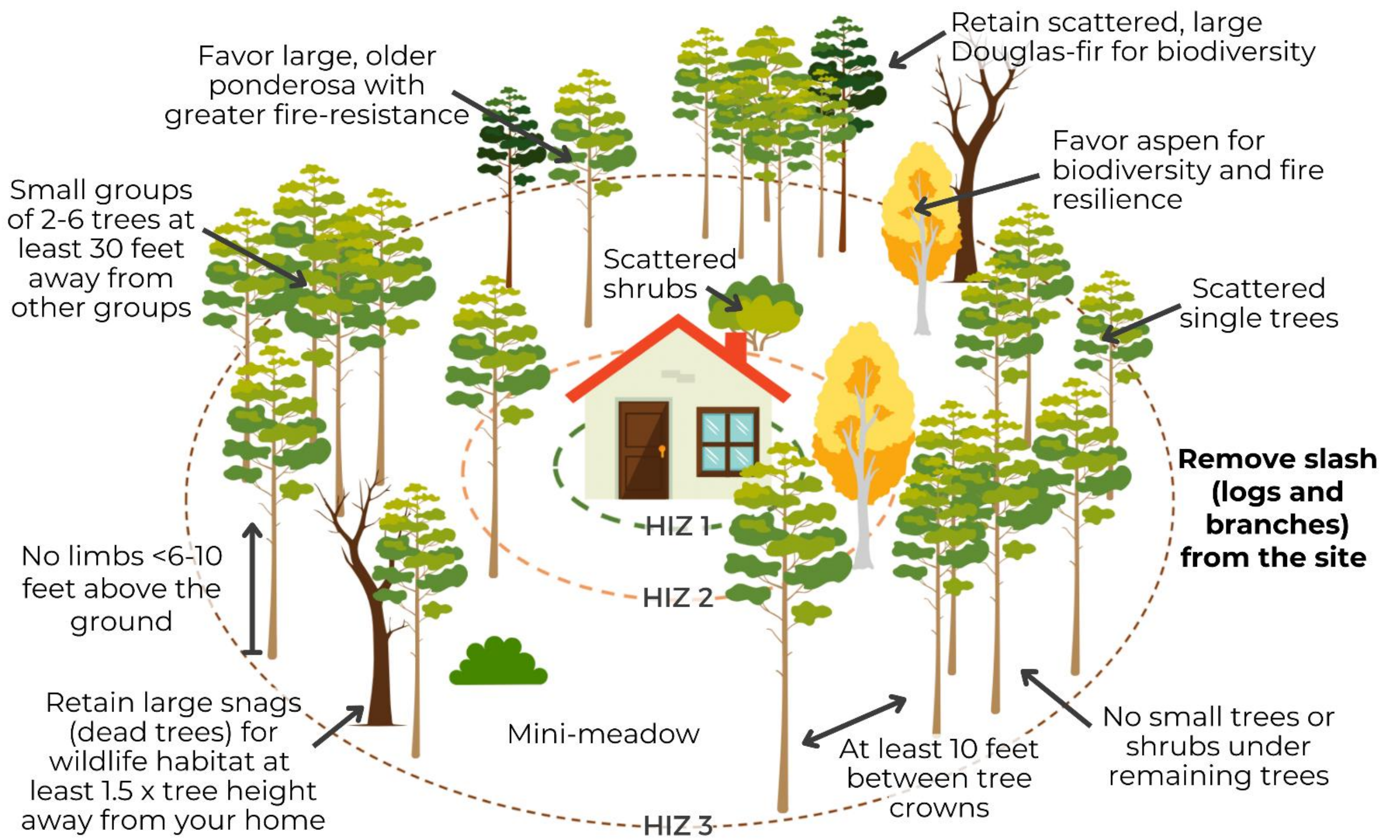
Management in Home Ignition Zone 3

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)

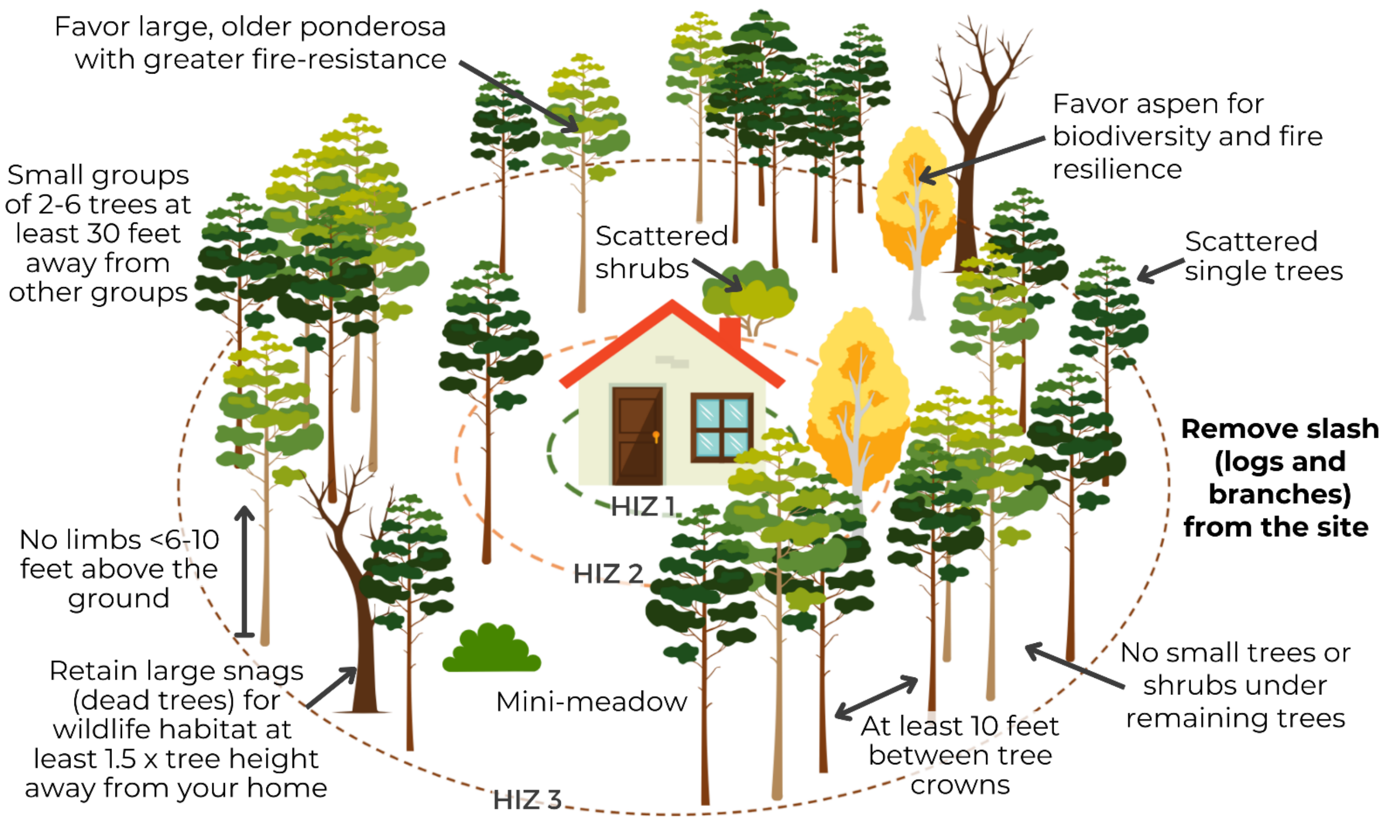
Fire severity: Moderate-severity with patches of stand-replacing fire where most or all trees die

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.

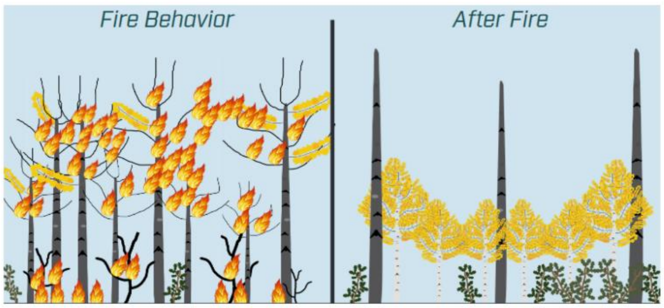
Aspen forests

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

Typical elevation: Highly variable

Fire return interval: Highly variable

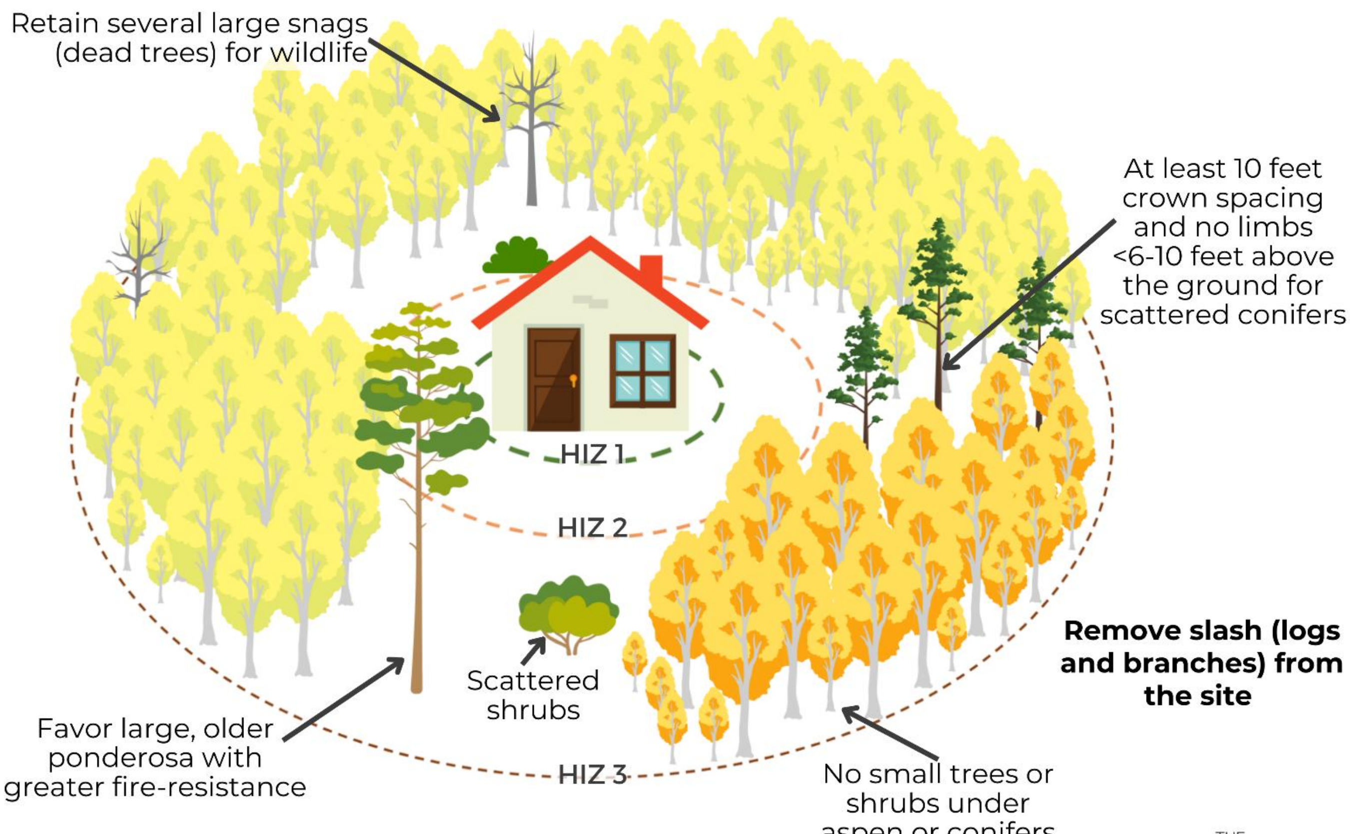
Fire severity: Slow and creeping or, during drought, stand-replacing fire where most or all trees die



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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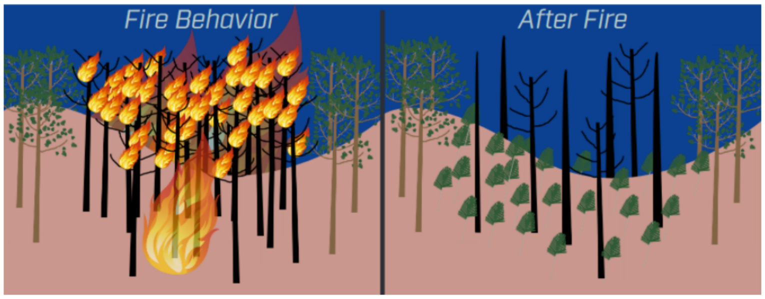
Typical elevation: 8,000-10,000 ft

Fire return interval: 75 to 300 years (infrequent)

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

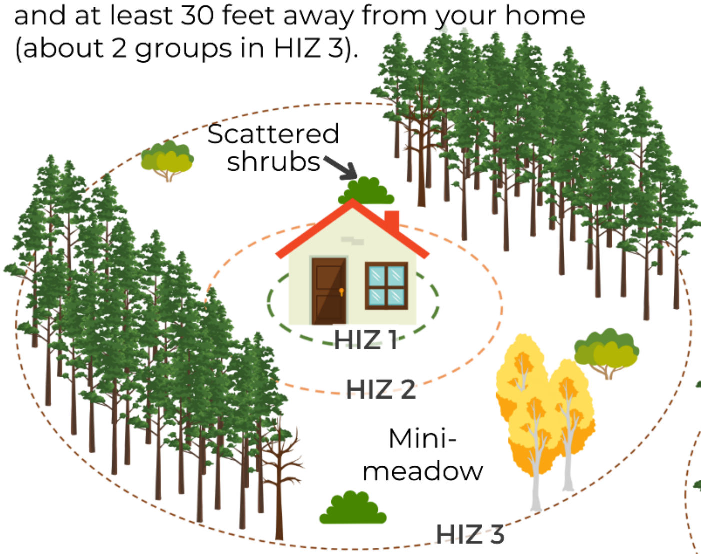


Lodgepole pine forests naturally grow densely, so fire spreads easily from tree crown to tree crown, resulting in patches where most trees are killed. Lodgepole pine also can have serotinous cones, which open and release seeds when heated by fire. These seeds then readily regenerate the new forest. More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

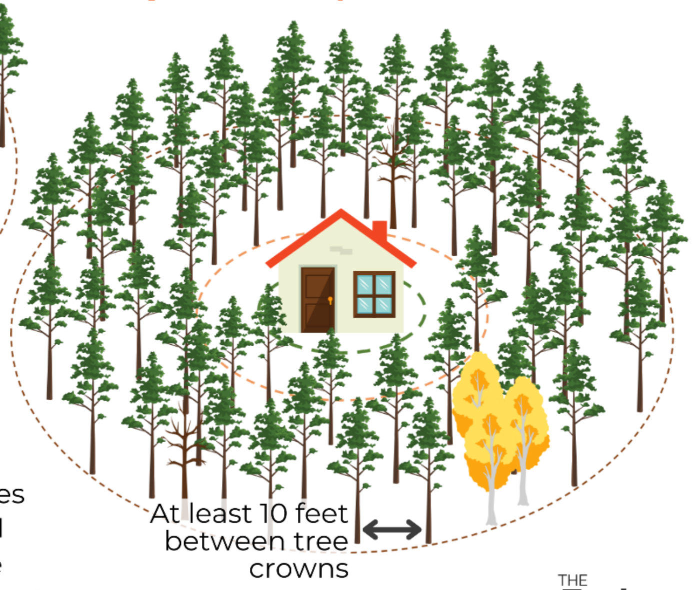
Management in Home Ignition Zone 3

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.

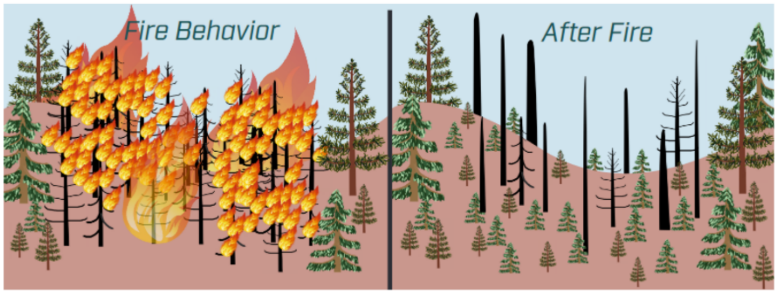
Subalpine forests

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

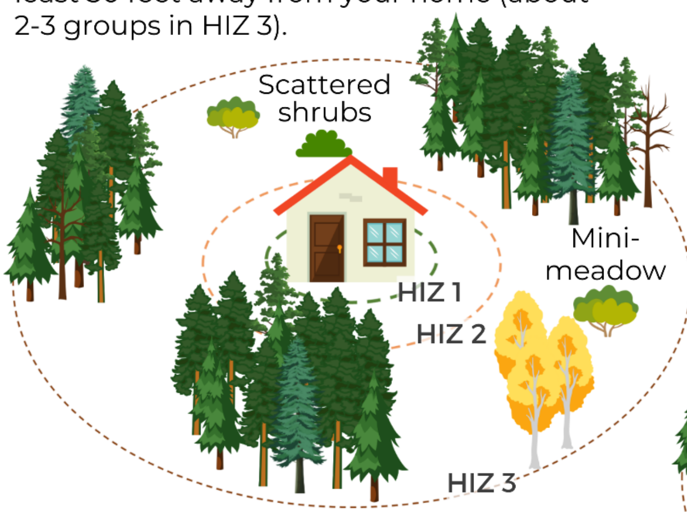


Subalpine forests are the wettest and densest forests in Colorado. When extended dry conditions occur in these forests, dead trees and other fuels that have accumulated over long periods of time dry out, creating conditions ripe for fire. Fires are infrequent, stand-replacing, and often synchronous across 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.

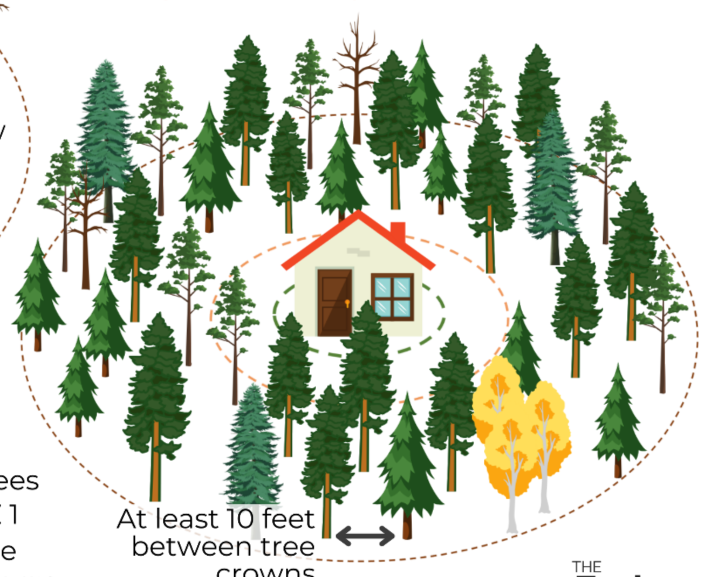
Management in Home Ignition Zone 3

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)**

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

3.d. Recommendations for GGFPD and Partner Organizations

The following overarching goals were determined through meetings with the advisory committee and wider project partners. In subsequent meetings, specific activities were determined based on input from subject matter expertise from the advisory committee. Additionally, information gathered from the Mid-Project Community Workshop was shared with the advisory committee and taken into consideration when determining the following recommendations for GGFPD and partner organizations.

Golden Gate Fire Protection District Priority Recommendations

Fuels Management		
Goals	**Activities**	**Responsible Parties**
Increase Capacity to Complete Mitigation Work	Establish Wildland Mitigation Division through GGFPD - volunteer fuels crews	GGFPD
Streamline HIZ mitigation process for homeowners	Establish a mitigation trailer / equipment cache	GGFPD Wildland Mitigation Division
	Conduct home assessments with feedback for homeowner education	GGFPD Wildland Mitigation Division
	Establish annual district slash collection program	GGFPD Wildland Mitigation Division
Secure Funding to Increase Capacity	Identify funding sources for fuel management and apply	GGFPD Wildland Mitigation Division

Community Outreach and Education		
Goals	**Activities**	**Responsible Parties**
Broaden Wildfire Education and Community Engagement	Create 3 spots for educators within Wildland Mitigation Division that will serve as educational ambassadors to community	GGFPD
	Put up "Fire Danger Level" signage throughout district	GGFPD
	Diversify modes of communication and forms of educational outreach	GGFPD Wildland Mitigation Division
	Host community events in conjunction with fire safety education (ie: pig roast, slash event)	GGFPD Wildland Mitigation Division
Streamline HIZ Mitigation Process for Homeowners	Organize and disseminate best practices for HIZ work, slash management info, etc.	GGFPD Wildland Mitigation Division
	Join wildfire prepared program - forestry contractors for HIZ work	GGFPD Wildland Mitigation Division
	Inform community of county micro-grants and other funding opportunities for mitigation work	GGFPD Wildland Mitigation Division, Jefferson County

District Capacity		
Goals	**Activities**	**Responsible Parties**
Understand current capacity and identify needs / opportunities	Perform an assessment of needs (water availability, CWPP District Capacity)	GGFPD, Community members, Community organizations
	Determine cistern locations and conditions	GGFPD, Community members, Community organizations
	Create proper signage to mark water locations	GGFPD, Community members, Community organizations
Increase overall district capacity: Improve all terrain water carrying capacity, Improve backcountry access	Wildland fire apparatus replacement and acquisition	GGFPD
	Identify sources of funding	GGFPD
	Increase / advance training for wildland firefighting	GGFPD, Jefferson County

Evacuation and Safety		
Goals	**Activities**	**Responsible Parties**
Public Educated on Evacuation Best Practices	Organize and disseminate Sheriff's evacuation reference (1-pager)	GGFPD Wildland Mitigation Division, Jefferson County Sheriff's Office, Auxiliary, Grange, Jefferson County
	Host fire safety events with booths and information on evacuation safety and best practices	GGFPD Wildland Mitigation Division, Jefferson County Sheriff's Office, Auxiliary, Grange, Jefferson County
Public Prepared in Case of Evacuation	Lookout Alert	Jefferson County Sheriff's Office, Community Members, GGFPD
	Organize go-bags	GGFPD Wildland Mitigation Division, Community Members
	Make pre-arrangements for evacuating livestock	GGFPD Wildland Mitigation Division, Community Members, Jefferson County Sheriff's Office
Increase Evacuation Efficiency and Safety	Establish shelter-in-place and areas of safe refuge	GGFPD, Jefferson County Sheriff's Office
	Proper signage for addresses throughout district	GGFPD, Community Members, Auxiliary

Misc: Code, Certification, HIZ, Home Hardening		
Goals	**Activities**	**Responsible Parties**
Receive Firewise Community designation	Complete CWPP and other firewise requirements	GGFPD, TEA
Adopt Fire Code that meets or exceeds 2025 State of CO wildfire resiliency code	Write and adopt wildfire resiliency codes	Jefferson County, GGFPD
Adhere to adopted fire code	Enforce adopted wildfire resiliency code	GGFPD delegated to Jefferson County

3.e. 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** 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 fuel breaks, 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.

Treatment Types Covered in the CWPP

This CWPP covers fuel treatments in the home ignition zone 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, addressed in Section 3.c of this document. zones 1-2 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. 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

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

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). Hand crews 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.

