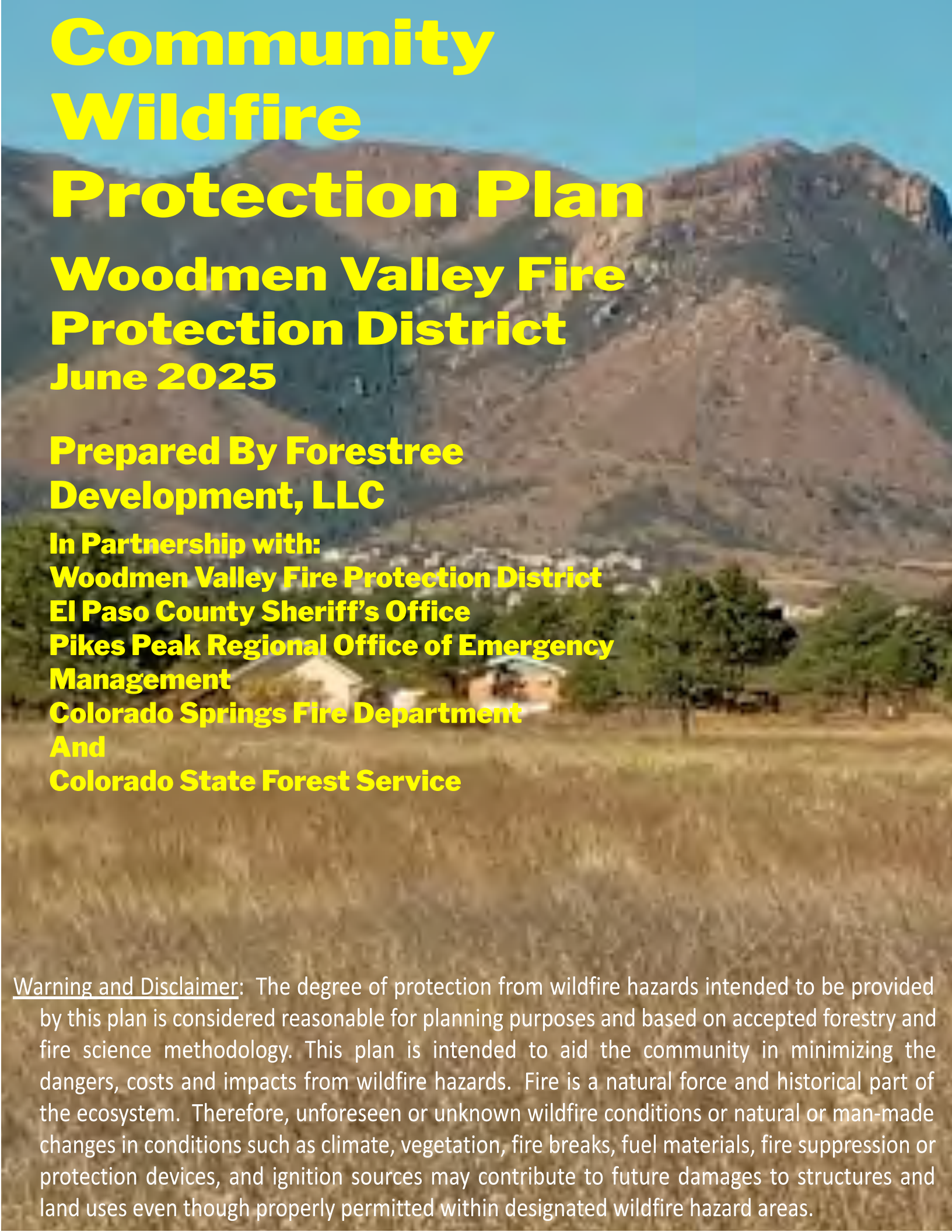
Community Wildfire Protection Plan

Woodmen Valley Fire Protection District

June 2025

Prepared By Forestree Development, LLC

In Partnership with:
Woodmen Valley Fire Protection District
El Paso County Sheriff's Office
Pikes Peak Regional Office of Emergency Management
Colorado Springs Fire Department
And
Colorado State Forest Service