Broadcast Prescribed Burning

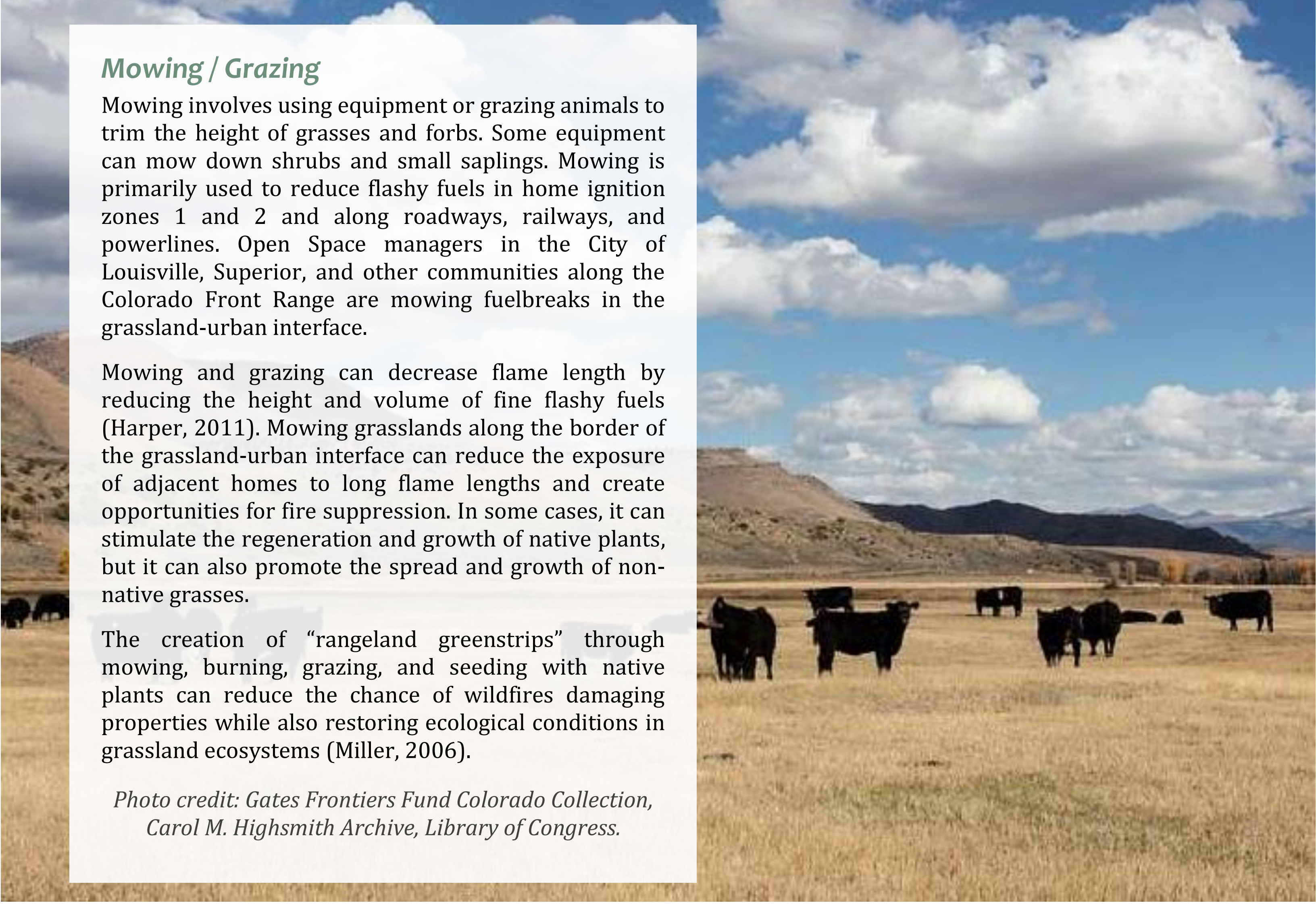
Broadcast prescribed burning (also called broadcast burning, prescribed fire, or controlled fire) is defined as wildland fire originating from a planned ignition in accordance with applicable laws, policies, and regulations to meet specific objectives. It is often the most effective method to mitigate 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.

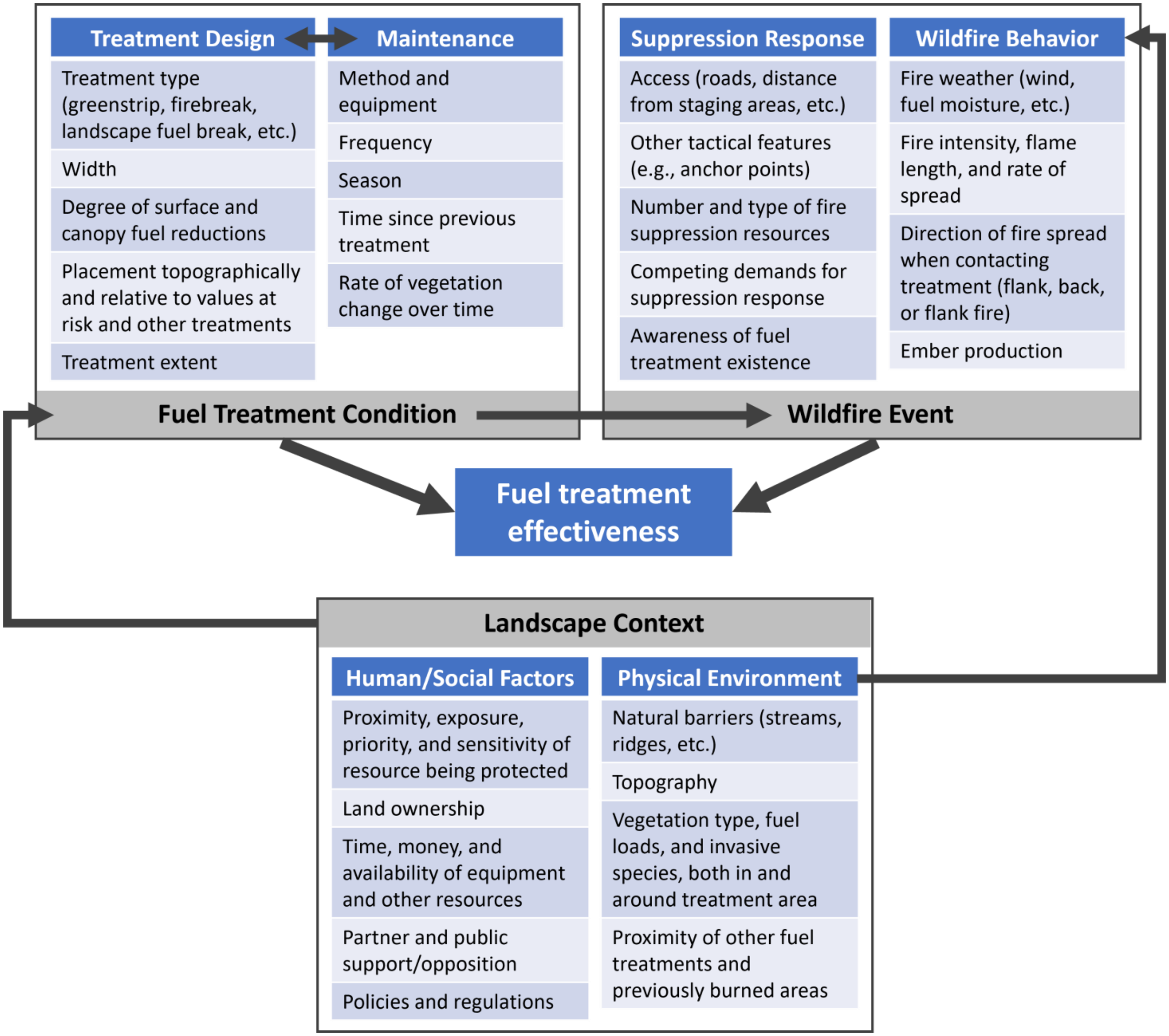


Figure 4.a.1. The effectiveness of fuel treatments at altering wildfire behavior is influenced by numerous factors related to landscape context, fuel treatment specifications, and conditions during a wildfire event. Figure modified by The Ember Alliance based on (Jain et al., 2021; Trauernicht and Kunz, 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.d.1**). Treatments along roadways are often used as part of a shaded fuel break (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.d.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.3** 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 crown spacing between remaining trees or clumps within the roadside treatment zone specified in **Table 4.d.1** in order to reduce the intensity of wildfire if a fire were to approach the road. See **Figure 3.a.2** 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 people 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.

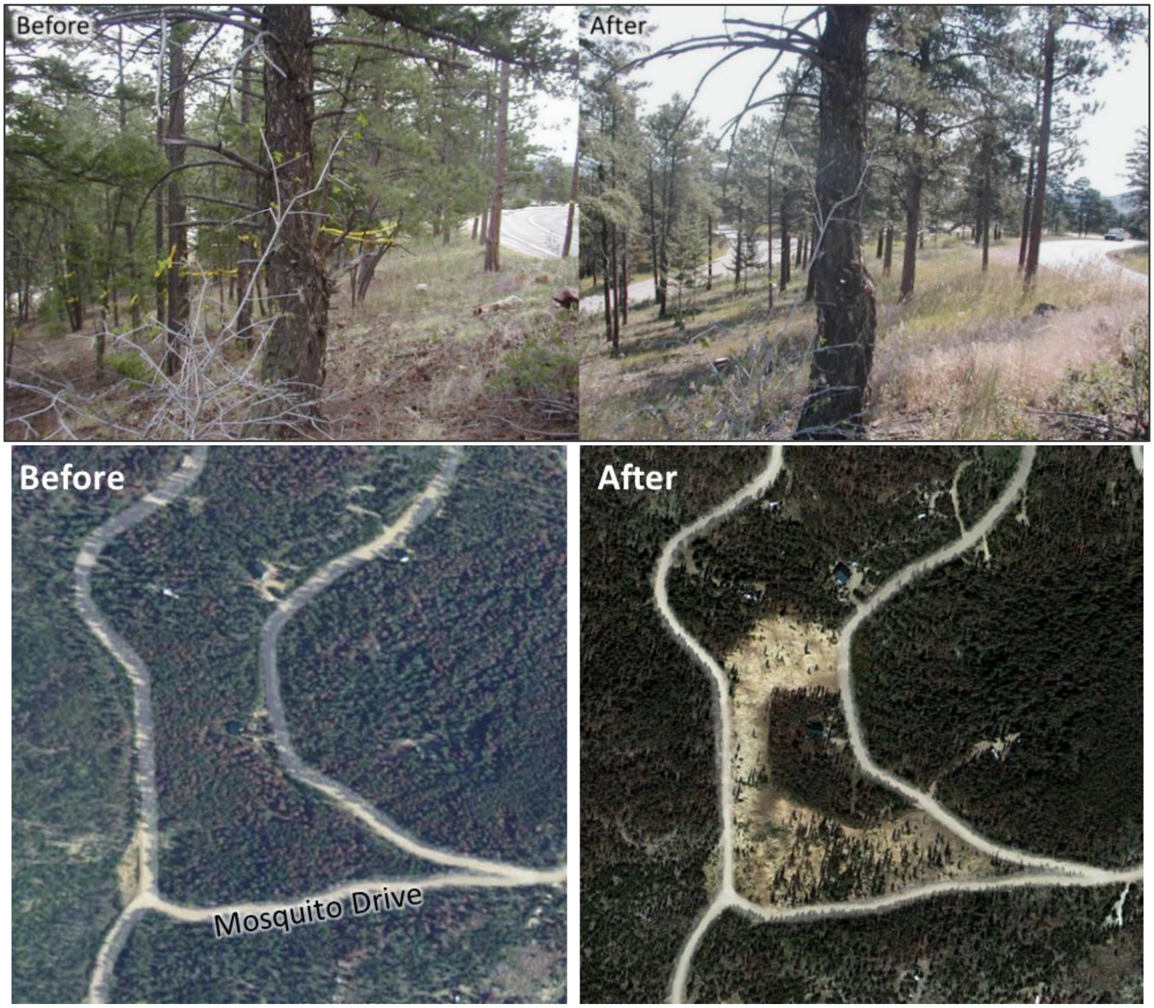


Figure 4.b.1. *Effective roadside fuel treatments remove enough trees to result in widely spaced crowns, remove ladder fuels, and reduce surface fuels. Photos: Genesee Foundation (top) and USDA/FPAC/GEO/Google Earth (bottom).*

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.

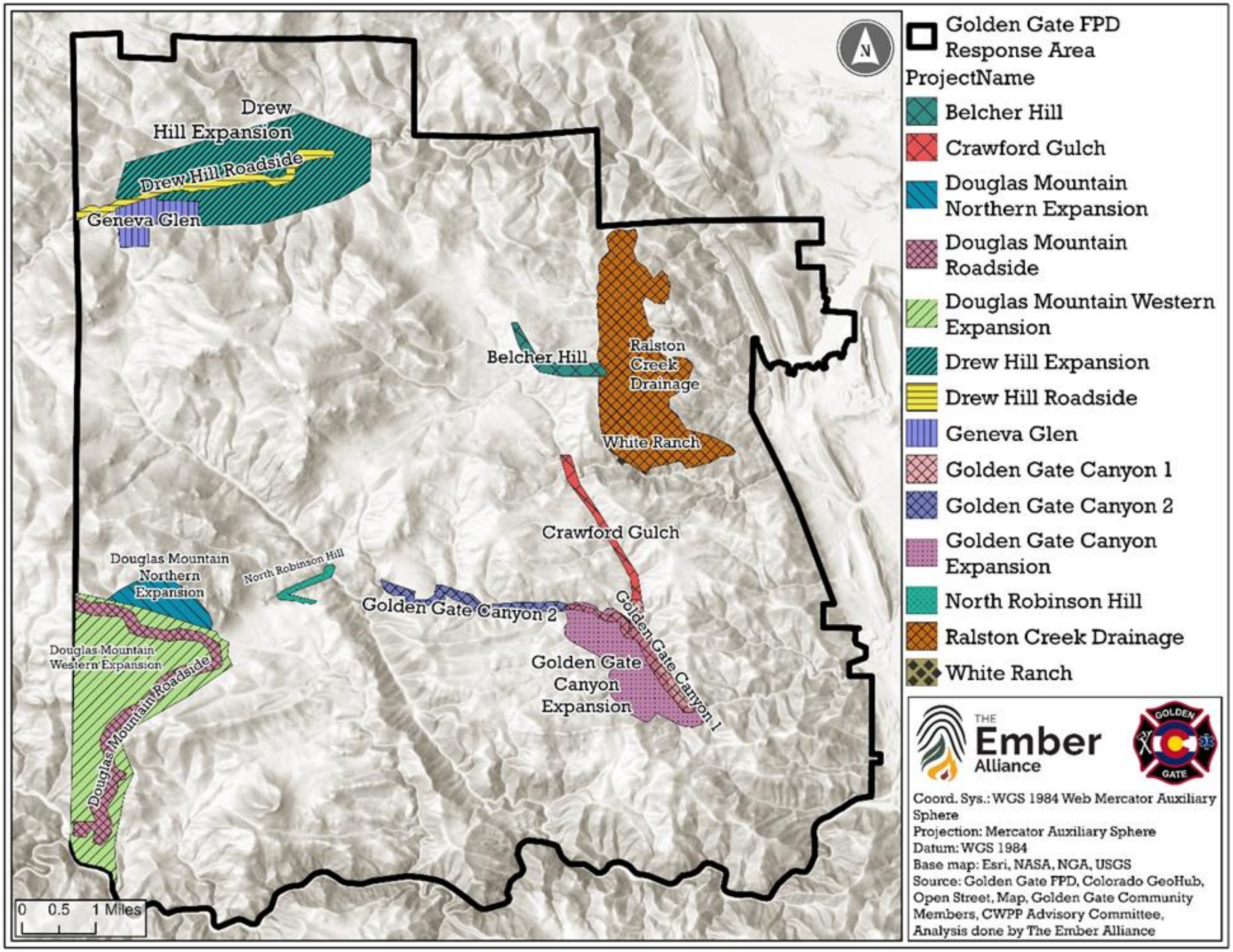
4.c. Priority Project Areas for GGFPD

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 GGFPD to be implemented in the next 5 years (**Figure 4.b.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.

To identify project areas in this CWPP, the advisory committee conducted a project identification and prioritization process. This process consisted of an initial 3-hour project identification meeting held on April 28, 2025 at the Golden Gate Grange. Total in attendance were 16 people with attendees representing the following organizations and interests:

- Clear Creek Watershed and Forest Health Partnership
- Colorado State Forest Service
- CSU's Conservation Leadership graduate program
- Denver Water
- Golden Gate Grange and community interests
- Golden Gate Fire Protection District
- Jefferson County Sheriff's Office
- Jefferson County Parks & Open Space
- Jefferson Conservation District
- The Ember Alliance

Attendees were divided into three groups and worked through the prioritization process facilitated by TEA staff. Each group was asked to provide their perspective based on subject matter expertise and discuss amongst themselves at each stage to produce a final output. First, attendees were shown maps that compiled outputs produced throughout the CWPP process representative of the fire risks within GGFPD to determine areas of highest wildfire concern. Once these areas were identified, the groups were given a new map consisting of infrastructure exposure outputs and asked to identify priority areas based on valuable infrastructure within the district. For the final stage, groups were given a map that displayed land ownership information (agency vs private), multi-agency priority areas, and previous and planned fuel treatments. This map was used to determine feasible locations for project implementation to address the risk identified in the previous two stages. The outputs from each stage were compiled and examined to determine final project boundaries. Over the subsequent weeks following this initial project identification meeting, advisory committee members and wider project partners reviewed the project areas and determined feasibility and priority amongst the projects. In addition to advisory committee input, community feedback collected during the Mid-Project Community Workshop was also consulted during this process to help determine locations of projects and final priority. Based on expert feedback, each project was assigned to an agency or organization that would take the lead on the project, and any other organizations or individuals whose participation would be required for successful implementation were identified and noted. Lead organizations for each project determined the feasible time frame. Finally, the priority of each project was determined through discussion amongst partner organizations and feedback from subject matter experts. In addition to advisory committee input, community feedback collected during the Mid-Project Community Workshop was also consulted during this process to help determine locations of projects and final priority.


Drew Hill Expansion
Drew Hill Roadside
Geneva Glen
Belcher Hill
Ralston Creek Drainage
White Ranch
Crawford Gulch
Douglas Mountain Northern Expansion
North Robinson Hill
Golden Gate Canyon 2
Golden Gate Canyon 1
Golden Gate Canyon Expansion
Douglas Mountain Western Expansion
Douglas Mountain Roadside
0 0.5 1 Miles
Golden Gate FPD Response Area
ProjectName
Belcher Hill
Crawford Gulch
Douglas Mountain Northern Expansion
Douglas Mountain Roadside
Douglas Mountain Western Expansion
Drew Hill Expansion
Drew Hill Roadside
Geneva Glen
Golden Gate Canyon 1
Golden Gate Canyon 2
Golden Gate Canyon Expansion
North Robinson Hill
Ralston Creek Drainage
White Ranch
THE Ember Alliance
GOLDEN GATE
Coord. Sys.: WGS 1984 Web Mercator Auxiliary Sphere
Projection: Mercator Auxiliary Sphere
Datum: WGS 1984
Base map: Esri, NASA, NGA, USGS
Source: Golden Gate FPD, Colorado GeoHub, Open Street, Map, Golden Gate Community Members, CWPP Advisory Committee, Analysis done by The Ember Alliance

Roadside Fuel Treatments				
Project Name	**Lead Org**	**Orgs involved**	**Priority**	**Time Frame**
Golden Gate Canyon 1	GGFPD	GGFPD, JCSO, Private Landowners	1	2025
Golden Gate Canyon 2	GGFPD	GGFPD, JCSO, Private Landowners	1	2025-2026
North Robinson Hill	GGFPD	GGFPD, JCSO, TNC, Private Landowners	1	2026 start and finish
Crawford Gulch	GGFPD	GGFPD, JCSO, Private Landowners	1	2026
Douglas Mountain Roadside	GGFPD	GGFPD, JCPOS, JCSO, Douglas Mountain HOA, Private Landowners	2	2027 (start and finish)
Drew Hill Roadside	JCSO	CSFS, GGFPD	2	2027 (start planning)
Belcher Hill	GGFPD	GGFPD, JCSO, Private Landowners	3	2030 (start and finish)

Overall Goals for Roadside Treatments:

Golden Gate Canyon 1: Increase evacuation safety for residents along the main evacuation route for the district. As Golden Gate Canyon Rd serves as a main evacuation route for most plan units in the district, this route will experience high congestion during evacuations. This project seeks to address the areas of road with non-survivable conditions by completing roadside fuel work to provide a safe means of egress for residents. This is of highest priority due to its importance in evacuations and current conditions.

Golden Gate Canyon 2: Increase evacuation safety for residents along a main evacuation route in the district. This project ties into Golden Gate Canyon 1 and seeks to improve roadside conditions along an evacuation route ahead of a main pinch-point/intersection with another main means of egress. This project seeks to address the areas of road with non-survivable conditions by completing roadside fuel work to provide a safe means of egress for residents.

North Robinson Hill: Increase evacuation safety for residents along an evacuation route and provide volunteer firefighters with a safe, accessible roadway to respond to wildfire incidents. This project seeks to address the areas of road with non-survivable conditions and inaccessibility by completing roadside fuel work.

Crawford Gulch: Increase evacuation safety for residents along a main evacuation route in the district. Similar to Golden Gate Canyon 2, this project ties into Golden Gate Canyon 1 and seeks to improve roadside conditions along an evacuation route ahead of a main pinch-point/intersection with another main means of egress. This project seeks to address the areas of road with non-survivable conditions by completing roadside fuel work to provide a safe means of egress for residents.

Douglas Mountain Roadside: Increase evacuation safety for residents along an evacuation route that serves as a main route for a portion of the district and may see increased traffic during an incident due to neighboring districts and counties evacuating. This project seeks to address the areas of road with non-survivable conditions by completing roadside fuel work to provide a safe means of egress for residents.

Drew Hill Roadside: Increase evacuation safety for residents along an evacuation route that serves as a main route for a portion of the district. This thoroughfare contains many stretches with potentially non-survivable conditions. As this serves as a main evacuation route for residents in this plan unit, it is imperative to address the areas along this route with dense fuels and potentially non-survivable conditions.

Belcher Hill: Improve roadside conditions leading into White Ranch Open space.

Stand-Scale Fuel Treatments				
Project Name	**Lead Org**	**Orgs involved**	**Priority**	**Time Frame**
Golden Gate Canyon Expansion	GGFPD	GGFPD, JCSO, Private Landowners	1	2026 (long term)
Douglas Mountain Western Expansion	GGFPD	GGFPD, JCPOS, JCSO, Private Landowners, Douglas Mountain HOA	2	2027 (longer term)
Drew Hill Expansion	CSFS	CPW	2	2027 (start planning)
Geneva Glen	GGFPD	GGFPD, JCSO, Private Landowners, CSFS or JCD (for larger parcels)	2	long term (start in 2026)
Douglas Mountain Northern Expansion	JCPOS	GGFPD, JCPOS, JCSO, Private Landowners	3	2030 (long term)
Ralston Creek Drainage	Denver Water	JCPOS, Arvada Water, CCWFHP	3	2030
White Ranch	JCPOS	Arvada Water, Denver Water, CCWFHP	3	2030

Overall Goals for Stand-scale Fuel Treatments:

Golden Gate Canyon Expansion: Alter fire behavior in areas surrounding main evacuation routes that could experience extreme fire behavior. This expansion would expand the Golden Gate roadside treatments westward, addressing the risk posed by surrounding fuels and prevailing winds out of the west.

Douglas Mountain Western Expansion: Alter fire behavior in areas surrounding the Douglas Mountain evacuation route that could experience extreme fire behavior. This expansion would expand the Douglas Mountain roadside treatments westward, addressing the risk posed by surrounding fuels and prevailing winds out of the west

Drew Hill Expansion: Alter fire behavior in areas surrounding the Drew Hill evacuation route that could experience extreme fire behavior. This expansion would expand the Drew Hill roadside treatments, addressing the risk posed by surrounding fuels.

Geneva Glen: Alter fire behavior in areas of Drew Hill with higher housing density that could experience extreme fire behavior.

Douglas Mountain Northern Expansion: Alter fire behavior in areas of Douglas Mountain on public land that could experience extreme fire behavior.

Ralston Creek Drainage: Address post-fire concerns surrounding highly valued water resources and assets by altering fire behavior in areas west of important source water resources.

White Ranch: Alter fire behavior in areas on public lands that could experience extreme fire behavior and increase overall resilience by tying into past treatments.

4.d. Logistics of Fuel Treatments

Roles and Responsibilities

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 (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., 2017). 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.

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.*

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 moistures, 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 22-1 Darcy's Last Call Act), individuals must contact their local fire department before burning.

- 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.

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. [FPD_ACRONYM] and partner organizations should continue to host their chipping events and programs for residents as 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 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 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
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, [FPD_ACRONYM], 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 2025. • Has the highest potential for immediate return-on-investment. • Can be funded within the current capacity of [FPD_ACRONYM] 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 [FPD_ACRONYM] 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 2027. • Requires moderate expansion of financial and implementation capacity of [FPD_ACRONYM] 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 2030. • Requires multi-year planning and funding. • Requires extensive grant funding. • Requires substantial expansion of financial and implementation capacity of [FPD_ACRONYM] 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

Recommendation	Responsibility	Priority	Category
Immediate Implementation Phase			
Embrace the concept of Fire Adapted Communities	GGFPD, HOAs, residents	First	Fire Adapted Communities
Complete home hardening	Residents	First	Fire Adapted Communities
Mitigate HIZ 1	Residents	First	Fire Adapted Communities
Mitigate HIZ 2	Residents	First	Fire Adapted Communities
Follow specific recommendations for HIZ 3 based on fuel type	Residents	First	Fire Adapted Communities
Get involved in the Wildland Mitigation Division	Residents	First	Fire Adapted Communities
Sign up for emergency notification through Lookout Alert	Residents	First	Fire Adapted Communities
Attend events hosted by GGFPD and other agencies about wildfire mitigation, emergency preparedness, and evacuation	Residents	First	Fire Adapted Communities
Invest time and energy into proper evacuation preparedness	Residents	First	Fire Adapted Communities
Consider animals and livestock in evacuation planning	Residents	First	Fire Adapted Communities
Make private water resources such as cisterns accessible for firefighters	Residents	First	Fire Adapted Communities
Notify GGFPD of the private water resources and home fire defense systems you have on your property	Residents	First	Fire Adapted Communities
Check the condition of your cistern or private water resource	Residents	First	Fire Adapted Communities

Establish Wildland Mitigation Division through GGFD - volunteer fuels crews	GGFPD	First	Resilient Landscapes
Apply for grants to fund roadway improvements and roadside fuel treatments	GGFPD Wildland Mitigation Division	First	Resilient Landscapes
Create 3 spots for educators within Wildland Mitigation Division that will serve as educational ambassadors to community	GGFPD Wildland Mitigation Division	First	Fire Adapted Communities
Perform an assessment of needs (water availability, CWPP District Capacity)	GGFPD, Community members, Community organizations	First	Fire Adapted Communities
Create proper signage to mark water locations	GGFPD, Community members, Community organizations	Third	Fire Adapted Communities
Identify sources of funding to increase district capacity and apply	GGFPD	First	Fire Adapted Communities
Organize and disseminate Sheriff's evacuation reference (1-pager)	GGFPD WMD, JCSO, Auxiliary, Grange, Jefferson County	First	Fire Adapted Communities
Proper signage for addresses throughout district	GGFPD, Community Members, Auxiliary	First	Fire Adapted Communities
Organize and disseminate best practices for HIZ work, slash management info, etc.	GGFPD Wildland Mitigation Division	First	Fire Adapted Communities
Begin communication and outreach to implement roadside and stand-scale projects	GGFPD Wildland Mitigation Division	First	Fire Adapted Communities, Resilient Landscapes
Begin and complete work on Golden Gate Canyon 1	GGFPD, JCSO, Private Landowners	First	Fire Adapted Communities
Begin and complete work on Golden Gate Canyon 2	GGFPD, JCSO, JCPOS, Private Landowners	First	Fire Adapted Communities
Begin work on Golden Gate Canyon Expansion	GGFPD, JCSO, Private Landowners	First	Resilient Landscapes
Begin and complete work on North Robinson Hill Road	GGFPD, JCSO, TNC, Private Landowners	First	Fire Adapted Communities

Short-term Implementation Phase			
Offer home assessments to interested residents	GGFPD Wildland Mitigation Division	First	Fire Adapted Communities
Fire Danger Level signage throughout district	GGFPD Wildland Mitigation Division	Second	Fire Adapted Communities
Establish annual district slash collection program	GGFPD Wildland Mitigation Division	Second	Fire Adapted Communities
Determine cistern locations and conditions	GGFPD, Community members, Community organizations	Second	Fire Adapted Communities
Increase / advance training for wildland firefighting	GGFPD, Jefferson County	Second	Safe and Effective Fire Response
Establish shelter-in-place and areas of safe refuge	GGFPD, JCSO	Second	Fire Adapted Communities
Write and adopt wildfire resiliency codes	Jefferson County, GGFPD	Second	Fire Adapted Communities
Begin and complete work on Douglas Mountain Roadside	GGFPD, JCPOS, JCSO, Douglas Mountain Homeowners Association, Private Landowners	Second	Fire Adapted Communities
Begin planning treatment on Drew Hill Roadside	CSFS, JCSO	Second	Fire Adapted Communities
Begin planning treatment for Douglas Mountain Expansion	GGFPD, JCPOS, JCSO, Private Landowners, Douglas Mountain Homeowners Association	Second	Resilient Landscapes
Begin planning treatment for Drew Hill Expansion	CSFS, CPW	Second	Resilient Landscapes
Begin planning treatment for Geneva Glen	GGFPD, JCSO, Private Landowners, CSFS or JCD (for larger parcels)	Second	Resilient Landscapes
Host community events w/ safety education (ex: pig roast, slash event)	GGFPD Wildland Mitigation Division	Third	Fire Adapted Communities
Diversify modes of communication	GGFPD Wildland Mitigation Division	Third	Fire Adapted Communities

Begin and complete work on Douglas Mountain Roadside	GGFPD, JCPOS, JCSO, Douglas Mountain Homeowners Association, Private Landowners	Third	
Mid-term Implementation Phase			
Inform community of county micro-grants and other funding opportunities as county program becomes available	GGFPD Wildland Mitigation Division	First	Fire Adapted Communities
Wildland fire apparatus replacement and acquisition	GGFPD	First	Safe and Effective Fire Response
Complete CWPP and other Firewise requirements	GGFPD, TEA	First	Fire Adapted Communities
Join wildfire prepared program - forestry contractors for HIZ work	GGFPD Wildland Mitigation Division	Third	Fire Adapted Communities
Establish a mitigation trailer / equipment cache	GGFPD Wildland Mitigation Division	Third	Fire Adapted Communities
Code enforcement	GGFPD delegated to Jefferson County	Third	Fire Adapted Communities
Plan and Complete treatment for Belcher Hill Roadside	GGFPD, JCSO, Private Landowners	Third	Fire Adapted Communities
Begin Planning treatment for Douglas Mountain Northern Expansion	GGFPD, JCPOS, JCSO, Private Landowners	Third	Resilient Landscapes
Begin Planning treatment for Ralston Drainage	Denver Water, JeffCo Open Space, Arvada Water, Clear Creek Partnership	Third	Resilient Landscapes
Begin Planning treatment for White Ranch	Denver Water, JeffCo Open Space, Arvada Water, Clear Creek Partnership	Third	Resilient Landscapes
Long-term Implementation Phase			
Complete outstanding fuel treatments	see designated organizations per treatment	See priority per treatment	Fire Adapted Communities, Resilient Landscapes

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 GGFPD 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 GGFPD 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 and across your neighborhood. 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).

Fuel break: A natural or manmade change in fuel characteristics that affects fire behavior so that fires burning into them can be more readily controlled. Fuel breaks differ from firebreaks due to the continued presence of vegetation and organic soil. Trees in shaded fuel breaks 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).

Hand crews: 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 fuel breaks 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 fuel breaks; they are greatly enlarged areas that can be used with relative safety by firefighters without the use of a fire shelter (NWCG, 2018b).

Shaded fuel break: 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): 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 (Mowry and Johnston, 2018).

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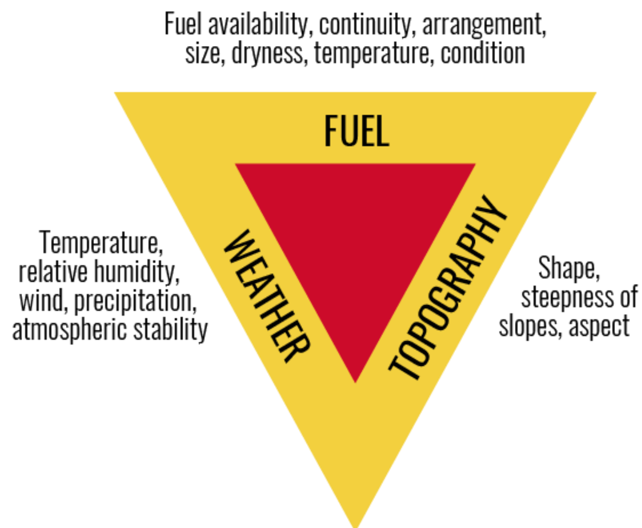
8. Appendix A: Introduction to Wildfire Behavior and Terminology

8.a. Fire Behavior Triangle



Interactions between fuels, weather, and topography dictate fire behavior. Source: [California State University](#).

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).

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).

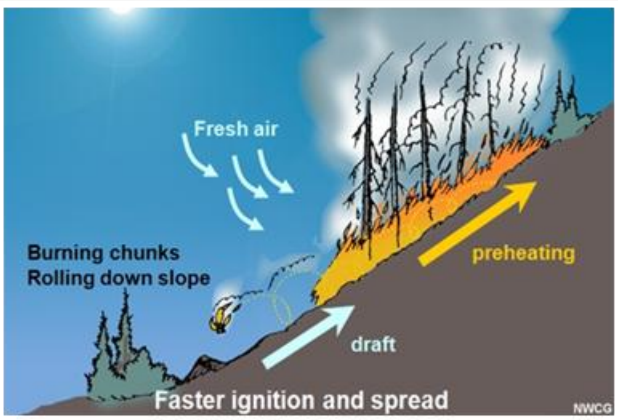
[3] Radiant heat transfer occurs by short-wavelength energy traveling through air. Radiant heat is what you feel when sitting in front of a fire. Radiant heat preheats and dries fuels adjacent to a wildfire, which initiates combustion by lowering the fuel’s ignition temperature. Convective heat transfer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

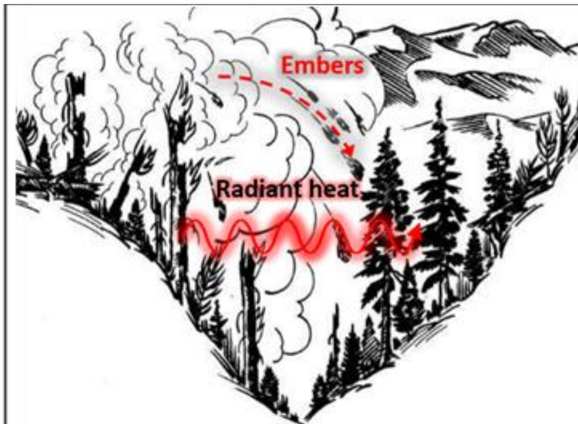
Topography (slope and aspect) influences fire intensity, speed, and spread. In the northern hemisphere, north-facing slopes experience less sun exposure during the day, resulting in higher fuel moisture. Tree density is often higher on north-facing slopes due to higher soil moisture. South-facing slopes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

8.b. 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).

8.c. Wildfire Threats to Homes

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

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 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.

8.d. 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)

9. Appendix B: Community Risk Assessment and Modeling Methodology

9.a. WUI Delineation

Delineating the wildland–urban interface (WUI) is a critical component of Community Wildfire Protection Plans (CWPPs) and is required under the Healthy Forest Restoration Act (HFRA) of 2003. HFRA allows communities to extend the WUI boundary into adjacent areas that pose a wildfire threat to the community, can serve as strategic locations for wildfire response, and are adjacent to evacuation routes (HFRA, 4 U.S.C. §101.16). Strategic wildfire mitigation across the WUI increases the safety of residents and wildland firefighters and reduces the likelihood of structure loss.

For the Golden Gate Fire Protection District (GGFPD), the WUI was delineated using an administrative and operational alignment approach rather than fire behavior modeling. Existing WUI boundaries from Jefferson County, which encompasses GGFPD, and Gilpin County, which borders GGFPD, were reviewed and incorporated. These WUI boundaries were intersected with established Potential Operational Delineation (POD) boundaries to create a consolidated WUI boundary for GGFPD. This approach ensures consistency with adjacent jurisdictions and focuses planning and mitigation efforts along POD boundary lines that are already being prioritized by neighboring fire protection districts and U.S. Forest Service staff for wildfire response and operations.

The approach we took for delineating the WUI for GGFPD aligns with the WUI delineation in the 2024 Jefferson County CWPP, which is being used to inform WUI building code, planning, and zoning. All of GGFPD falls within the WUI under both the approach we used for the GGFPD CWPP and that used for the Jefferson County CWPP.

9.b. Fire Behavior Analysis

Model Specifications and Inputs

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 utilized the 2022 Colorado Wildfire Risk Assessment (2022 CO-WRA) as the basis of the wildfire risk assessment for GGFPD. The 2022 CO-WRA is the most recent and advanced version of the wildfire risk assessment available through the Colorado Forest Atlas. The Colorado State Forest Service (CSFS) and Technosylva made improvements in methodology for the 2022 update, notably greater ground-truthing of input data, novel approaches for predicting wildfire spread into suburban and urban areas, and a higher spatial resolution (20-meter resolution versus 30-meter that was used before).

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 GGFPD, 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 GGFPD than predicted by the 2022 Colorado Wildfire Risk Assessment.

The 2022 CO-WRA includes predictions of flame length, rate of spread, crown fire activity, fire intensity scale, burn probability, and spotting distance from Technosylva's Wildfire Analyst software, which is similar to the fire behavior model FlamMap. FlamMap 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. Details on the 2022 CO-WRA are provided by (CSFS & Technosylva 2023a, 2023b).

The fire behavior model utilized by CSFS and Technosylva for the 2022 CO-WRA requires information on topography, surface fuel loads, canopy fuel loads, and fire weather conditions (**Figure B.1**). Fuel models are a stylized set of fuel bed characteristics used to characterize surface fuel loads areas the area of interest. **Figure B.2** depicts the fire behavior fuel models present across GGFPD. CO-WRA developers modeled fire behavior under four percentile weather categories that represent low, moderate, high, and extreme weather conditions based on historical observations for each 20-m x 20-m portion of the landscape.

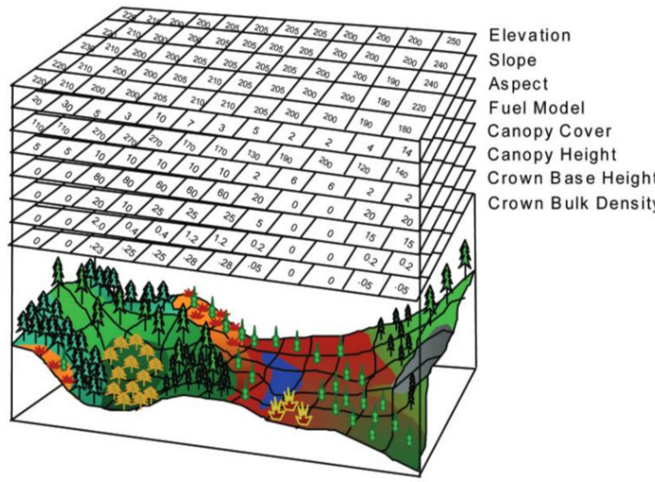


Figure B.1. *Fire behavior fuel models requires a variety of information about topography and fuels. Image from Finney (2006).*

We also used predictions of expected net value change from the 2022 Colorado All-Lands (COAL) fire risk assessment conducted by the U.S. Forest Service Rocky Mountain Region and Pyrologix. The 2022 CO-WRA analysis does not account for potential benefits of wildfire to ecological conditions and other highly valued resources and assets (HVRAs), so we used predictions from the 2022 COAL to provide a holistic view of potential consequences of wildfire on the landscape. Predictions of expected net value change utilize flame length and burn probability predictions from FSim combined with potential sensitivity of HVRAs to different fire intensities and the relative importance of HVRAs. HVRAs included in the assessment were people and property (housing density), infrastructure (electric transmission lines, communication sites, powerplants, substations), vegetation (ecosystem function), and surface drinking water. Relative weights for HVRA categories were 53% for people and property, 32% for infrastructure, 10% for water, and 5% for vegetation. Details on the COAL assessment are provided by (Napoli et al., 2022b, 2022a).

Interpretations and Limitations

Fire behavior analyses are useful for assessing relative risk across the entire GGFPD 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.

Fire behavior models like Technosylva's Wildfire Analyst software and 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, Wildfire Analyst and 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, The Ember Alliance conducted a separate analysis to predict potential exposure of homes to radiant heat and ember cast (see section below).

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).

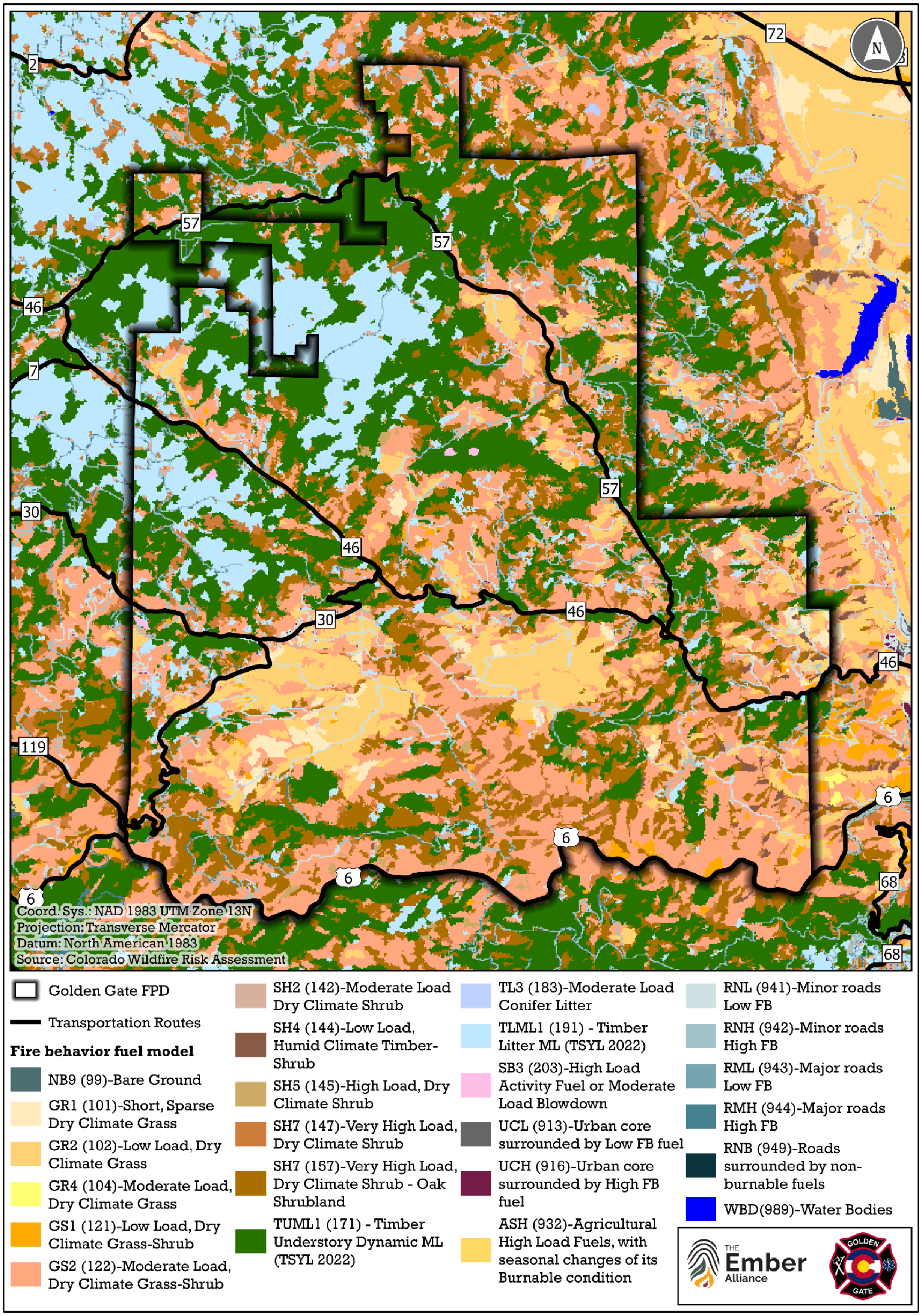


Figure B.2. Timber understory, timber litter, grass, and grass-shrub fuel models are common across GGFPD. See (CSFS and Technosylva, 2023b) for a description of each fuel model. Source: 2022 CO-WRA.

Predicted Fire Behavior

Wildland firefighters pay attention to current and expected fire behavior when making tactical decisions. The Haul Chart is a tool in the Incident Response Pocket Guide carried by all wildland firefighters that can help them interpret fire behavior based on observed flame length, rate of spread, and crown fire activity (**Table B.1**). We utilize cutoffs from the Haul Chart for classifying flame length, rate of spread, and producing a map of fire behavior class using outputs from the 2022 CO-WRA.

Characteristic Flame Length

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 fire intensity—the amount of energy released by a fire.

Characteristic flame length from the 2022 CO-WRA is the weighted average flame length predicted under CO-WRA's low, moderate, high, and extreme fire weather scenarios (**Figure B.3**).

Crown Fire Activity

Figure B.4 shows the potential fire type that might occur across GGFPD (see **Appendix A** for a description of different types of fire behavior). CO-WRA predictions of crown fire activity were made for extreme fire weather conditions. Torching (aka, passive crown fire) could occur over much of GGFPD, and active crown fires are possible on steep slopes in densely forested areas in the northwestern portion of the district. 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.

Characteristic Rate of Spread

Characteristic rate of spread from the 2022 CO-WRA is the weighted average speed with which a head-fire moves in a horizonal direction across the landscape under low, moderate, high, and extreme weather scenarios (**Figure B.6**). Rates of spread are faster on steep slopes, when wind speeds are greater and aligned with the direction of spread, and in fine, flashy fuels like continuous, dry grass. Although slopes are steep and forests dense in the northwestern part of GGFPD, predicted rates of spread are low because under most fire weather conditions, fire moves slowly through timber litter in lodgepole pine forests.

Fire Behavior Class

Ember Alliance combined estimates of characteristic flame length and crown fire activity from the 2022 CO-WRA to produce a map of fire behavior class across the district (**Figure B.5Error! Reference source not found.**). Under hot, dry, and windy weather, 84% percent of the district could experience high to extreme fire behavior, including 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 moisture increases.

Relative Burn Probability

Relative burn probability indicates how likely an area is to burn during a wildfire compared to other areas. Developers of the 2022 CO-WRA simulated over 3 million wildfires over the state of Colorado, with a mean ignition density of 10 fires / km^2. Ignition locations were spatially distributed based on historical fire occurrence. They then determined how many of those fires intersected each 20 m x 20 m portion of the landscape (CSFS and Technosylva, 2023a).

Areas with a greater potential for rapidly-growing wildfires have higher relative burn probabilities because more fire perimeters are likely to overlap when fires are larger. 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 roads, and CO-WRA modelers account for the potential for spot fires when modeling fire spread to predict burn probability.

Most parts of GGFPD have high burn probabilities relative to the rest of the state of Colorado (**Figure B.7**). Burn probabilities are lower in some of the dense lodgepole pine forests in the northwestern part of the district where fires could move slowly through timbe litter under most fire weather conditions. 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.

Table B.1. *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 flames. 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 at the head of the fire by persons using handtools. Handline cannot be relied on to hold the 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.

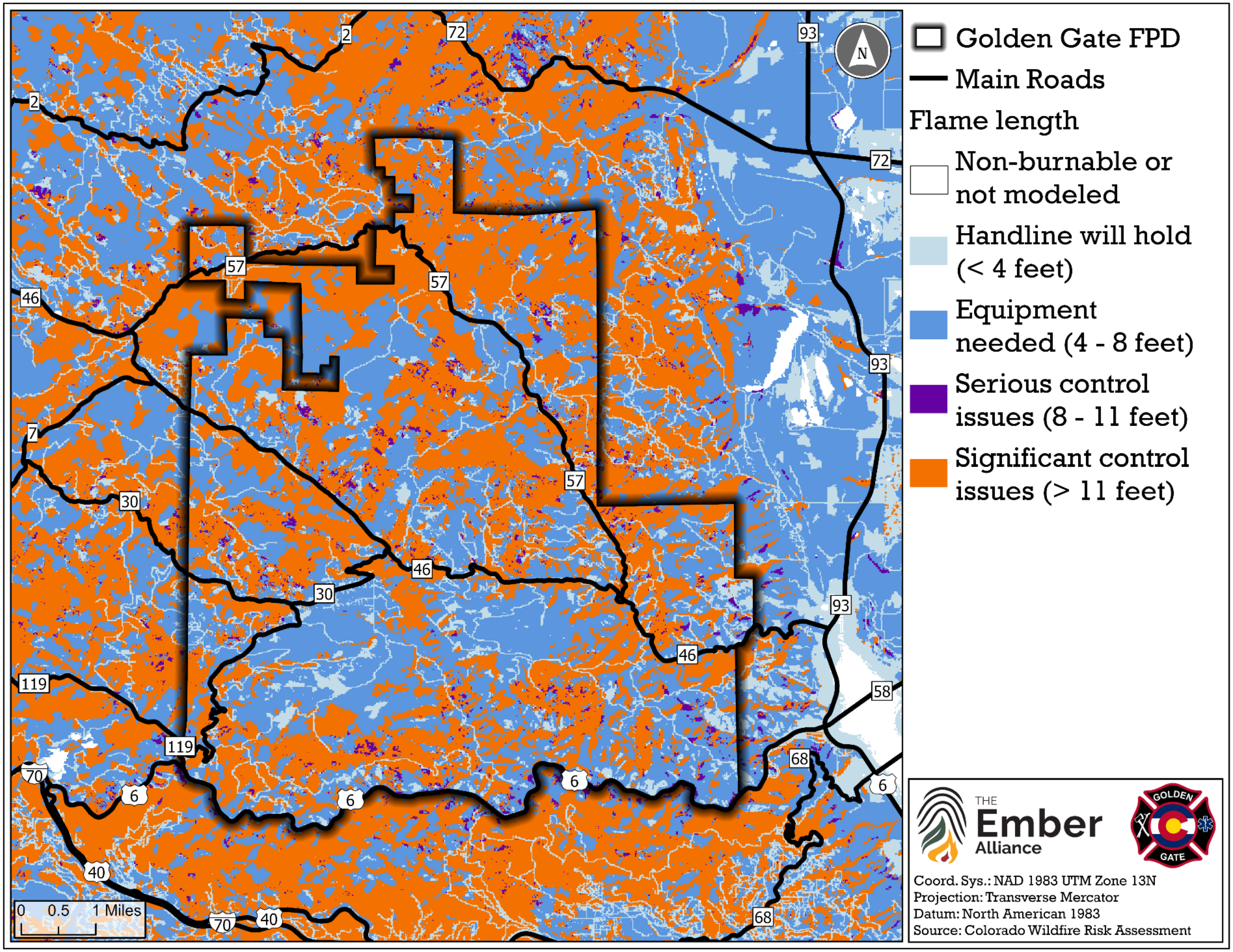


Figure B.3. *Predicted flame lengths in GGFPD categorized by the Haul Chart and averaged across various weather scenarios. Source: 2022 CO-WRA.*

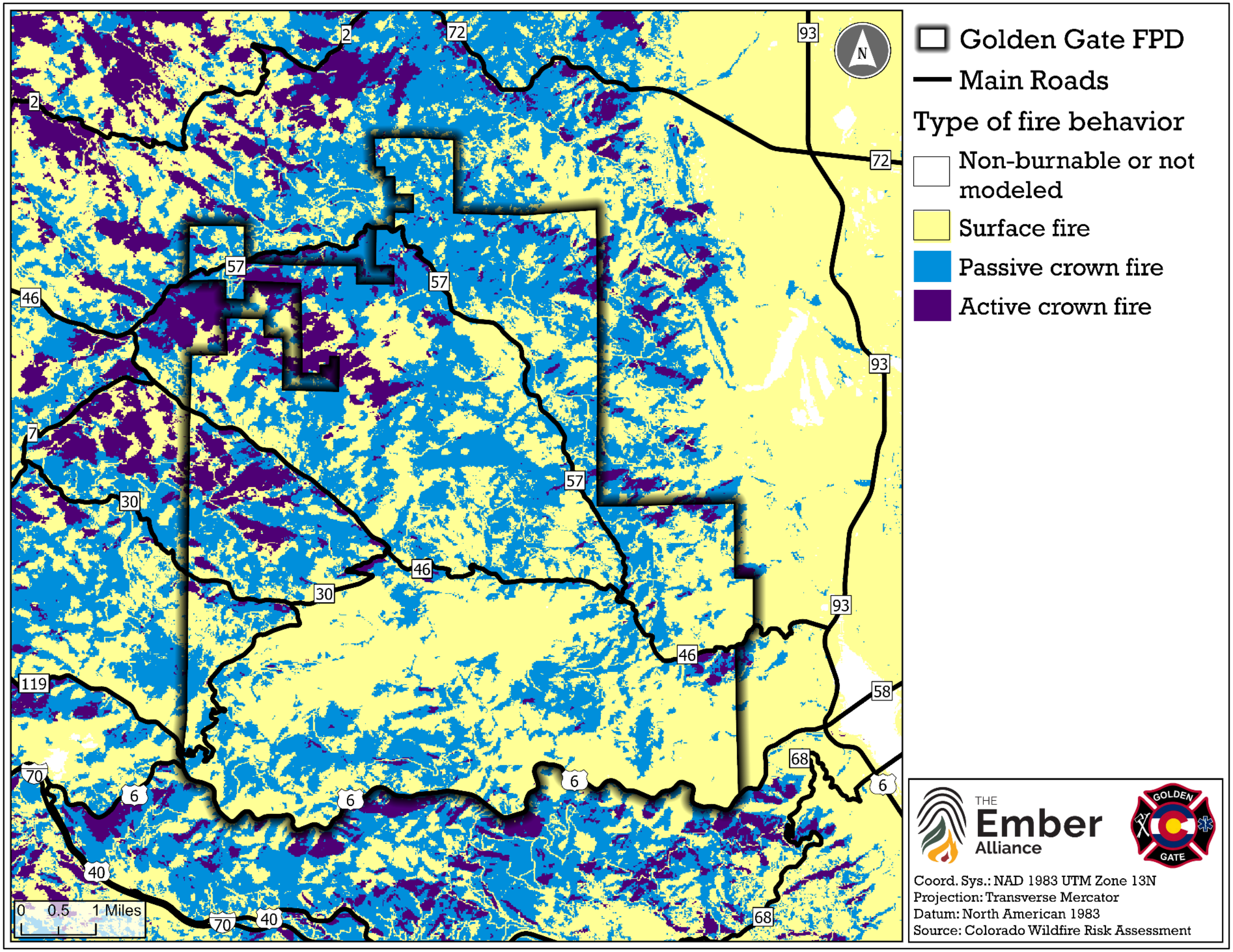


Figure B.4. *Crown fire activity in GGFPD under extreme fire weather conditions. Source: 2022 CO-WRA.*

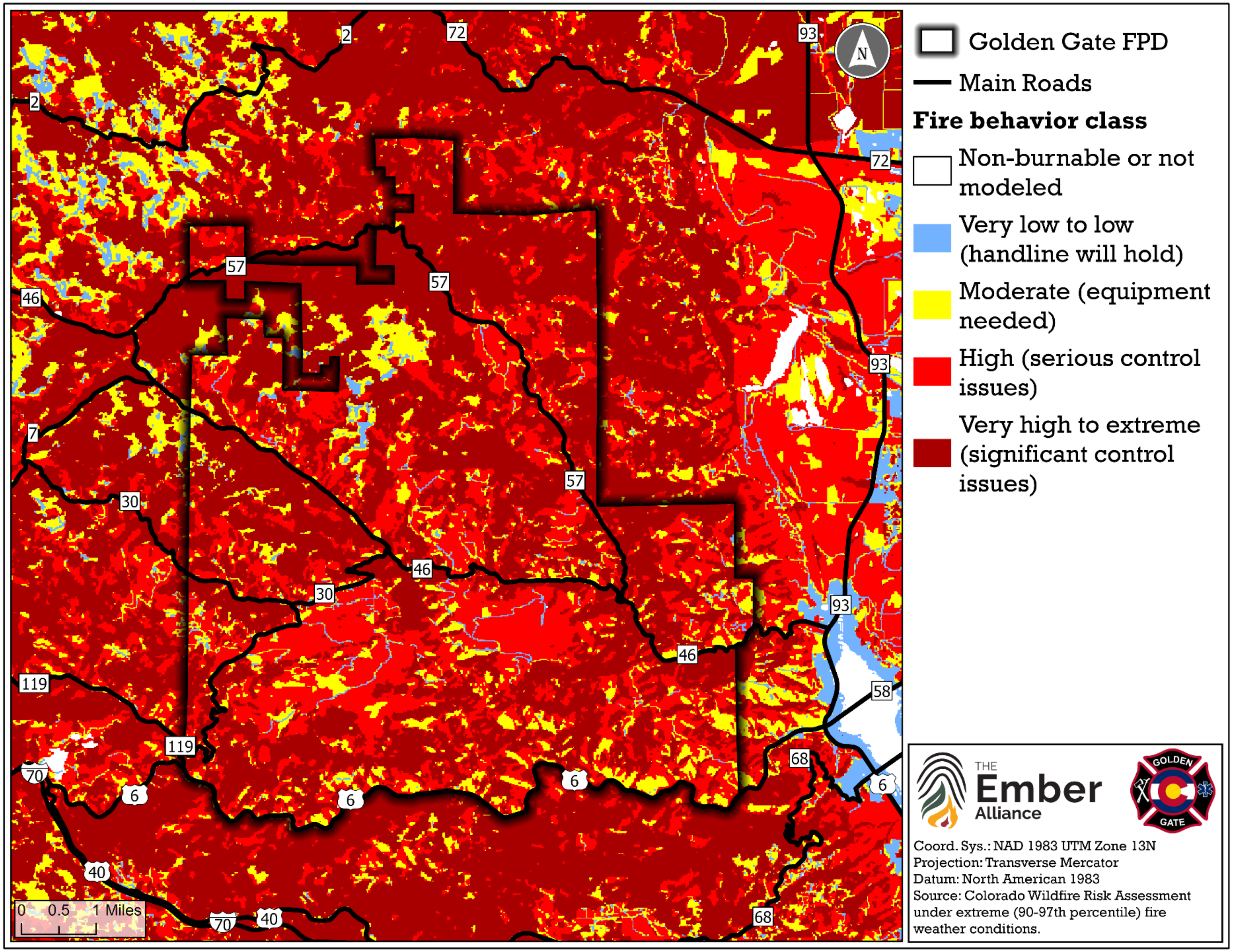


Figure B.5. *Under high to extreme fire behavior conditions, 84% percent of GGFPD could experience high to extreme fire behavior, which includes long flame lengths and active crown fires that are difficult for firefighters to suppress. Source: 2022 CO-WRA.*

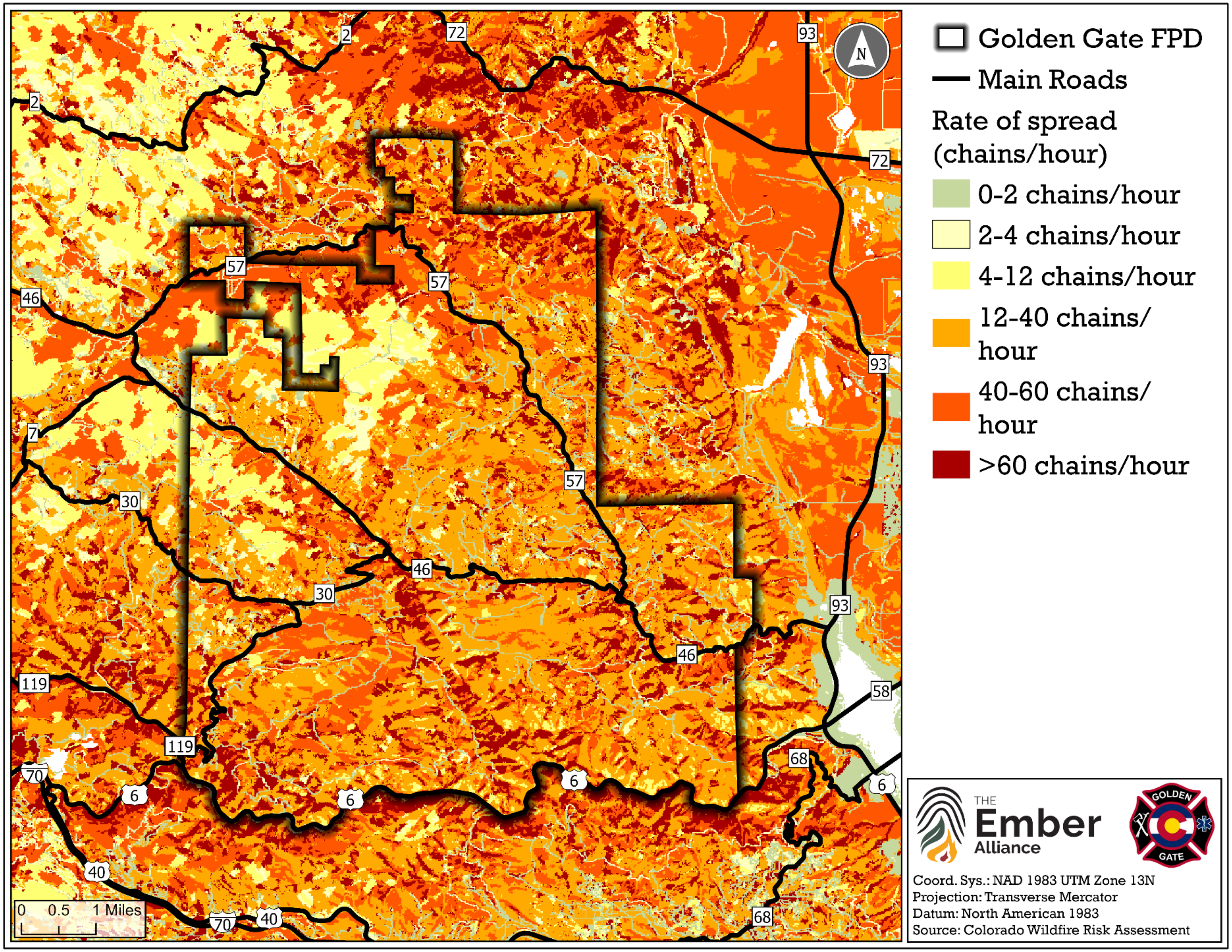


Figure B.6. *Rate of spread (chains/hour) in [FPD_ACRONYM] under various weather conditions. 1 chain/hour = 1.1 feet/minute. Chains are commonly used in forestry and fire management as a measure of distance. Source: 2022 CO-WRA.*

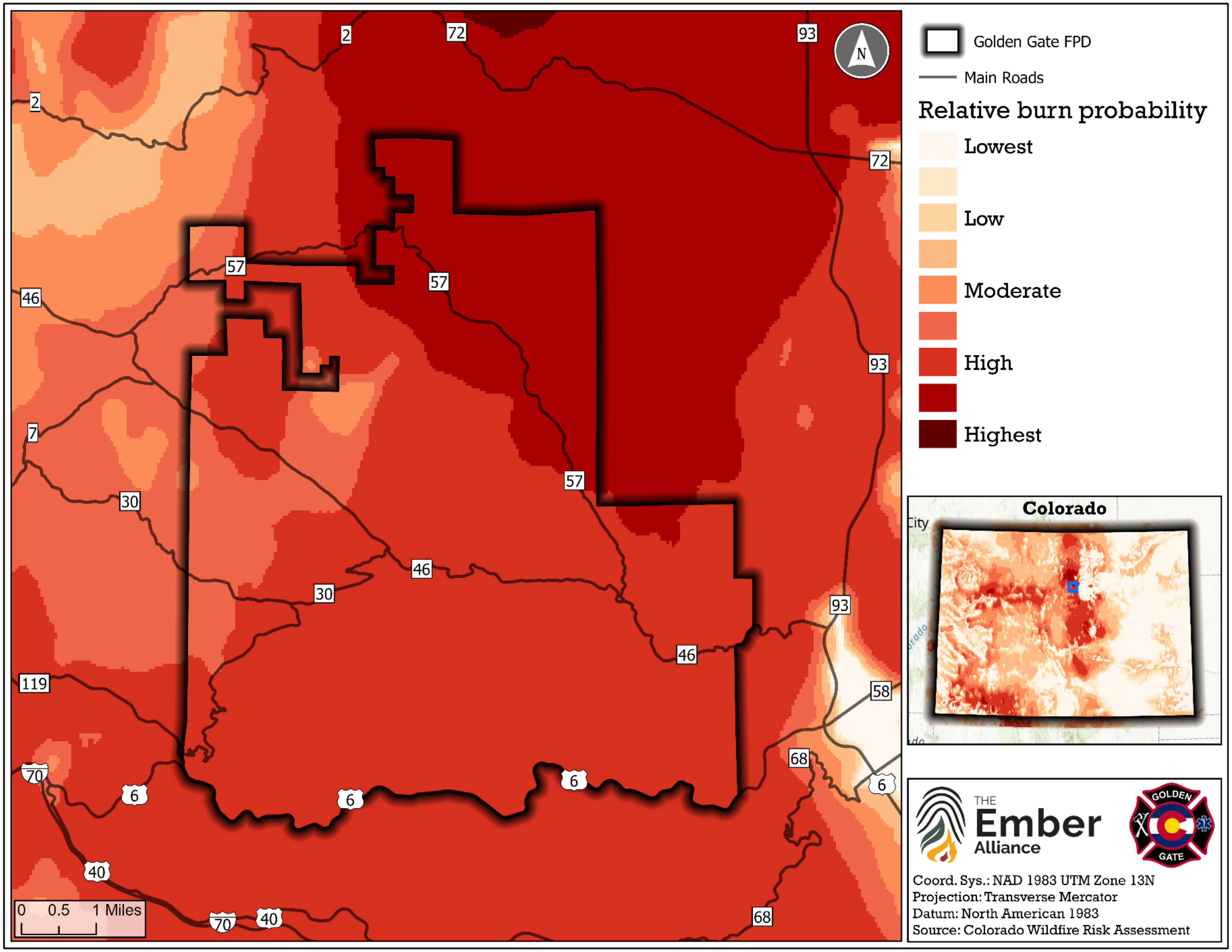


Figure B.7. *Relative burn probability under various weather conditions compared to the rest of the state of Colorado. Source: 2022 CO-WRA.*

9.c. Expected Net Value Change

Expected net value change (eNVC) from the 2022 COAL analysis is a quantitative assessment of wildfire risk to highly valued resources and assets (HVRAs) at each location of a landscape based on potential fire intensity, likelihood of wildfire, and the exposure, relative importance, and sensitivity of values at risk to different types of fire behavior. Expected net value change is positive where the overall impact of wildfire is expected to benefit HVRAs present at a location, and eNVC is negative where the overall impact is expected to degrade HVRAs. Expected net value change is calculated by multiplying flame length probability for each flame length class by the potential impact of each flame length class on each HVRA (positive or negative impact) by the relative importance of each HVRA by the burn probability at each location.

HVRAs included in the assessment by the U.S. Forest Service were people and property (i.e., housing density, infrastructure (i.e., electric transmission lines, communication sites, powerplants, and substations), vegetation (i.e., ecosystem function), and surface drinking water. Relative weights of HVRA categories were 53% for people and property, 32% for infrastructure, 10% for surface drinking water, and 5% for vegetation. Maps and response functions for HVRAs are provided in (Napoli et al., 2022b, 2022a).

The expected net value change analysis suggests that some portions of GGFPD that do not have homes or critical infrastructure could benefit from wildfire. Many ecosystems along the Colorado Front Range have been shaped by wildfire for centuries with fire, helping to maintain healthy forests, grasslands, and watersheds, and wildfire creates important habitat for wildlife by removing trees and promoting the growth of a diversity of grasses and forbs. In certain vegetation types, areas burned by wildfires may be able to serve as fuel breaks for decades afterwards and reduce the potential for damaging wildfire both in the burned area and surrounding landscape. Beneficial fire is more likely in areas without homes, where expected fire behavior is moderate, and where ecosystems are more adapted to wildfire (**Figure B.8**).

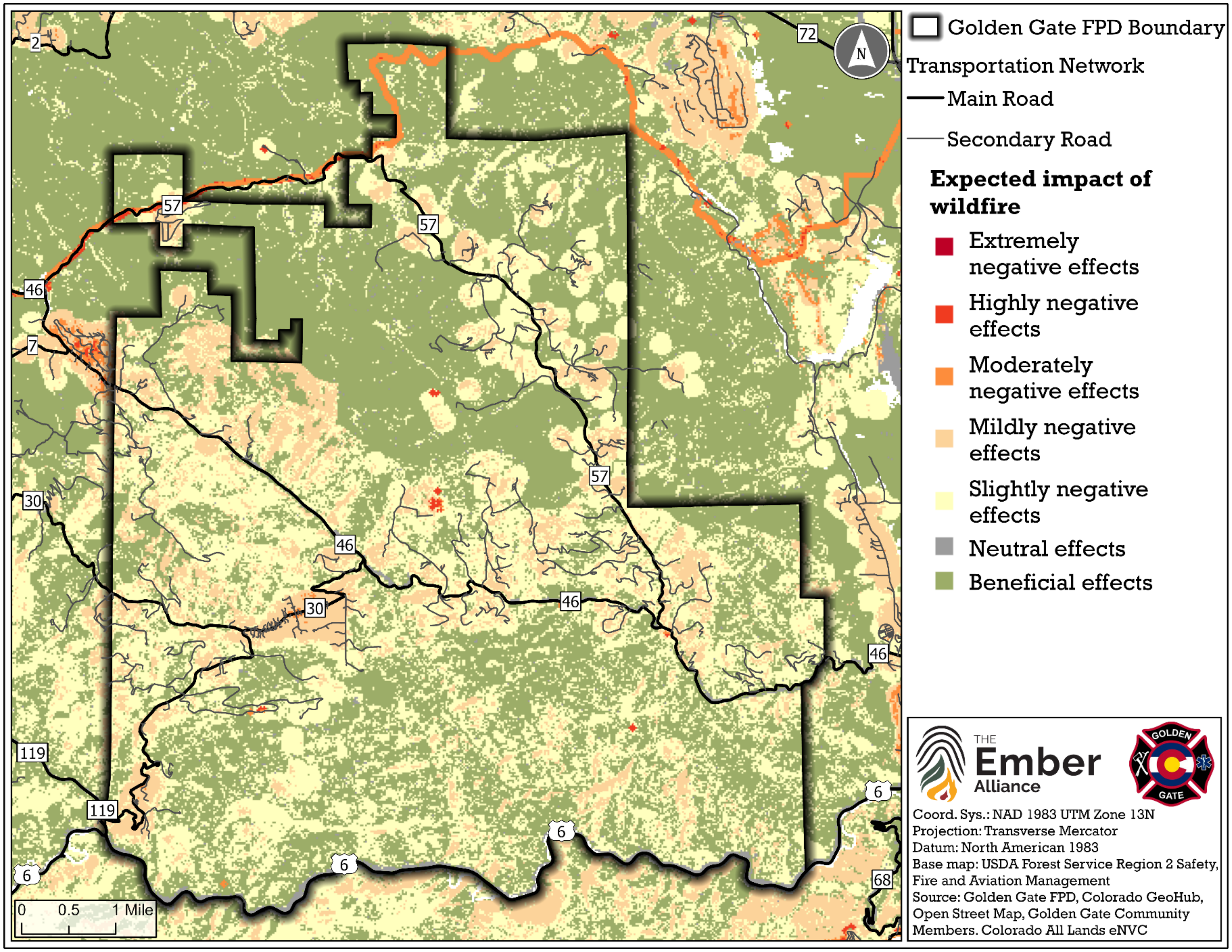


Figure B.8. *According to an analysis by the U.S. Forest Service for the state of Colorado, wildfire could benefit non-populated portions of GGFPD by restoring ecological conditions and reducing fuel loads. The analysis considered potential fire behavior, likelihood of wildfire, exposure of values at risk, relative importance of values, and sensitivity of values to different types of fire behavior. Source: (Napoli et al., 2022b).*

Predicted Radiant Heat and Ember Cast Exposure

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.

We assessed the risk that radiant heat and short-range and long-range ember cast pose to structures[4]. 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. on distance from long flame lengths and torching trees assuming:

- Radiant heat can ignite homes when extreme fire behavior (flame lengths > 8 feet) occurs within 33 yards (30 meters) of structures, following the approach of Beverly et al., (2010). Areas with mean flame lengths of >8 feet (**Figure B.3**) were included in these predictions. Research summarized by (Abo El Ezz et al., 2022) suggest that 75% of structures are destroyed when exposed to >8-foot flame lengths during actual wildfires.
- Short-range embers can reach homes within about 110 yards (100 meters) of active crown fires, following the approach of Beverly et al., (2010).
- Long-range embers can reach homes within 930 yards (850 meters) of mid-grade passive crown fire, high-grade passive crown fire, or active crown fires (**Figure B.4**). (Caggiano et al., 2020) found that a vast majority (95%) of home losses during WUI fires occurred within 100 meters of wildland vegetation, but homes were lost as far as 850 meters from the flaming front. The density of long-range embers received by a location will be less than the density of short-range embers.

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 GGFPD, and this awareness should encourage residents and business owners to complete home hardening practices to reduce the risk of ignition (**Figure B.9**). Under high to extreme fire weather, all homes in GGFPD could experience long-range ember cast, 22% could experience short-range ember cast, and 58% could be exposed to damaging radiant heat. The potential for short-range ember cast is isolated to parts of GGFPD with a greater likelihood of active crown fires, primarily in the northwestern part of the district. Exposure to radiant heat and embers is lower south of Highway 46 and north of U.S. 6 due to the prevalence of grassland fuel types, which tend to support lower flame lengths under moderate fire weather conditions and result in fewer ember production. However, under high winds, dry burning grasses can emit damaging radiant heat and support fast-moving wildfires. I nfact, wildfires in grasslands and shrublands destroy more homes in the WUI than wildfires in forests across the United States (Radeloff et al., 2023). Fuel treatments within HIZs and surrounding undeveloped areas in GGFPD, even in grasslands, could reduce the exposure of homes to radiant heat and ember cast. All structures in the district should be built and upgraded with ignition-resistant materials and need mitigated HIZs to reduce structure exposure to wildfire. This includes secondary structures (e.g., sheds, garages, barns) to reduce the likelihood of ignition and fire spread to primary structures (Maranghides et al., 2022). This CWPP outlines home hardening practices that residents and business owners can complete to reduce the risk of embers penetrating their homes.

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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. Fire behavior predictions from the 2022 CO-WRA 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.

Homes serve as an additional source of fuel that could produce high-intensity flames, emit embers, and initiate home-to-home ignitions. We identified the number of structures that are within 100 feet of other structures, meaning the number of structures with shared, overlapping home ignition zones (**Figure B.10**). Homes within close proximity of other homes are at greater risk of home-to-home ignitions from short-range ember cast, and neighbors must coordinate to reduce shared risk in shared HIZs (Maranghides et al., 2022; Syphard et al., 2012). Properties are larger and homes more spread out in GGFPD than some surrounding areas, so the risk of home-to-home exposure is lower than other parts of Jefferson, Gilpin, and Clear Creek Counties. However, almost two-thirds of homes in GGFPD (64% of homes) share a HIZ with at least one home, and some homes share HIZ with up to six other homes.

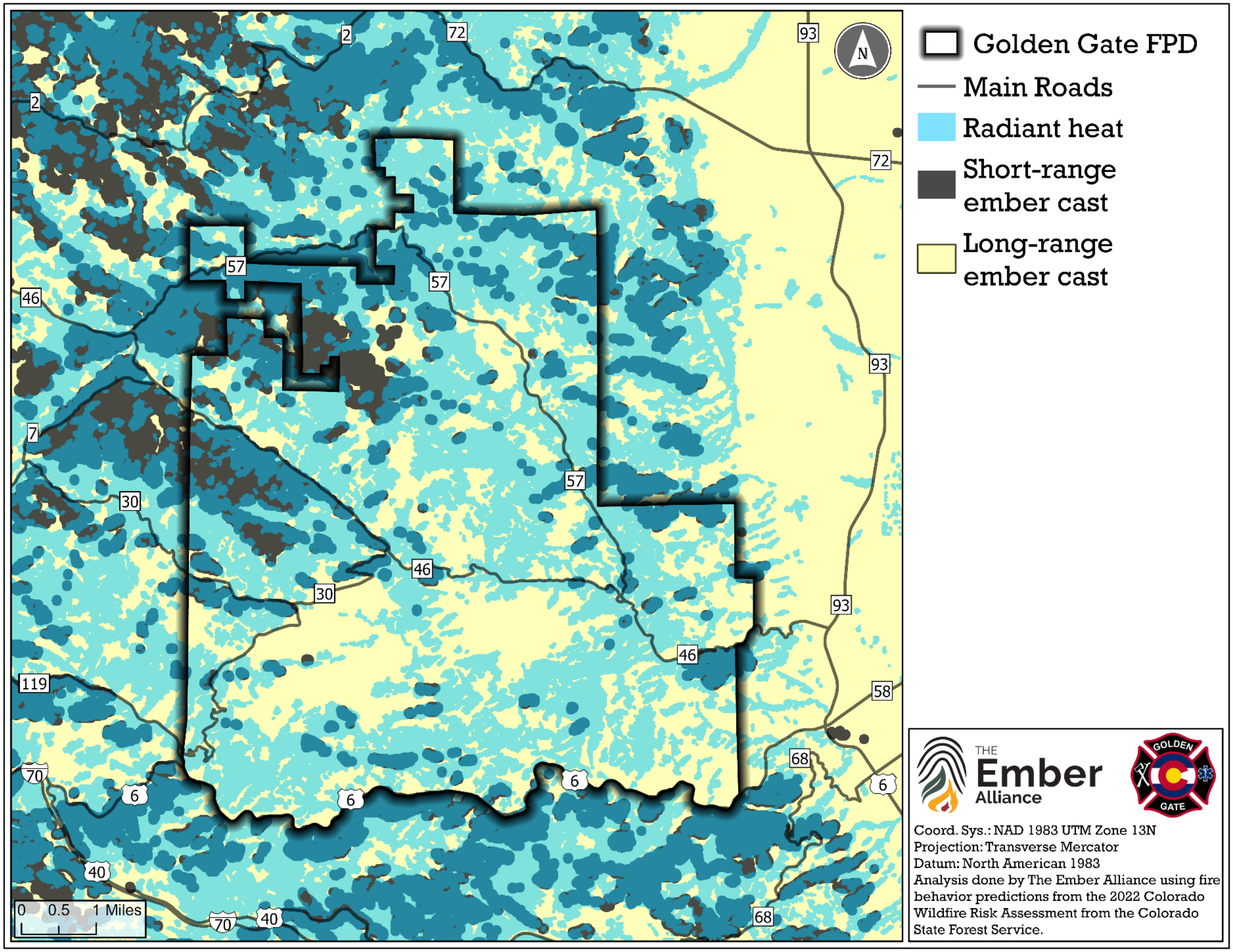


Figure B.9. *Predicted exposure to short- and long-range ember cast and radiant heat averaged across various weather scenarios in GGFPD. Source: Analysis by The Ember Alliance using output from the 2022 CO-WRA.*

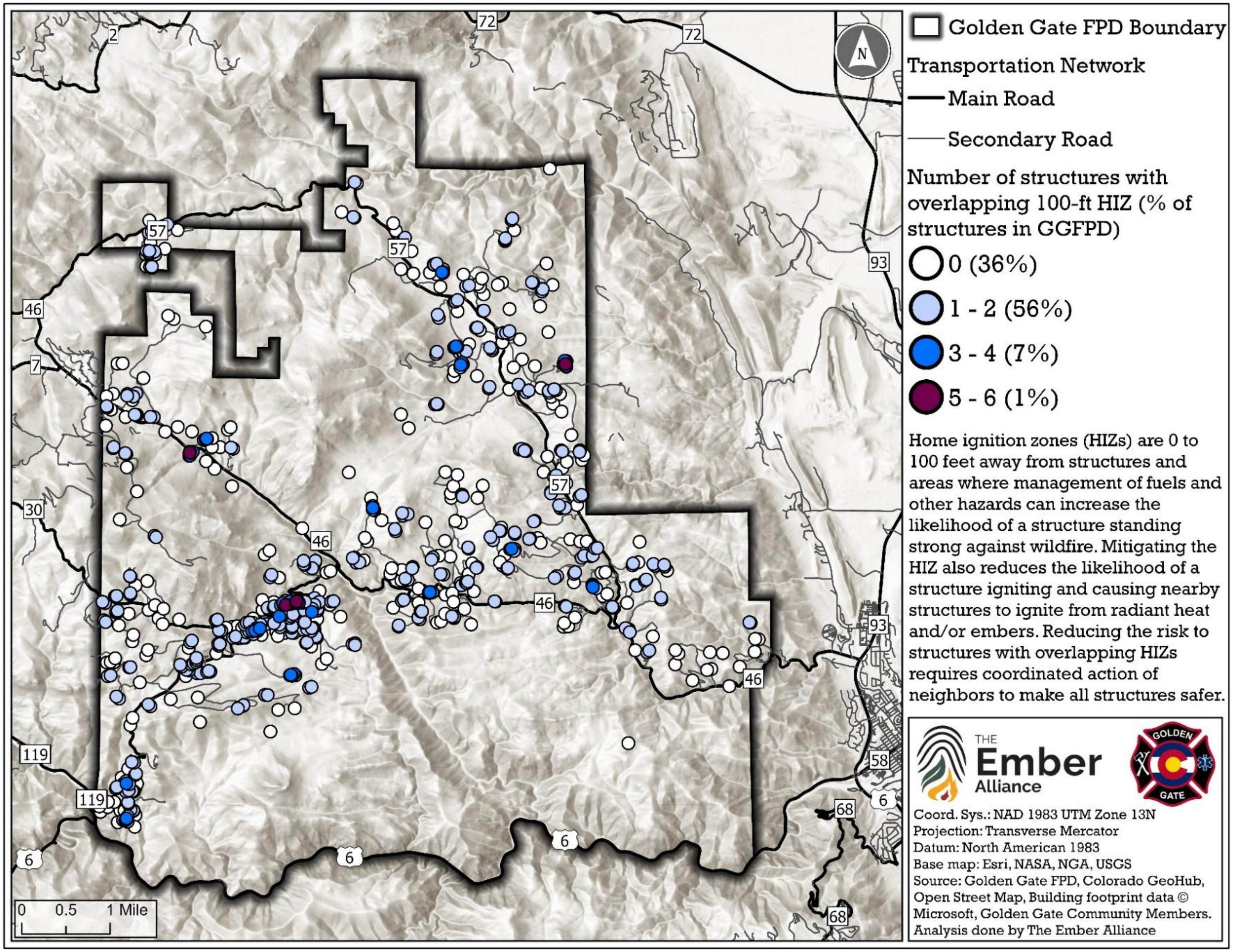


Figure B.10. *Almost two-thirds of homes in GGFPD (64% of homes) have overlapping home ignition zones (HIZ; 0-100 ft from structures) with at least one neighboring home. Homes within close proximity of other homes are at greater risk of home-to-home ignitions from short-range ember cast, and neighbors must coordinate to reduce shared risk in shared HIZs (Maranghides et al., 2022; Syphard et al., 2012). Source: Analysis by The Ember Alliance using output from the 2022 CO-WRA.*

Exposure of Highly Valued Resources

We identified highly valued resources in areas that could experience damaging radiant heat, short-range ember cast, and/or long-range embers (**Figure B.11**; **Table B.4**). Highly valued resources that are exposed to radiant heat and/or short-range embers have greater potential risk from wildfire than those exposed to long-range embers. The concentration of embers received by an area decreases with distance from the flaming front of a fire. This analysis informed fuel treatment prioritization and plan unit recommendations. Keep in mind that the 2022 CO-WRA 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.**

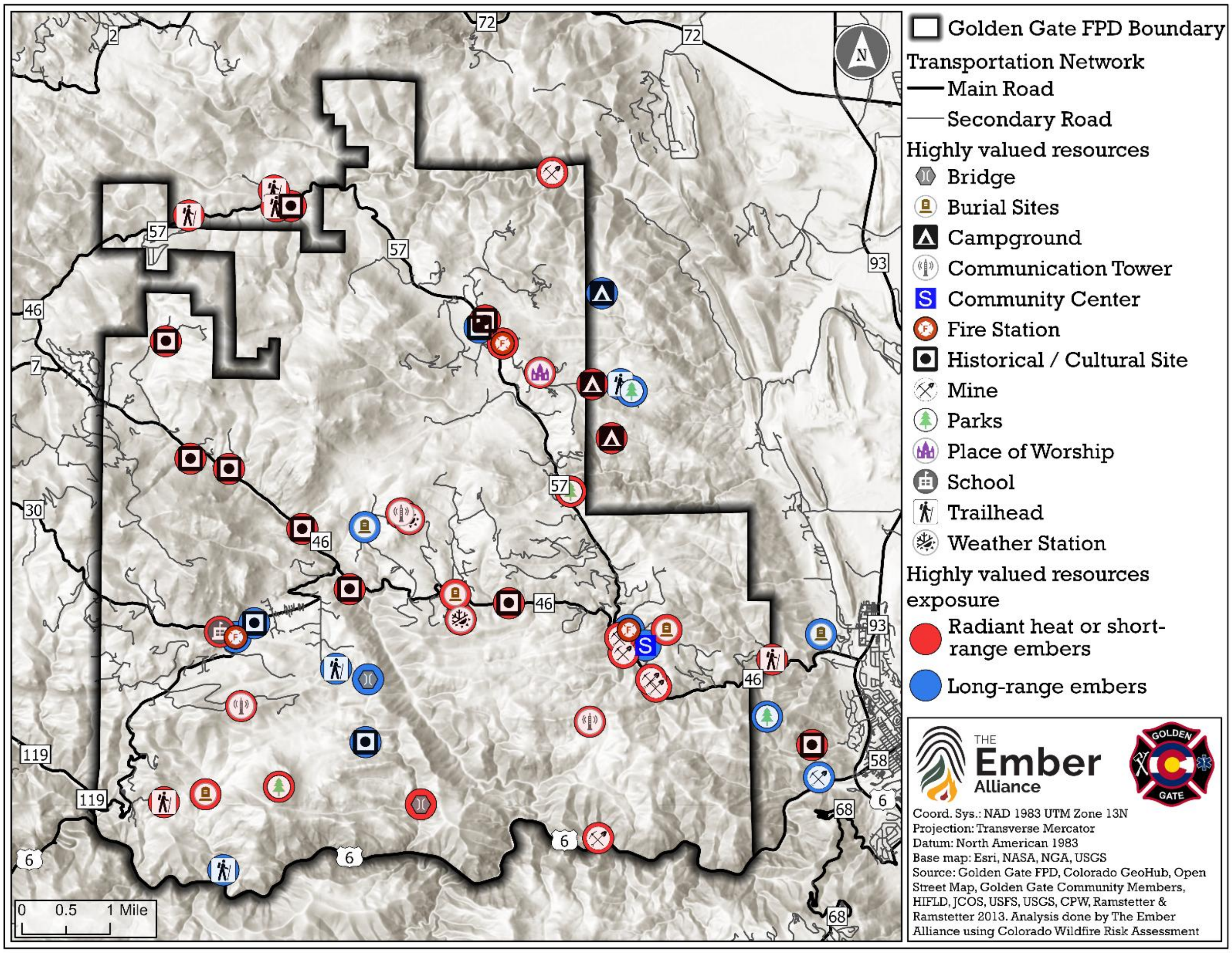


Figure B.11. *Predicted exposure of highly valued resources in and around GGFPD. Source: Analysis by The Ember Alliance using output from the 2022 CO-WRA.*

Table B.2. *Highly valued resources with potential exposed to radiant heat, short-range ember cast, and/or long-range embers. Source: Analysis by The Ember Alliance using output from the 2022 CO-WRA.*

Type	Name/location	Exposure type
Bridge	Northern bridge on Travois Trail over Elk Creek	Long-range embers
Bridge	Southern bridge on Travois Trail over Elk Creek	Radiant heat or short-range embers
Burial Sites	Enter Mountain burial sites	Long-range embers
Burial Sites	Koch	Long-range embers
Burial Sites	Eight-mile House site	Radiant heat or short-range embers
Burial Sites	Olson Burial Site	Radiant heat or short-range embers
Burial Sites	Hanging Tree	Radiant heat or short-range embers
Communication Tower	Tower located off Harkwood Run Trail	Radiant heat or short-range embers
Communication Tower	Tower between Guy Gulch and Highway 46	Radiant heat or short-range embers
Communication Tower	Tower located off Night Hawk View Trail	Radiant heat or short-range embers
Community Center	The Golden Gate Grange	Long-range embers
Fire Station	Golden Gate Fire Station 81	Long-range embers
Fire Station	Golden Gate Fire Station 83	Long-range embers
Fire Station	Golden Gate Station 82	Radiant heat or short-range embers
Fire Station	Golden Gate Station 81	Radiant heat or short-range embers
Historical Site	Robinson Hill School	Long-range embers
Historical Site	Plantation	Long-range embers
Historical Site	Belcher Hill School (2nd Site)	Long-range embers
Historical Site	Guy Gulch Man	Radiant heat or short-range embers
Historical Site	Guy Hill School	Radiant heat or short-range embers
Historical Site	Ferree's Mountain Park, 1st site	Radiant heat or short-range embers
Historical Site	Ferree's Mountain Park, 2nd site	Radiant heat or short-range embers
Historical Site	Cheese Box School	Radiant heat or short-range embers
Historical Site	Belcher Hill School (1st Site)	Radiant heat or short-range embers
Historical Site	Centennial House	Radiant heat or short-range embers
Mine	Golden (Bertrand) Quarry	Long-range embers
Mine	Goltra Road Quarry	Radiant heat or short-range embers
Mine	Buckman Adit Mine	Radiant heat or short-range embers
Mine	Ohman Mine	Radiant heat or short-range embers
Mine	Jefferson County Rock Quarry (Pit 6)	Radiant heat or short-range embers
Mine	Jefferson County Rock Quarry (Pit 6A)	Radiant heat or short-range embers
Mine	Mena Mine	Radiant heat or short-range embers
Parks	Mount Galbraith Park	Long-range embers
Parks	Centennial Cone Park	Radiant heat or short-range embers
Parks	Sam Bowser's Park	Radiant heat or short-range embers
Place of Worship	Little White Church	Radiant heat or short-range embers
School	Robinson Hill School	Radiant heat or short-range embers
Trailhead	Centennial Cone Park Ralph Schell Trailhead	Long-range embers
Trailhead	Mayhem Gulch Trailhead	Long-range embers
Trailhead	Centennial Cone West Trailhead	Radiant heat or short-range embers
Trailhead	Mount Galbraith Trailhead	Radiant heat or short-range embers
Weather Station	Station located off Daydream Road	Radiant heat or short-range embers
Weather Station	Station located off Night Hawk View Trail	Radiant heat or short-range embers

Evacuation Analysis

Evacuation can weigh heavily on the minds of residents in the GGFPD. The death of 29 people in Los Angeles, California during the 2025 Palisades and Eaton Fires and 86 people in Paradise, California during the 2018 Camp Fire underscores the importance of evacuation preparedness and fuel mitigation along evacuation routes. Of those who tragically perished in these fires, some did not receive evacuation alerts, others could not leave their home due to limitations from animals or family members, and many were simply overwhelmed by the 'perfect storm' of extreme fire weather conditions.

Modeling relative evacuation times and congestion were important for the CWPP to provide an understanding of relative evacuation challenges in GGFPD, guide prioritization of roadside treatments, and inform targeted evacuation education. Dozens of evacuation models are available, all with varying complexities, purposes, assumptions, and limitations (Intini et al., 2019; Ronchi et al., 2019). Modeling hypothetical evacuations is extremely challenging—there are hundreds of possible evacuation scenarios in terms of the direction of wildfire spread, the timing of evacuation orders, the behavior of individuals during an evacuation, potential confusion due to misinformation, potential for impaired visibility due to smoke, potential for lane closures to accommodate emergency traffic, potential for accidents, etc. These assumptions and uncertainties are compounded and layered upon each other when conducting fire behavior and evacuation modeling, making it nearly impossible to precisely model potential evacuation outcomes (Maranghides and Link, 2023).

Simulation models cannot account for all variables present during an evacuation. Evacuation analyses for the 2025 CWPP are useful for assessing relative evacuation times and congestion across GGFPD, but they are not intended to depict what will occur in any specific evacuation event or to suggest specific routes for individual residents. All residents should know and practice driving different routes out of their neighborhoods. **Residents need to follow guidance from law enforcement personnel during evacuation events, practice safe driving, and follow evacuation etiquette (e.g., allowing cars to merge and not texting or stopping to take photographs).**

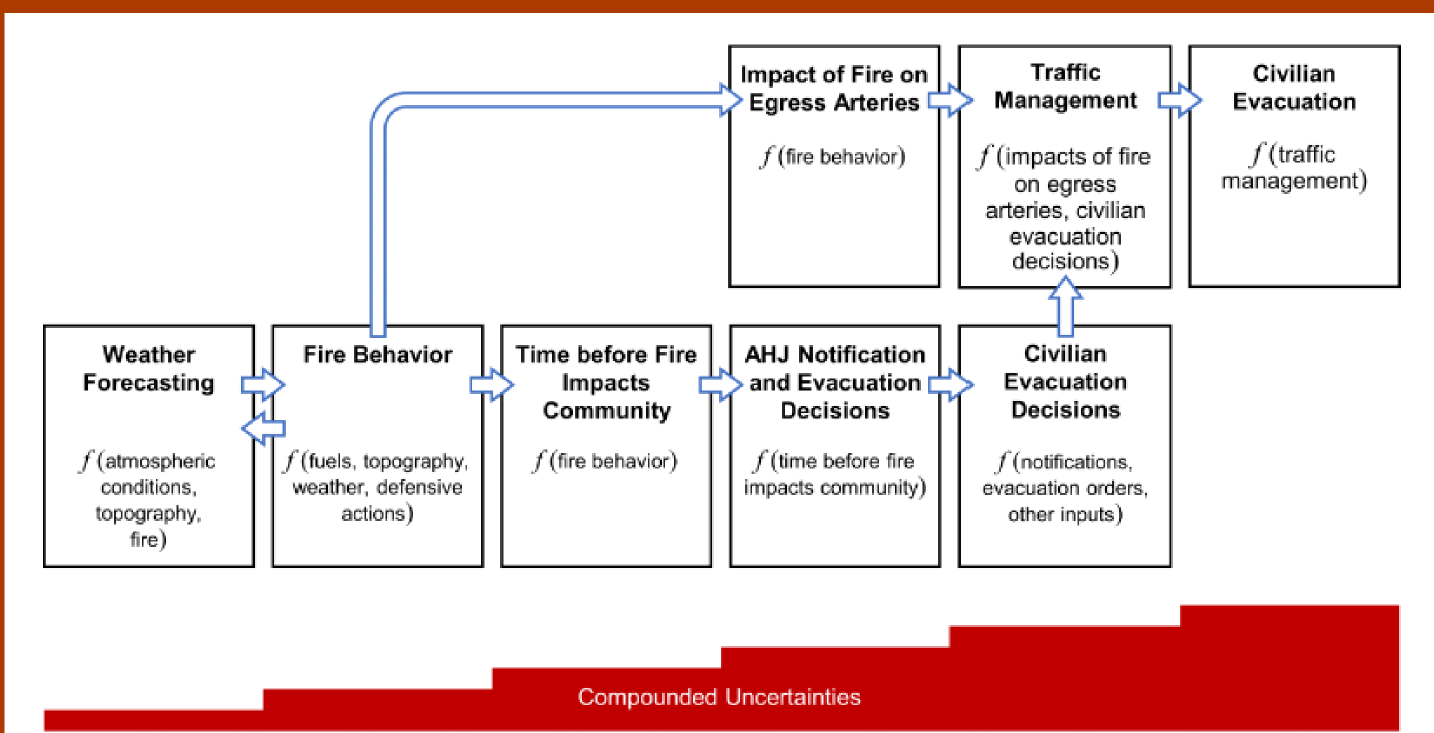


Illustration from Maranghides and Link (2023) demonstrating the interrelationships and compounding uncertainties involved in evacuation models. AHJ = authorities having jurisdiction.

The Ember Alliance utilized ArcCASPER to model relative evacuation times by plan unit and potential congestion along roadways. ArcCASPER is an open-source, large-scale evacuation routing tool based on peer-reviewed research, and it has been found to simulate reasonable evacuation patterns (Harris et al., 2015; Shahabi, 2015; Shahabi and Wilson, 2014). ArcCASPER easily integrates into ArcMap software, which was utilized for other spatial analyses and maps for the 2025 CWPP, making it a reasonable and cost-effective approach. Assumptions and limitations of ArcCASPER are described below. Many of these limitations are shared with other widely available evacuation models.

The analysis completed using ArcCASPER for the 2025 CWPP was conducted for two specific purposes:

- Determining which parts of GGFPD might take relatively longer to evacuate than others given the roadway network and housing densities under potential evacuation scenarios. This information fed into plan unit relative risk ratings for the CWPP, and it is helping the district determine where residents might be most in need of targeted education about evacuation preparedness before and assistance during an evacuation.
- Determining which roadways might experience relatively more congestion under evacuation scenarios. Congestion predictions were one piece of information supporting the prioritization of roadside fuel treatment for the CWPP.

The analysis using ArcCASPER for the CWPP is NOT intended or appropriate for:

- Developing general or incident-specific evacuation plans. A limited number of scenarios were modeled for the CWPP, so it is unlikely that a specific incident would match the exact situations modeled here.
- Determining when evacuation orders should be given. These decisions are context specific and made by experts during an actual emergency as it unfolds.
- Determining which specific routes people should take during an evacuation. Individual residents are responsible for being familiar with potential evacuation routes and to practice driving these routes under various conditions, including under limited visibility and at night. Law enforcement personnel will provide specific information about route closures and availability during an actual incident.
- Determining the exact amount of time it might take individual residents to evacuate. The purpose of ArcCASPER is to minimize global evacuation time—the time it takes for all simulated evacuees to reach scenario endpoints—and not to optimize evacuation routes for each individual evacuee.
- Determining the exact amount of time it would take for all evacuees to reach scenario endpoints. Relative times are much more reliable than exact times given inherent uncertainty in the model, and relative times were more important than exact times for the purposes of assessing relative risk among plan units.
- Determining the exact level of congestion that could be experienced along a roadway. Estimates of relative congestion are more reliable than exact estimates of congestion given inherent uncertainty in the model, and relative congestion was more important than exact congestion estimates for the purpose of prioritization roadways fuel treatments.

Modeling Approach

We modeled relative evacuation time and roadway congestion using ArcCASPER (Shahabi, 2015; Shahabi and Wilson, 2014). ArcCASPER "intelligently and dynamically takes into account road capacity and travel time to create routes that minimize traffic congestion and evacuation times" (Shahabi, 2012). The CASPER (Capacity-Aware Shortest Path Evacuation Routing) system estimates traversal speeds for road segments based on roadway capacity (number of lanes), road speed, number of cars evacuating per address, and the relationship between roadway congestion and reduction in travel speed (also known as the "traffic model"). We used an exponential traffic model with a critical density of 10 and saturation density of 120 (see Shahabi, 2015 for a description of traffic models).

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). The objective of the model is NOT to minimize the evacuation time for each individual evacuee.

ArcCASPER Limitations

- 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.
- ArcCASPER does not model the impact that different types of vehicles might have on evacuations, such as semi-trucks, trucks with trailers, or large recreational vehicles.
- ArcCASPER assumes simultaneous departure of vehicles.
- Predictions are very sensitive to decisions about the shape of the traffic model (e.g., power, exponential, linear), the critical density (number of cars that can be on a road with two lanes [one lane in each direction] without a reduction in travel speed, and the saturation density (number of cars on the road at which the traversal speed reduces to half the original speed) (Shahabi, 2015; Shahabi and Wilson, 2014).
- ArcCASPER does not model the impact of traffic lights, stop signs, or curves on traffic flow. We reduced the baseline traffic speed for all roads to help account for this.

Evacuation Scenarios

An accurate road network is vital for evacuation modeling, so we worked with the CWPP Advisory Committee to conduct an extensive quality assurance / quality control on road data from Open Street Map. We also work with the Advisory Committee to define evacuation groups, scenario endpoints, and the number of vehicles that might be departing from recreation locations. **Endpoints were locations along major roads at which point the evacuation simulation ended; endpoints were NOT evacuation destinations that would be used during an actual incident.**

We conducted evacuation assessments for each plan unit individually or in pairs depending on feedback from the Advisory Committee. Centennial Cone Open Space, White Ranch Open Space, and Mount Galbraith Open Space plan units were combined with an adjacent plan unit for evacuation scenarios (**Table B.3**). The rationale for modeling evacuation from each plan unit individually is that the Jefferson County Sheriff's Office recently started using CWPP plan units to assist with evacuation decisions in the county. We also modeled evacuation for the entire district at once to simulate what might happen if there were a rapidly spreading wildfire that ignited on the district boundary and triggered the need for rapid evacuation of the entire area.

Each plan unit or pair of plan units had specific scenario endpoint(s) based on the most likely direction(s) of travel for evacuees from that unit assuming a fire were to spread from west to east into the district. Plan units also differed in which recreational areas and addresses outside the district were included in the simulation (**Table B.3**, **Table B.4**). Recreation areas and addresses outside the district were included to simulate background traffic that residents might encounter during evacuations (**Figure B.12**). Roadway networks were modified for each plan unit to eliminate unnecessary roadways that ArcCASPER might include to reduce global evacuation times but that would not realistically be used by evacuees.

We modeled 2 vehicles leaving each residential address, 30 from each casino or hotel (only relevant for scenarios that included additional evacuees from Black Hawk and Central City), and 10 vehicles departing from other non-residential addresses (e.g., schools, fire stations, places of worship, businesses). We worked with the Advisory Committee and partners to estimate the number of vehicles that might be parked at major recreation sites in the district on a busy summer day (**Table B.4**). Even though it might take time for evacuees at recreation sites to hike back to their vehicles, delayed departure times cannot be assigned to individual evacuees in ArcCASPER, plus the number of recreators that might be away from their vehicles and their hiking pace are highly variable and unknown.

For the district-wide evacuation scenario, we created a smoothed layer predicting evacuation times for each location within 200 m of roads and then presented the results in terms of percentile ranking of evacuation times. Smoothing was done with kriging with a spherical semi-variogram model and a lag size of 53.2 meters (value selected by ArcPro to perform kriging with this data). The purpose of doing this is to mask predictions of evacuation times for individual addresses since the model is not appropriate for that. The goal of the model is to minimize global evacuation times for all evacuees, so predictions for individual evacuees cannot be interpreted as exact, point-specific evacuation times. Instead, output from this scenario can show hotspots where evacuation times might be slower than others if the entire district were to evacuate at once.

Table B.3. *Conditions of evacuation scenarios for each plan unit or pair of plan units modeled in ArcCASPER. A description of the number of vehicles evacuated from each recreation area is included in* ***Table B.4****.*

GGFPD plan unit(s) included in scenario	Number of vehicles in scenario		Scenario endpoint(s)	Recreation areas included in scenario	Additional evacuees included in scenario from outside district boundaries
	Inside district	Outside district			
All plan units	1,364	3,471	Intersection of Hwy 93 and Hwy 46 Intersection of Hwy 93, Hwy 58, and U.S. 6 East-bound I-70	All listed in ***Table B.4***	**Evacuees from evacuation units in Gilpin County:** All of the Central City, Black Hawk, and Golden Gate State Park / Mineral Acres evacuation units, most of the Smith Hill evacuation unit (excluding a few addresses that would not evacuate towards the intersection of Hwy 93 and Hwy 46), the lower third of the Dory Lakes evacuation unit, and some homes in the South evacuation unit that would evacuate south on Central City Parkway. **Evacuees from Clear Creek County:** A handful of addresses located along U.S. 6. **Additional evacuees from Jefferson County:** Addresses off Pine Ridge Road.
Douglas Mountain	142	2,183	Intersection of Hwy 93, Hwy 58, and U.S. 6 East-bound I-70	Big Easy Trailhead Cannonball Flats Centennial Cone West Trailhead Mayhem Gulch Trailhead Oxbow Trailhead	**Evacuees from evacuation units in Gilpin County:** All of the Central City and Black Hawk evacuation units, a few homes in the southern part of the Smith Hill evacuation unit, and some homes in the South evacuation unit that would evacuate south on Central City Parkway. **Evacuees from Clear Creek County:** A handful of addresses located along U.S. 6.
Drew Hill / Geneva Glen	82	850	Intersection of Hwy 93 and Hwy 46	Black Bear Trailhead Bridge Creek Trailhead Frazer Meadow Trailhead Mountain Lion Trailhead at Ranch Pond Nott Creek Trailhead Ralston Creek Picnic Area Ralston Roost-Visitor Center Nature Trail and Beaver Trailhead Red Barn Group Picnic Area Round the Bend Picnic Area	**Evacuees from evacuation units in Gilpin County:** All of the Golden Gate State Park / Mineral Acres evacuation unit, most of the Smith Hill evacuation unit (excluding a few addresses that would not evacuate towards the intersection of Hwy 93 and Hwy 46), and the lower third of the Dory Lakes evacuation unit. **Evacuees from Clear Creek County:** None.

GGFPD plan unit(s) included in scenario	Number of vehicles in scenario		Scenario endpoint(s)	Recreation areas included in scenario	Additional evacuees included in scenario from outside district boundaries
	Inside district	Outside district			
Guy Hill	102	636	Intersection of Hwy 93 and Hwy 46	None	**Evacuees from evacuation units in Gilpin County:** All of the Golden Gate State Park / Mineral Acres evacuation unit, most of the Smith Hill evacuation unit (excluding a few addresses that would not evacuate towards the intersection of Hwy 93 and Hwy 46), and the lower third of the Dory Lakes evacuation unit. **Evacuees from Clear Creek County:** None.
Lower Canyon and Mount Galbraith Open Space	64	1,455	Intersection of Hwy 93 and Hwy 46	Golden Gate Grange Mount Galbraith Trailhead White Ranch East Trailhead	**Evacuees from evacuation units in Gilpin County:** All of the Golden Gate State Park / Mineral Acres evacuation unit, most of the Smith Hill evacuation unit (excluding a few addresses that would not evacuate towards the intersection of Hwy 93 and Hwy 46), and the lower third of the Dory Lakes evacuation unit. **Evacuees from Clear Creek County:** None.
Lower Crawford Gulch	94	666	Intersection of Hwy 93 and Hwy 46	Golden Gate Grange	**Evacuees from evacuation units in Gilpin County:** All of the Golden Gate State Park / Mineral Acres evacuation unit, most of the Smith Hill evacuation unit (excluding a few addresses that would not evacuate towards the intersection of Hwy 93 and Hwy 46), and the lower third of the Dory Lakes evacuation unit. **Evacuees from Clear Creek County:** None.
Robinson Hill and Centennial Cone Open Space	250	2,541	Intersection of Hwy 93 and Hwy 46 Intersection of Hwy 93, Hwy 58, and U.S. 6 East-bound I-70	Big Easy Trailhead Cannonball Flats Centennial Cone Park Ralph Schell Trailhead Mayhem Gulch Trailhead Oxbow Trailhead	**Evacuees from evacuation units in Gilpin County:** All of the Smith Hill, Central City and Black Hawk evacuation units and some homes in the South evacuation unit that would evacuate south on Central City Parkway. **Evacuees from Clear Creek County:** A handful of addresses located along U.S. 6.

GGFPD plan unit(s) included in scenario	Number of vehicles in scenario		Scenario endpoint(s)	Recreation areas included in scenario	Additional evacuees included in scenario from outside district boundaries
	Inside district	Outside district			
Upper Canyon	106	762	Intersection of Hwy 93 and Hwy 46	Blue Grouse Trailhead Golden Gate Canyon State Park-staff parking lot Kriley Pond Slough Pond Trailhead	**Evacuees from evacuation units in Gilpin County:** All of the Golden Gate State Park / Mineral Acres evacuation unit, most of the Smith Hill evacuation unit (excluding a few addresses that would not evacuate towards the intersection of Hwy 93 and Hwy 46), and the lower third of the Dory Lakes evacuation unit. **Evacuees from Clear Creek County:** None.
Upper Crawford Gulch and White Ranch Open Space	132	715	Intersection of Hwy 93 and Hwy 46	Sourdough Campground parking lot White Ranch West Trailhead	**Evacuees from evacuation units in Gilpin County:** All of the Golden Gate State Park / Mineral Acres evacuation unit, most of the Smith Hill evacuation unit (excluding a few addresses that would not evacuate towards the intersection of Hwy 93 and Hwy 46), and the lower third of the Dory Lakes evacuation unit. **Evacuees from Clear Creek County:** None.

Table B.4. Number of vehicles simulated for recreation sites included in evacuation scenarios.

Recreation site	Number of vehicles	Source of estimate
Big Easy Trailhead	58	Estimated from aerial imagery
Black Bear Trailhead	24	Estimated from aerial imagery
Blue Grouse Trailhead	14	Estimated from aerial imagery
Bridge Creek Trailhead	28	Golden Gate Canyon State Park 2023 Management Plan
Cannonball Flats	20	Estimated from aerial imagery
Centennial Cone Park Ralph Schell Trailhead	36	Estimated from aerial imagery
Centennial Cone West Trailhead	20	Estimated from aerial imagery
Frazer Meadow Trailhead	14	Golden Gate Canyon State Park 2023 Management Plan
Gateway Trailhead	127	Estimated from aerial imagery
Golden Gate Canyon State Park-staff parking lot	6	Estimated from aerial imagery
Golden Gate Grange	30	Feedback from CWPP Core Team
Kriley Pond	23	Golden Gate Canyon State Park 2023 Management Plan
Mayhem Gulch Trailhead	57	Estimated from aerial imagery
Mount Galbraith Trailhead	87	Feedback from Jefferson County Parks & Open Space
Mountain Lion Trailhead at Ranch Pond	34	Golden Gate Canyon State Park 2023 Management Plan
Nott Creek Trailhead	50	Golden Gate Canyon State Park 2023 Management Plan
Oxbow Trailhead	14	Estimated from aerial imagery
Ralston Creek Picnic Area	5	Estimated from aerial imagery
Ralston Roost-Visitor Center Nature Trail and Beaver Trailhead	25	Golden Gate Canyon State Park 2023 Management Plan
Red Barn Group Picnic Area	30	Golden Gate Canyon State Park 2023 Management Plan
Round the Bend Picnic Area	9	Golden Gate Canyon State Park 2023 Management Plan
Slough Pond Trailhead	11	Golden Gate Canyon State Park 2023 Management Plan
Sourdough Campground parking lot	23	Estimated from aerial imagery
Tunnel 1 Trailhead	41	Estimated from aerial imagery
White Ranch East Trailhead	62	Feedback from Jefferson County Parks & Open Space
White Ranch West Trailhead	53	Feedback from Jefferson County Parks & Open Space

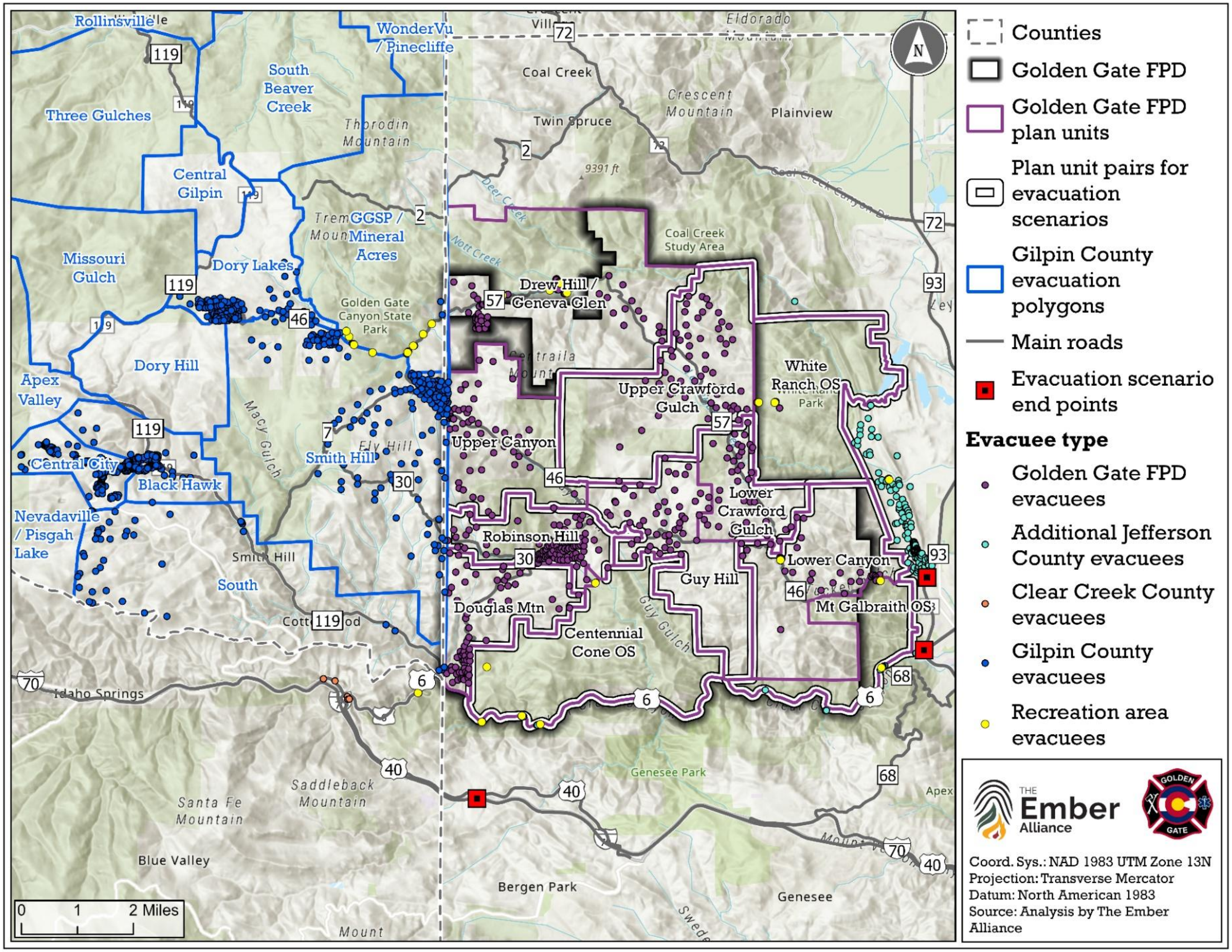


*Figure B.12. Evacuees and scenario end points used in different evacuation scenarios described in **Table B.3**. Plan units dominated by open space (Centennial Cone Open Space, White Ranch Open Space, and Mt. Galbraith Open Space) were paired with adjacent plan units for evacuation scenarios.*

Model Output

After simulating evacuations for each plan unit and for the entire district, we determined the maximum degree of congestion that was experienced for each segment of road across all evacuation scenarios (**Figure B.13**). Roads were categorized by the congestion index—how much longer it might take to traverse a segment of road with evacuation traffic versus without traffic. Congestion predictions were combined with potential roadway survivability to help prioritize roads for fuel treatments. The results demonstrate that Golden Gate Canyon Road (State Highway 46) has the greatest potential to experience extreme congestion in the district. Many evacuees within and without the district would utilize this road as their primary evacuation route. Parts of U.S. 6 and U.S. 40 could also experience extreme congestion, driven my evacuation from Black Hawk and Central City, and this could slow evacuation times for residents and recreators in Robinson Hill, Douglas Mountain, and Centennial Cone Open Space plan units. Moderate congestion could be experienced on east-bound U.S. 6, Douglas Mountain Drive (County Road 60), Robinson Hill Road (County Road 30), and Drew Hill Road (County Road 57).

We also determined the time required to evacuate all evacuees in each plan unit or pair of plan units to scenario endpoints. We relativized evacuation time by the scenario with the shortest evacuation time (the evacuation of Lower Canyon and Mt. Galbraith Open Space plan units) (**Figure B.14**). This is because there are few addresses in these plan units, few recreation areas, and they are closest to one of the scenario endpoints. We do not present the absolute evacuation times modeled by ArcCASPER because 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.

The plan unit with the slowest evacuation time was Drew Hill / Geneva Glen because evacuees in this plan unit only had one option for evacuation (south on Drew Hill Road), they were farthest from scenario endpoints, and there was a potential for moderate congestion on Drew Hill Road, partially due to evacuation traffic from recreationist in Golden Gate Canyon State Park and shared evacuation routes with the Dory Lakes evacuation polygon in Gilpin County. Under normal circumstances, residents in Drew Hill / Geneva Glen can drive either direction on Drew Hill Road, but the purpose of this assessment was to determine potential evacuation times under a scenario where fire is spreading from west to east and residents are not encouraged to drive towards the fire.

The pair of Robinson Hill and Centennial Cone Open Space had the next slowest evacuation times. There are many homes along Robinson Hill Road that could create congestion and slow evacuation times and residents could fact high to extreme congestion on State Highway 119 on their way to U.S. 6. (Clear Creek Canyon Road) or high congestion on Douglas Mountain Drive.

In the unlikely incident that all of GGFPD and portions of Gilpin County need to be evacuated simultaneously, the pattern of evacuation times is similar with longest evacuation times for residents in the Drew Hill / Geneva Glen plan unit (**Figure B.15**). Elevated evacuation times are possible for the Robinson Hill plan unit in addition to Upper Canyon plan unit and portions of Upper Crawford Gulch.

The CWPP Advisory Committee evaluated the model results and found the predictions reasonable based on their experience of traffic flow in the district. The output is useful for understanding where there might be a greater potential for evacuation congestion and extended evacuation times under the assumptions of these scenarios. **Evacuation preparedness is paramount for all residents, recreators, and visitors to the district.**

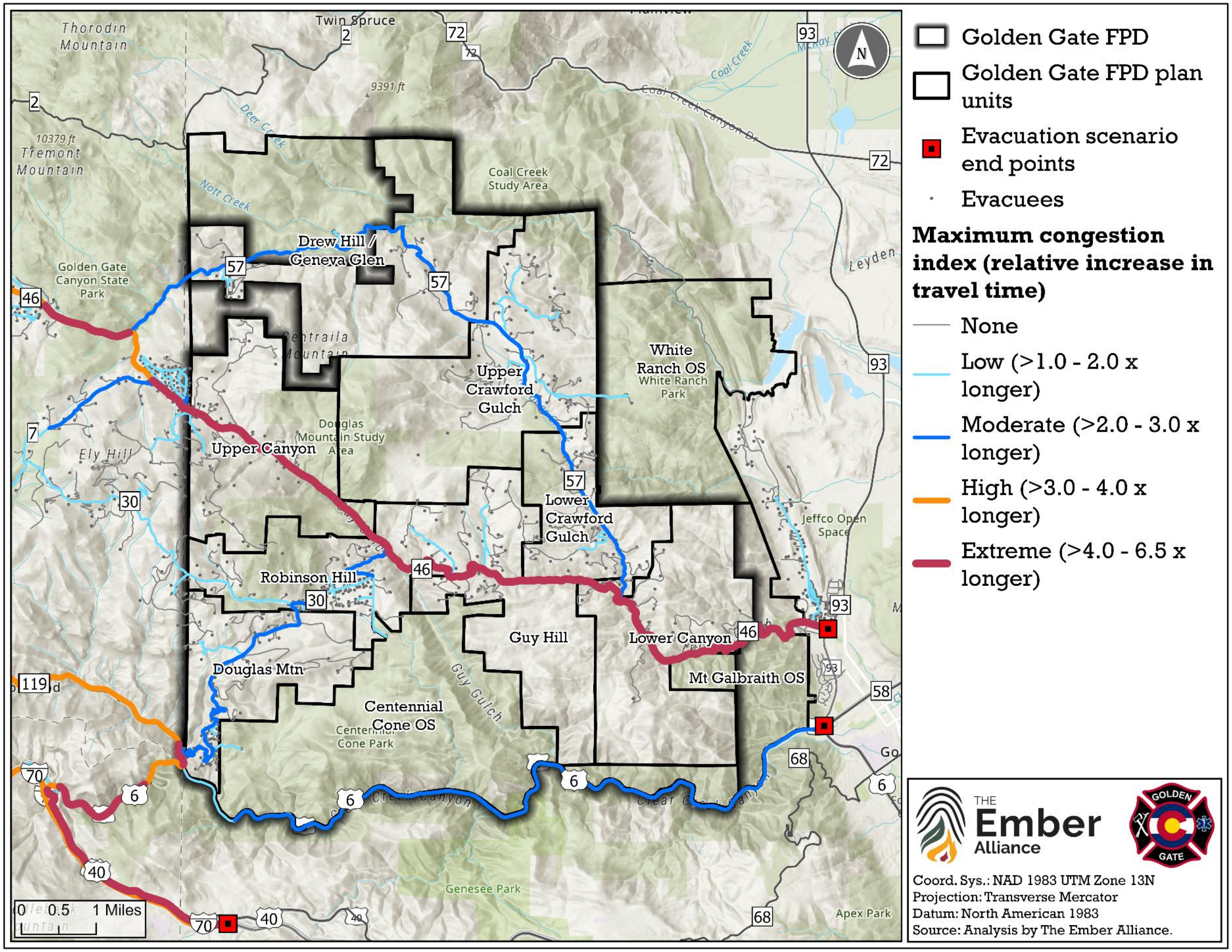


Figure B.13. *Maximum predicted congestion across all evacuation scenarios. Congestion index is the ratio between the time required to traverse a segment of road with congestion vs. without congestion.*

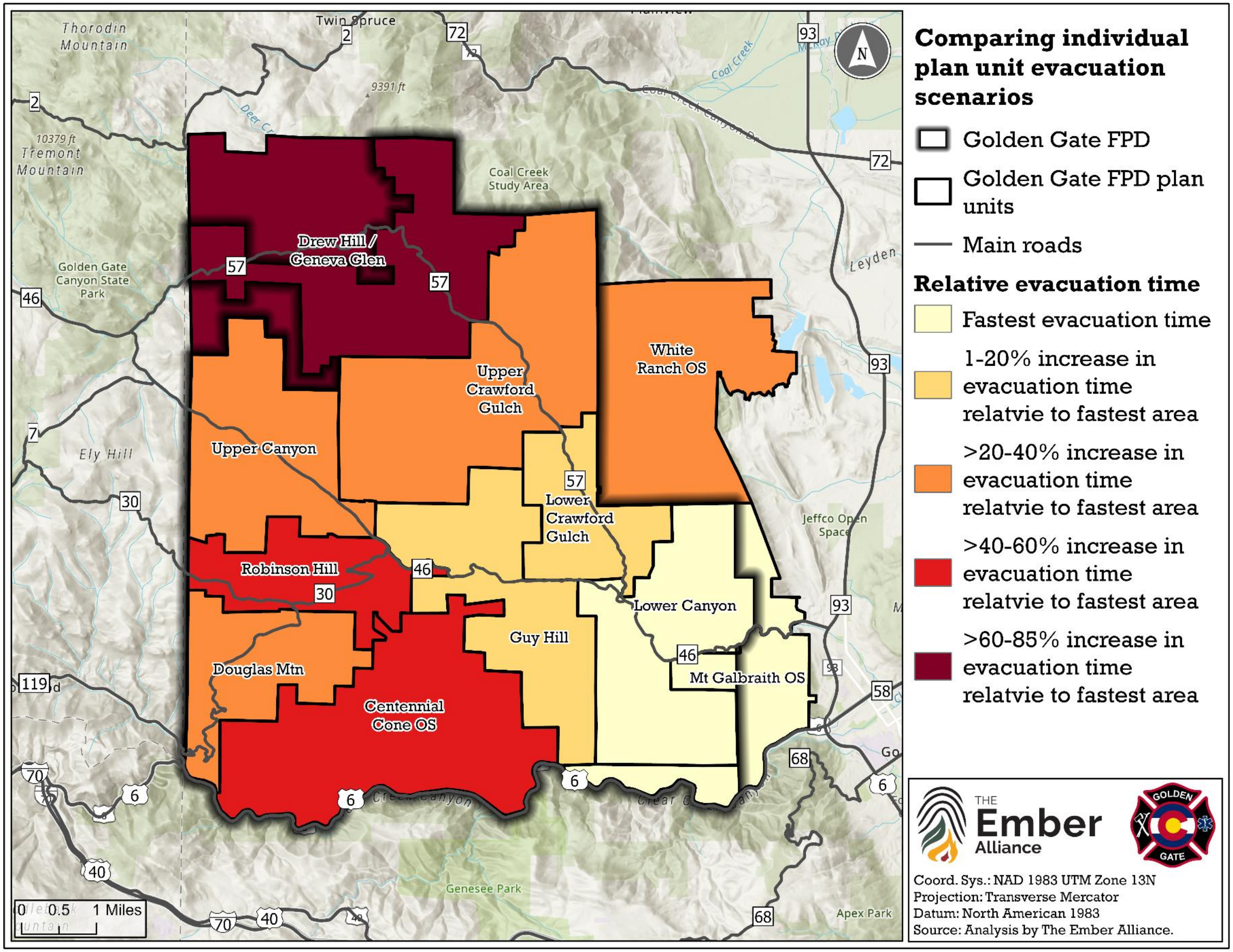
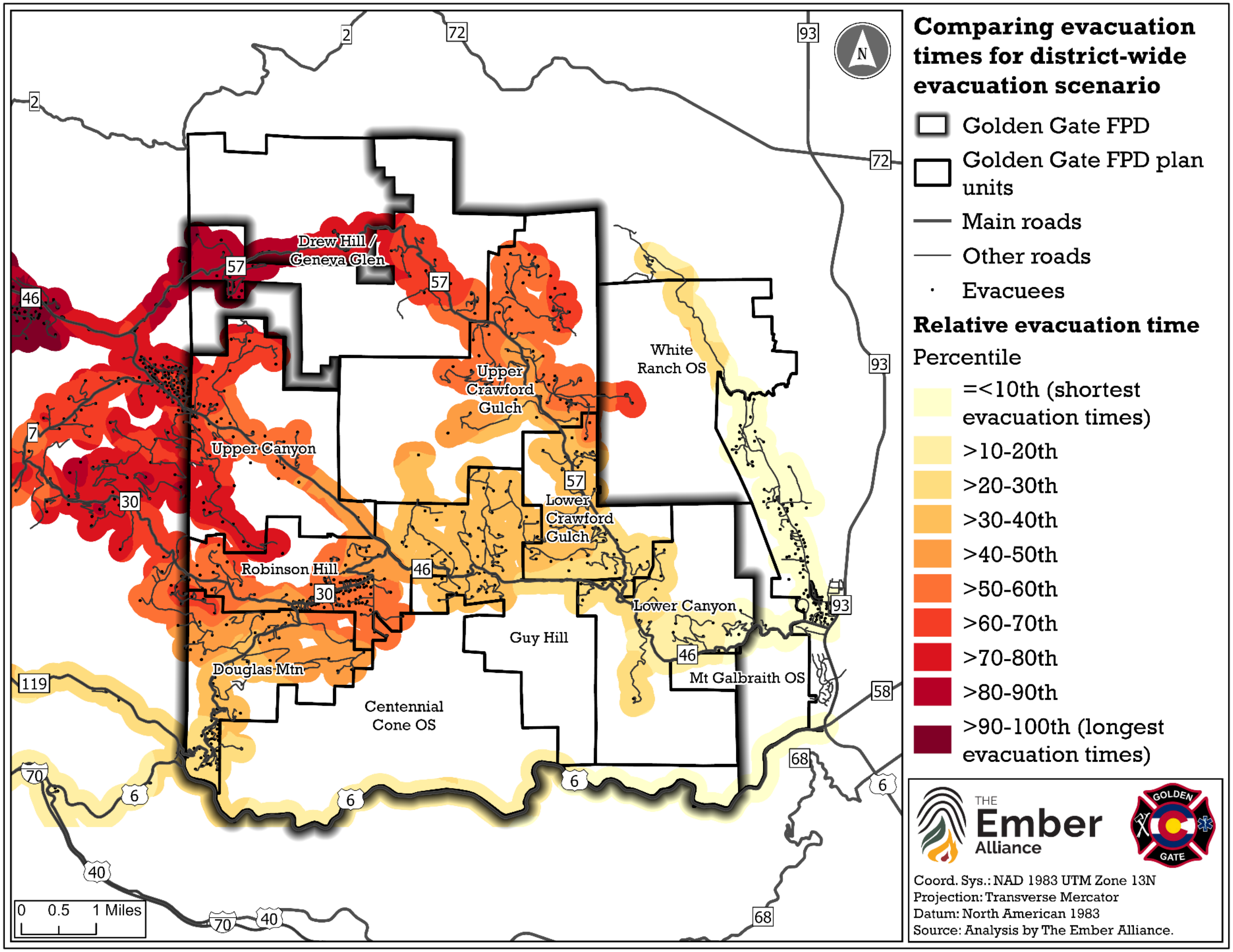


Figure B.14. *Relative time to evacuate all evacuees in each plan unit for scenarios where plan units (or pairs of plan units) were evacuated individually (see **Table B.3** for scenario parameters). Data is presented as percent increase in evacuation time relative to area with the fastest evacuation time, which was the pair of Lower Canyon and Mount Galbraith Open Space plan units. Evacuation preparedness is paramount for all residents, recreators, and visitors to the district, even in areas that could potentially have lower relative evacuation times.*



A map

Figure B.15. *Relative time to evacuate all evacuees in GGFPD and parts of Gilpin County at once (see* ***Table B.3*** *for scenario parameters). Predictions of evacuation times within 200 meters of roads were smoothed using kriging to highlight hotspots with higher relative evacuation times.*

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, 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 (**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.

Based on flame length predictions from the 2022 CO-WRA, 47% of the roads in GGFPD could experience non-survivable conditions (**Figure B.16**). Some non-survivable road segments are part of key evacuation routes, including portions of Golden Gate Canyon Road, Crawford Gulch Road, and Robinson Hill 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.

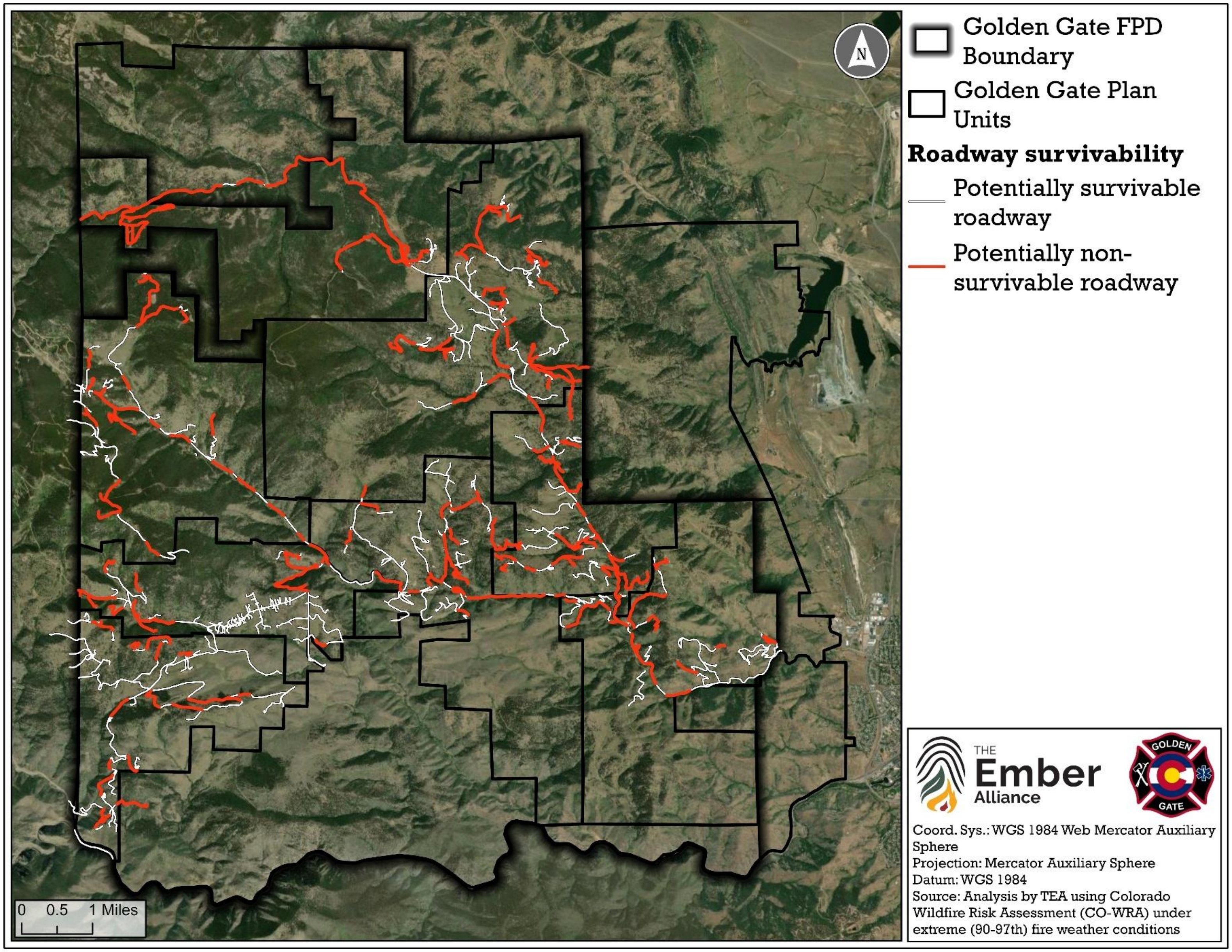


Figure B.16. *47% of roads in GGFPD could potentially experience non-survivable conditions during wildfires (i.e., flame lengths over 8 feet) based on average flame lengths from various fire weather conditions. Source: Analysis by The Ember Alliance using output from the 2022 CO-WRA.*

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 GGFPD could increase by 3.1-4.3° Fahrenheit by 2050, going from 76.8°F in 2005 to 79.9-81.1°F in 2050 (**Figure B.17**). GGFPD could experience 10-14 more days per year with very high fire danger (**Figure B.18**), and average summer VPD could increase from 1.4 to 1.6 kilopascal (kPa) between 2005 to 2050 (**Figure B.19**). Drier fuels in the summer have a greater potential to carry large wildfires; an increase in summer VPD from 1.4 to 1.6 kPa is related to a 7-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 GGFPD. 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.

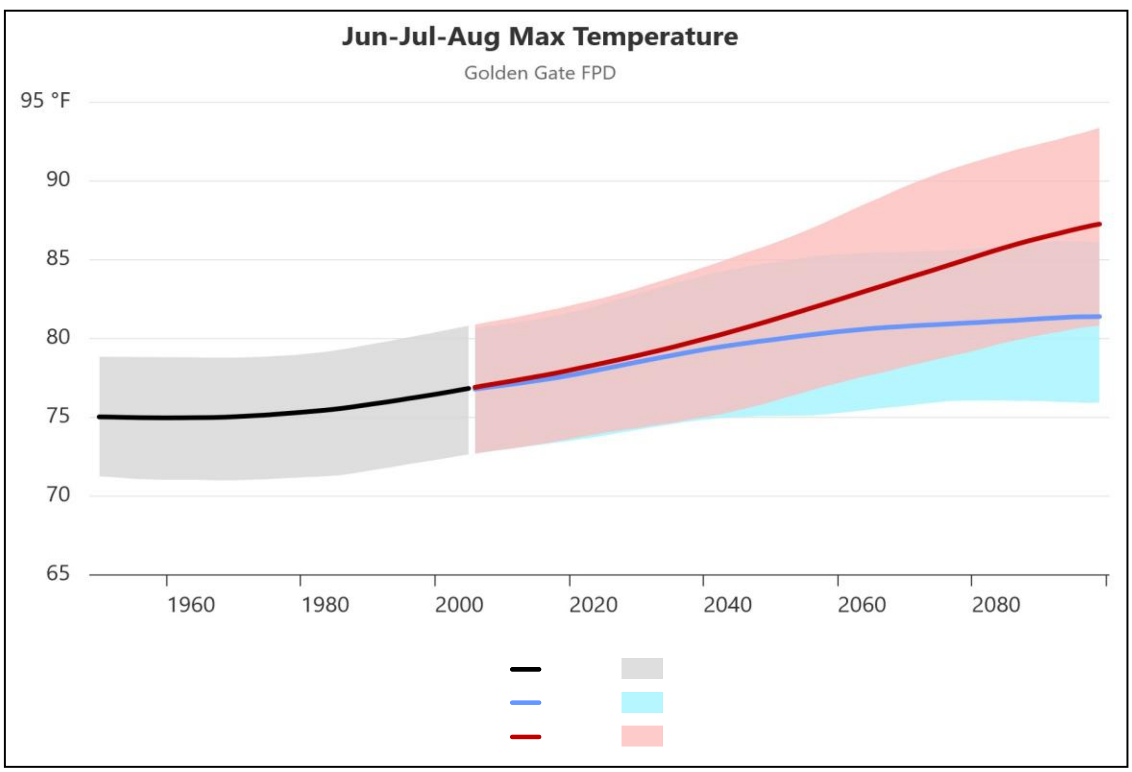


Figure B.17. *Predicted maximum temperature in summer months in GGFPD under lower and higher greenhouse gas emission scenarios. Source: Climate Toolbox (Hegewisch et al., 2021).*

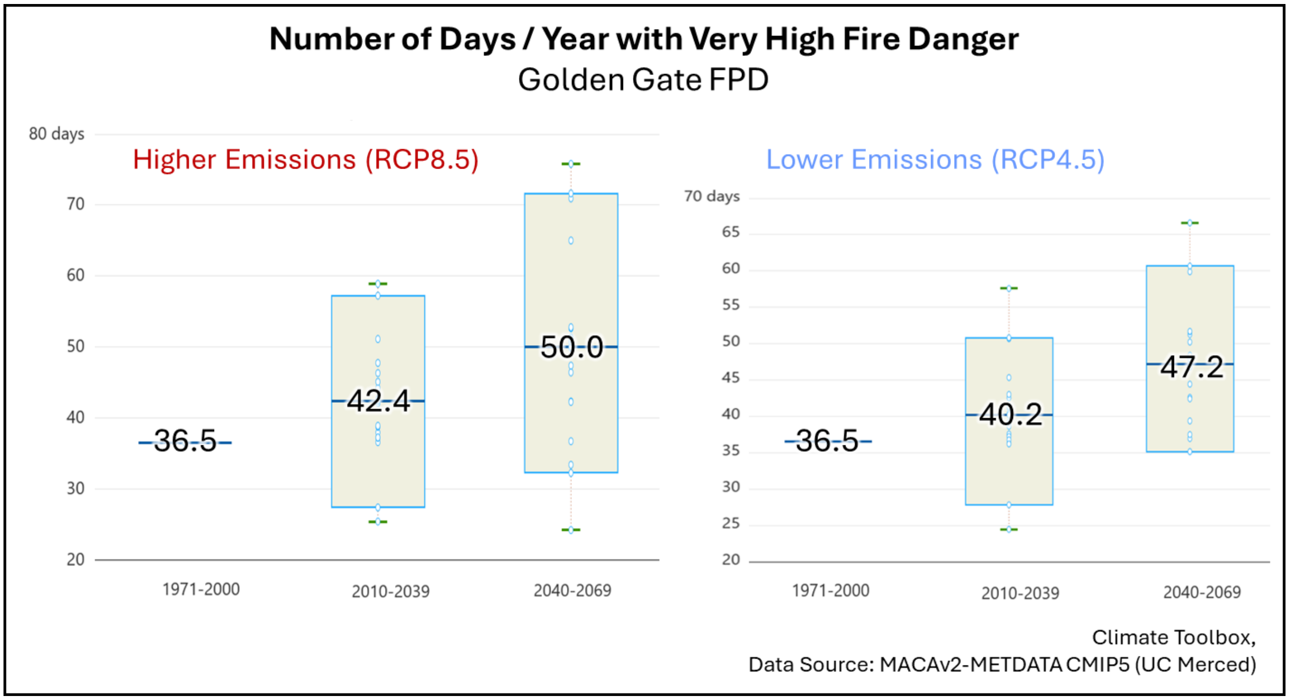


Figure B.18. *Predicted number of days with very high fire danger in GGFPD under lower and higher greenhouse gas emission scenarios. Source: Climate Toolbox (Hegewisch et al., 2021). Boxplots show 5th percentile, median, and 97th percentile predictions. Numbers indicate median values. Whiskers show minimum and maximum predictions. Dots represent individual predictions from different climate models.*

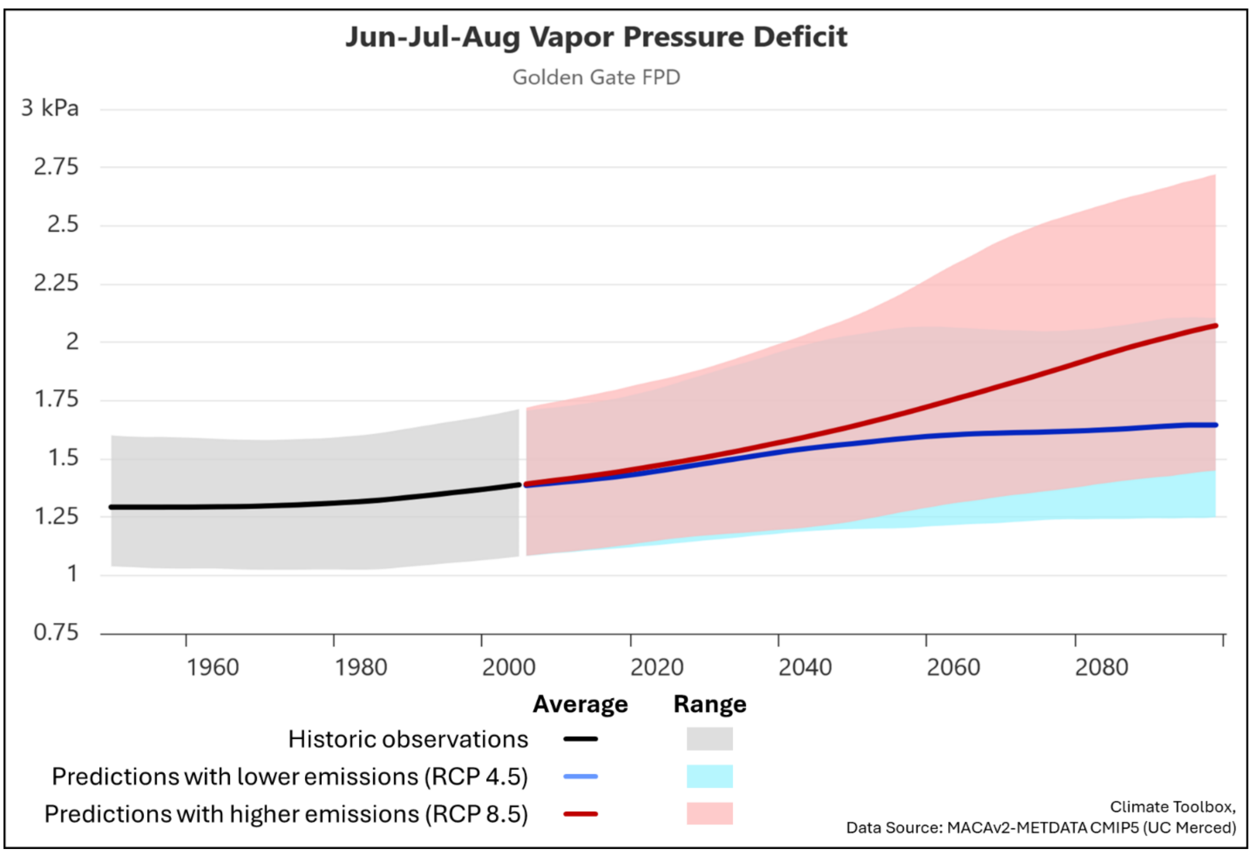


Figure B.19. *Predicted average vapor pressure deficit in summer months in GGFPD under lower and higher greenhouse gas emission scenarios. Source: Climate Toolbox (Hegewisch et al., 2021).*

Plan Unit Relative Risk Assessment

CWPP Plan Units

We compared the ***relative*** risk that wildfires pose to life and property in 11 plan units across GGFPD (**Figure B.20**). 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, fuel types, 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.

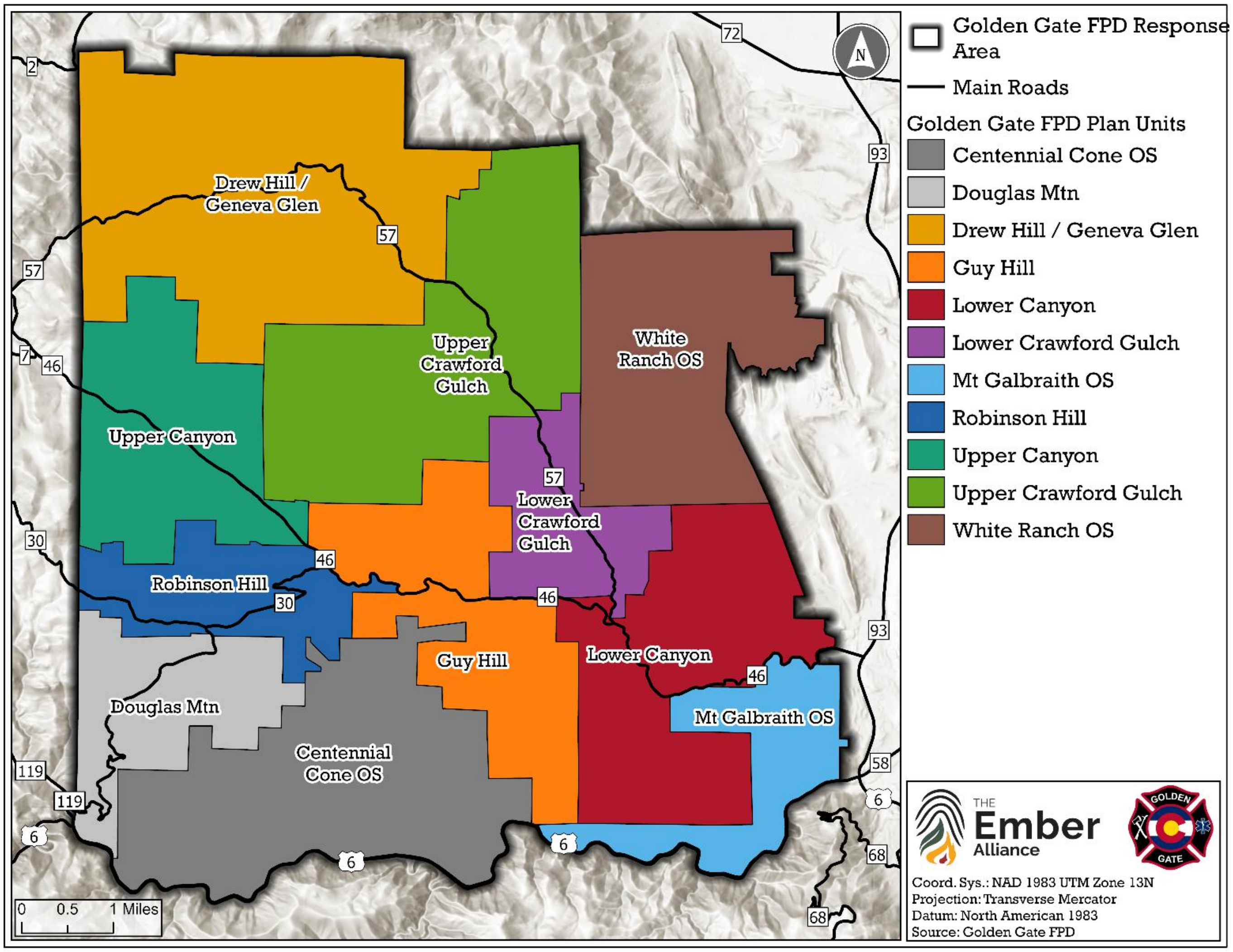


Figure B.20. *CWPP plan units in GGFPD.*

Risk Rating Approach

Some plan units in GGFPD 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 GGFPD, 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 late fall of 2024, employees of The Ember Alliance drove around GGFPD to familiarize themselves with the district and assess home ignition zone hazards within each plan unit. TEA employees 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 GGFPD 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 GGFPD to other communities.

Table B.5. *Relative risk rating values for GGFP: Hazard categories were ranked from Moderate to Extreme, with the 3 "Open Space" plan units receiving "N/A" rankings for "Home ignitions zone hazards" due to the lack of domestic dwellings. The overall risk was also ranked from Moderate to Extreme using the scale in the table below.*

Hazard category	Max. points possible	Range of values in GGFPD Plan Units	Moderate	High	Very High	Extreme
A. Fire risk	39	15-34	15-20	21-25	26-30	>30
B. Fire suppression challenges	21	3-20	3-8	9-12	13-17	>17
C. Evacuation hazards	35	6-32	6-12	13-18	19-25	>25
D. Home ignition zone hazards	22	13-17	13-14	15	16	17
Overall risk	117	40-98	40-50	51-66	67-80	>80

Relative Risk Rating Form

A. Fire Risk	Points
1. Percent area predicted for very high and extreme fire behavior (CO-WRA)	
<20%	0
20-<30%	3
30-<40%	6
40-<50%	9
≥50%	12
2. Percent area predicted for flame lengths greater than 11ft (CO-WRA)	
>20%	0
20-<30%	3
30-<40%	6
40-<50%	9
≥50%	12
3. Average relative burn probability (CO-WRA)	
<10%	0
10-<20%	2
20-<30%	4
≥30%	6
4. Historic ignitions per square mile	
<0.25	1
0.25-<0.5	2
0.5-<0.75	3
0.75-<1	4
1+	5
5. Topographic features	
Saddles / ravines / chimneys	4
A. Total points possible	**39**

B. Fire Suppression Challenges	Points
1. Average response time	
<5 minutes or no homes	0
5-<9 minutes	2
≥9 minutes	4
2. Average cisterns per square mile	
3+ cisterns/sq mi	0
2-<3 cisterns/sq mi	4
1-<2 cisterns/sq mi	8
<1 cistern/sq mi	12
3. Road/driveway accessibility for Type 3 engines (Rated by GGFPD)	
Most Accessible	1
Moderately Accessible	2
Inaccessible	3
Very Inaccessible	4
Most Inaccessible	5
B. Total points possible	**21**

C. Evacuation Hazards	Points
1. Percentage of road with non-survivable conditions	
<20%	0
20-<25%	5
25-<50%	10
50-<75%	15
≥75%	20
2. Total Plan Unit evacuation time[3]	
<20 minutes	0
20-<40 minutes	2
40-<60 minutes	4
60-<80 minutes	6
80-<100 minutes	8
≥100 minutes	10
5. Presence of livestock (on a scale)	
Few property	0
Many properties	5
C. Total points possible	**35**

[3]Estimates from ArcCASPER (see evacuation modeling methodology above).

D. Home Ignition Zone Hazards	Points
1. Average number of homes potentially exposed to short-range ember cast from other homes/structures	
0 homes	0
1 home	2
>1-2 homes	4
>2 homes	6
2. Percent of homes exposed to radiant heat or short-range ember cast from surrounding fuels	
0-<25%	0
25-<30%	3
30-<60%	6
60-<90%	9
≥90%	12
3. Number of mid-slope homes	
0-<5 homes	0
5-<20 homes	1
≥20 homes	2
4. Number of ridge-top homes	
0-<5 homes	0
5-<20 homes	1
≥20 homes	2
5. Other factors	
Poor HIZ rating	+1
D. Total points possible	**22**

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 extreme (97th percentile) fire weather conditions, and potential congestion under a district-wide evacuation order. Segments of roads 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 GGFPD. 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.6. *Methodology for ranking potential need for roadside treatments to mitigate fire hazards along roadways in GGFPD. 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).
High	Potentially non-survivable conditions under extreme fire weather conditions, and High evacuation congestion (congestion index >3.0 to ≤5.0).
Moderate	Potentially non-survivable conditions under extreme fire weather conditions, and Low to moderate evacuation congestion (congestion index >1.0 to ≤3.0).

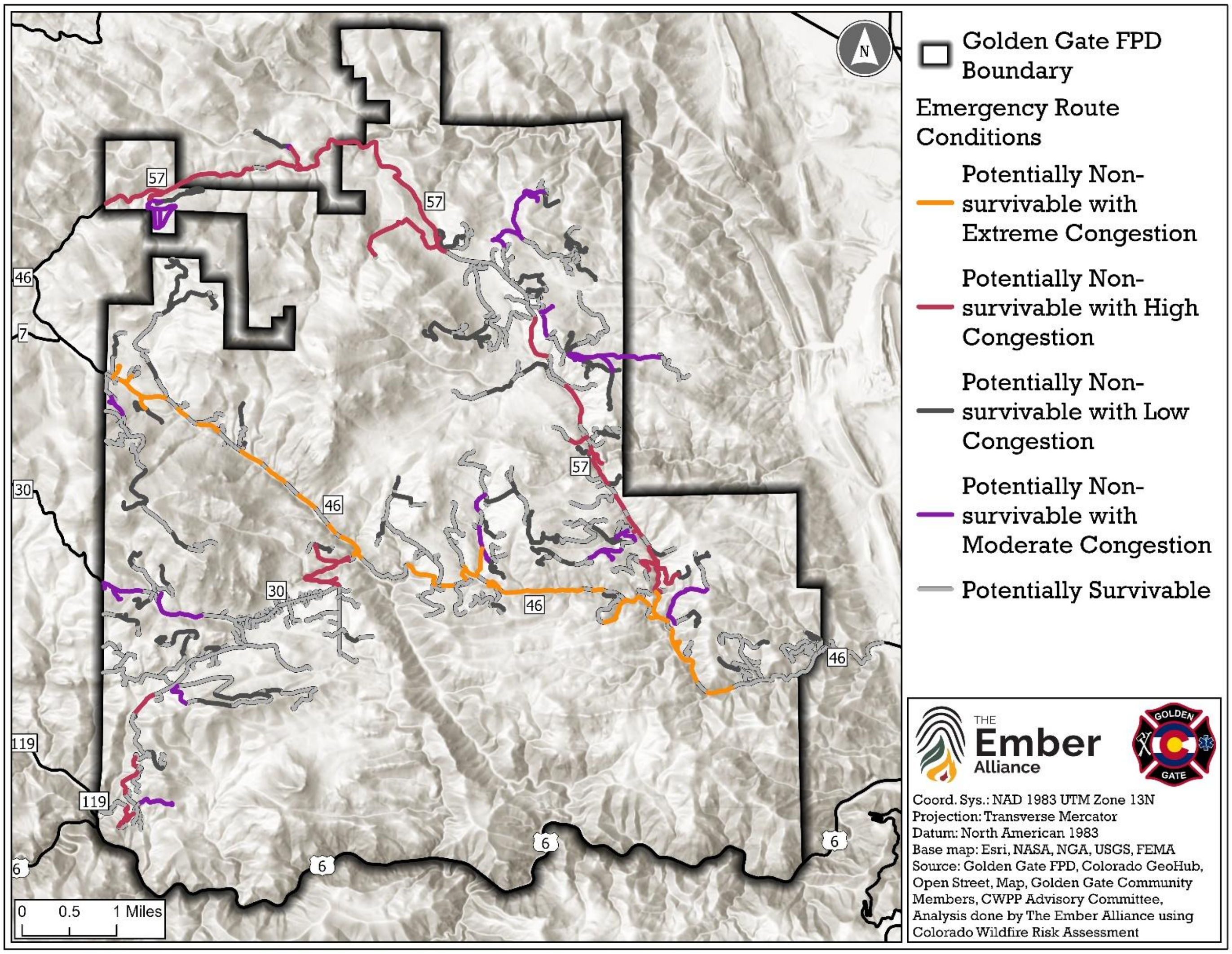


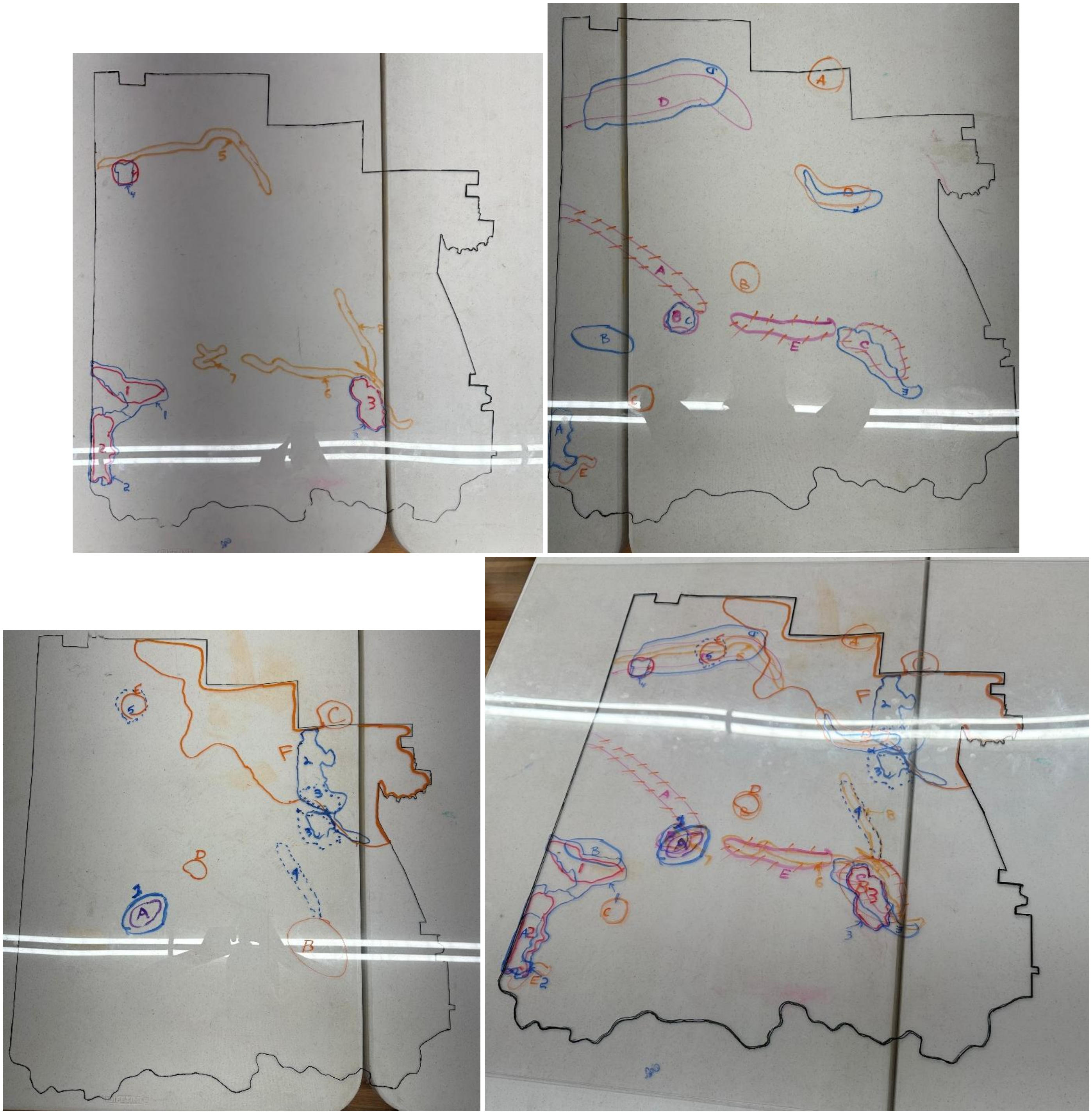
Figure B.21. *Potential need for roadside fuel treatments based on potential fire behavior and evacuation congestion in and around GGFPD. Our fire behavior analyses occurred at the scale of 0.1 acres (20 x 20 meters), so locations of potential treatment areas are approximate.*

Stand-Scale Fuel Treatments

To identify project areas in this CWPP, the advisory committee conducted a project identification and prioritization process. After completing fire modelling, post-fire erosion modelling, roadway analysis and values at risk analysis, residential hazard analysis, and compiling data of prior fires and fuels treatments, the Advisory Committee and partners met in person to prioritize locations and projects. This process consisted of an initial 3-hour project identification meeting held on April 28, 2025 at the Golden Gate Grange. Total in attendance were 16 people with attendees representing the following organizations and interests:

- Clear Creek Watershed and Forest Health Partnership
- Colorado State Forest Service
- CSU's Conservation Leadership graduate program
- Denver Water
- Golden Gate Grange and community interests
- Golden Gate Fire Protection District
- Jefferson County Sheriff's Office
- Jefferson County Parks & Open Space
- Jefferson Conservation District
- The Ember Alliance

Attendees were divided into three groups and worked through the prioritization process facilitated by TEA staff. Each group was asked to provide their perspective based on subject matter expertise and discuss amongst themselves at each stage to produce a final output. First, attendees were shown maps that compiled outputs produced throughout the CWPP process representative of the fire risks within GGFPD to determine areas of highest wildfire concern. Once these areas were identified, the groups were given a new map consisting of infrastructure exposure outputs and asked to identify priority areas based on valuable infrastructure within the district. For the final stage, groups were given a map that displayed land ownership information (agency vs private), multi-agency priority areas, and previous and planned fuel treatments. This map was used to determine feasible locations for project implementation to address the risk identified in the previous two stages. The outputs from each stage were compiled and examined to determine final project boundaries. Over the subsequent weeks following this initial project identification meeting, advisory committee members and wider project partners reviewed the project areas and determined feasibility and priority amongst the projects. In addition to advisory committee input, community feedback collected during the Mid-Project Community Workshop was also consulted during this process to help determine locations of projects and final priority. Based on expert feedback, each project was assigned an agency or organization that would take the lead on the project, and any other organizations or individuals whose participation would be required for successful implementation were identified and noted. Lead organizations for each project determined the feasible time frame. Finally, the priority of each project was determined through discussion amongst partner organizations and feedback from subject matter experts. In addition to advisory committee input, community feedback collected during the Mid-Project Community Workshop was also consulted during this process to help determine locations of projects and final priority.



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 evacuation route through Golden Gate Canyon, areas in Drew Hill/Geneva Glen, and the North Robinson Hill area.

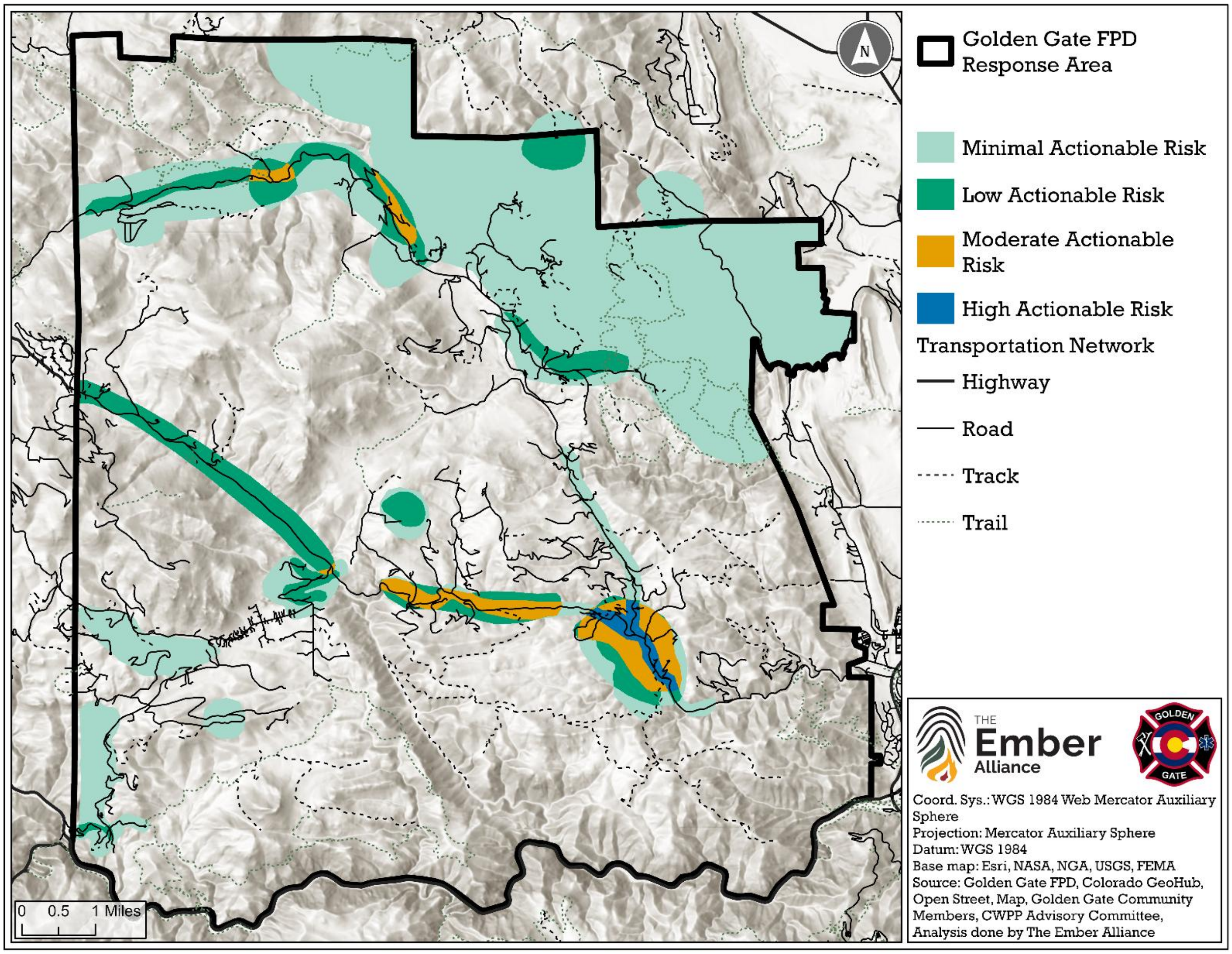


Figure B.22. *Priority areas identified by the Advisory Committee and partners. The blue areas have the greatest overlap and agreement between groups. These areas were refined through subsequent discussions about this map and feasibility to determine final priority project areas.*

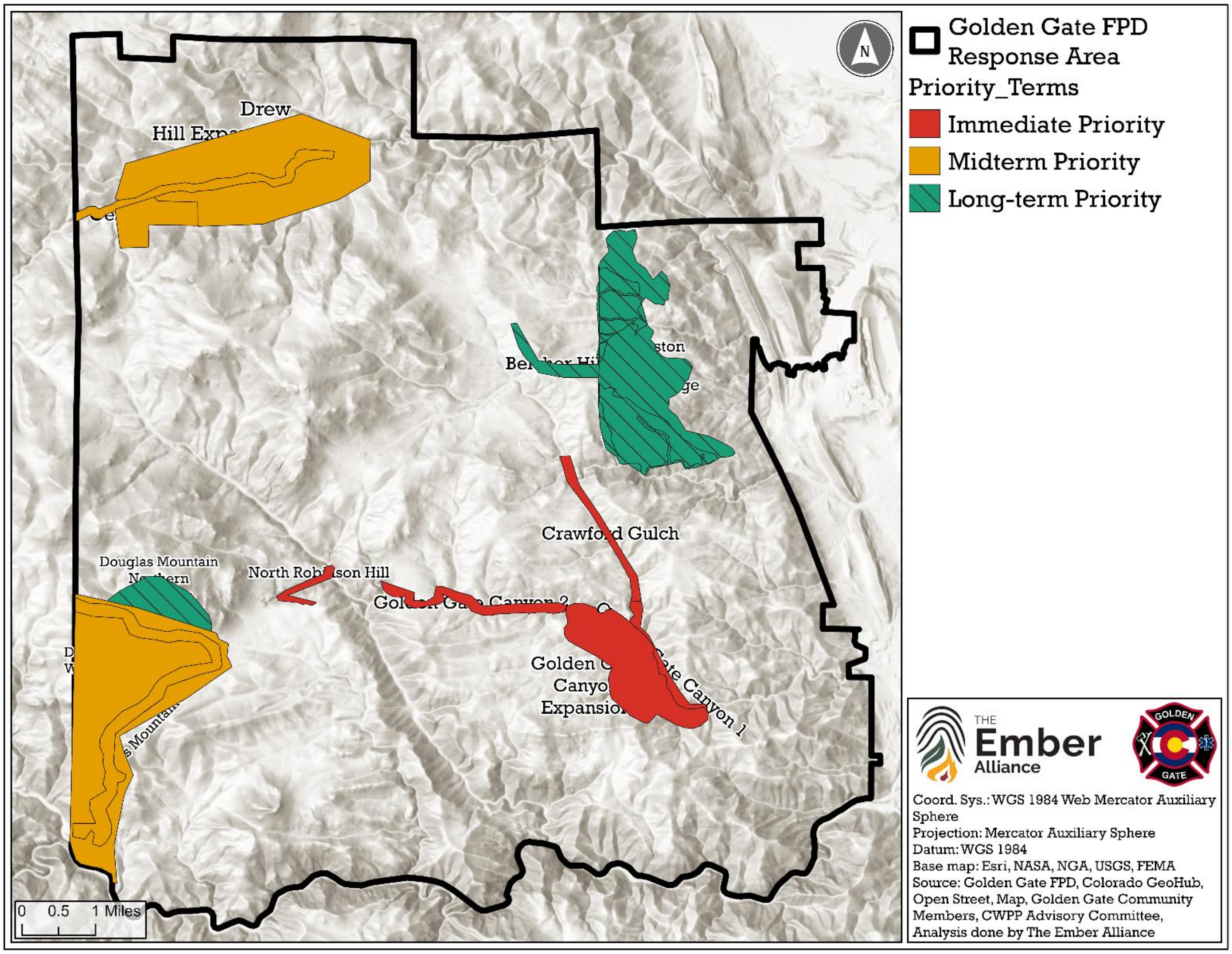


Figure B.23. *First, second, and third priority projects identified by the Advisory Committee and partners. There are many areas of GGFPD that need fuels treatment and forest health work; however, local land managers and partners are unable to accomplish all this work in the next 5-10 years, so only the top priority projects were chosen and detailed in this CWPP.*

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 Advisory Committee meetings, Community meetings and workshops, an Advisory Committee brainstorming session, and during partner meetings.

TEA and members of the Core Team combined similar ideas and grouped them. The Advisory Committee 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. After each potential recommendation was collected and discussed, the Advisory Committee determined which to keep as priority recommendations. Following this step, the Advisory Committee members individually ranked each recommendation according to its category. Individual rankings were averaged and the recommendations were given an overall priority based on these results. Top ranking recommendations within their category were determined to be first priority with lower ranking recommendations labeled as third priority.

Members of the Advisory Committee reviewed amended, combined, and edited the recommendations again, and these final recommendations were included in the **Implementation Activities and Responsibilities** Table.

Table 9.c-1. *Each of the final recommendations, grouped in their respective categories with their overall rankings and final priority designations.*

Community Outreach and Education Project/Activity	**Overall Ranking**	**Final Priority**
Diversify modes of communication	3	Second
Create 3 spots for educators within Wildland Mitigation Division that will serve as educational ambassadors to community	1	First
Host community events w/ safety education (ex: pig roast, slash event)	6	Third
Organize and disseminate best practices for HIZ work, slash management info, etc.	3	First
Join wildfire prepared program - forestry contractors for HIZ work	7	Third
Inform community of county micro-grants and other funding opportunities	2	First
Fire Danger Level signage throughout district	5	Second
Fuel Management Project/Activity	**Overall Ranking**	**Final Priority**
Establish Wildland Mitigation Division through GGFD - volunteer fuels crews	3	Second
Establish a mitigation trailer / equipment cache	5	Third
Conduct home assessments	1	First
Establish annual district slash collection program	4	Second
Identify funding sources for fuel management and apply	1	First
District Capacity Project/Activity	**Overall Ranking**	**Final Priority**

Perform an assessment of needs (water availability, CWPP District Capacity)	1	First
Determine cistern locations and conditions	5	Third
Create proper signage to mark water locations	6	Third
Wildland fire apparatus replacement and acquisition	2	First
Identify sources of funding	2	First
Increase / advance training for wildland firefighting	4	Second
Evacuation and Safety	**Overall Ranking**	**Final Priority**
Organize and disseminate Sheriff's evacuation reference (1-pager)	2	First
Lookout Alert	2	First
Organize go-bags	6	Third
Make pre-arrangements for evacuating livestock	4	Second
Establish shelter-in-place and areas of safe refuge	5	Second
Proper signage for addresses throughout district	1	First
Policy and Code Project/Activity	**Overall Ranking**	**Final Priority**
Complete CWPP and other firewise requirements	1	First
Write and adopt wildfire resiliency codes	2	Second
Code enforcement	3	Third