Warning and Disclaimer: The degree of protection from wildfire hazards intended to be provided by this plan is considered reasonable for planning purposes and based on accepted forestry and fire science methodology. This plan is intended to aid the community in minimizing the dangers, costs and impacts from wildfire hazards. Fire is a natural force and historical part of the ecosystem. Therefore, unforeseen or unknown wildfire conditions or natural or man-made changes in conditions such as climate, vegetation, fire breaks, fuel materials, fire suppression or protection devices, and ignition sources may contribute to future damages to structures and land uses even though properly permitted within designated wildfire hazard areas.

ACCEPTANCE

The Woodmen Valley Fire Protection District (WVFPD) Community Wildfire Protection Plan (CWPP) was developed in accordance with the guidelines set forth by the Healthy Forests Restoration Act of 2003 and the Colorado State Forest Services' Minimum Standards for CWPP's.

This CWPP is a collaborative effort to guide the WVFPD (District) and its stewardship management activities, including wildfire protection. The activities recommended in this plan are appropriate to meet District objectives and will benefit the natural resources and reduce the risk from wildland fire. This plan is voluntary, and where possible, the District intends to apply the recommended practices, thus improving community preparedness, and increasing public safety.

The CWPP has been reviewed and approved by the WVFPD CWPP Core Team.

President Kevin M. Bush — 6/30/25
Woodmen Valley Fire Protection District — Date

Deputy Fire Warden - Elizabeth Moro — 7/8/25
El Paso County — Date

Michael Till — Digitally signed by Michael Till Date: 2025.07.02 10:36:27 -06'00'
Supervisory Forester — Date
Colorado State Forest Service

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PREFACE

"Forest manipulations do not change the risk of a wildfire occurring. However, . . . they can reduce the risk of a wildfire turning into a crown fire and burning with such intensity that it cannot be controlled, and kills a majority of the trees it burns through. . . A look at the differences between treated and untreated areas provides a pretty obvious comparison."

--Peter Kolb: University of Montana, and Montana State University Extension Forestry Specialist.

On June 11, 2013, driven by high winds, low humidity and record high temperatures, the Black Forest Fire burned through the unnatural closed canopy forest as an intense crown fire killing all the vegetation and destroying all homes in its path.

Figure 1. Two months after the Black Forest Fire, of June 11, 2013 (Source: D. Root)

The photo above, taken on August 1, 2013, shows the forest on the north (right side of Shoup Road) a dense, unmanaged forest that suffered 100% tree mortality. On the left side of the photo, the forest is managed to be fire-adapted by reducing fuel, creating healthy forests and reducing susceptibility to bark beetles. When embers blew into this area, the fire changed from a high intensity crown fire to a low intensity surface fire. The trees with brown needles were scorched by the radiant heat of the fire across the road, but did not burn. Post-fire recovery was already in progress.

The Community Wildfire Protection Plan that follows is an analysis of the fuel conditions in the Woodmen Valley Fire Protection District ("District") where unnatural forest conditions currently exist. The recommendations in this plan are intended to create a fire adapted forest, and manage the wildfire risks to life, property and natural resources of the community.

I COMMUNITY IDENTIFICATION AND DESCRIPTION

LOCATION AND GENERAL DESCRIPTION

The Woodmen Valley Fire Protection District consists of three communities in an unincorporated area adjacent to northwestern Colorado Springs (***Figures 2 and 3***) The neighborhood was established in the late 1950's adjacent to the southern boundary of the new US Air Force Academy (USAFA). At that time, the community was a rural enclave of large lots far outside the city of Colorado Springs. Currently there are 313 lots, 304 homes. Some of the properties have horses.

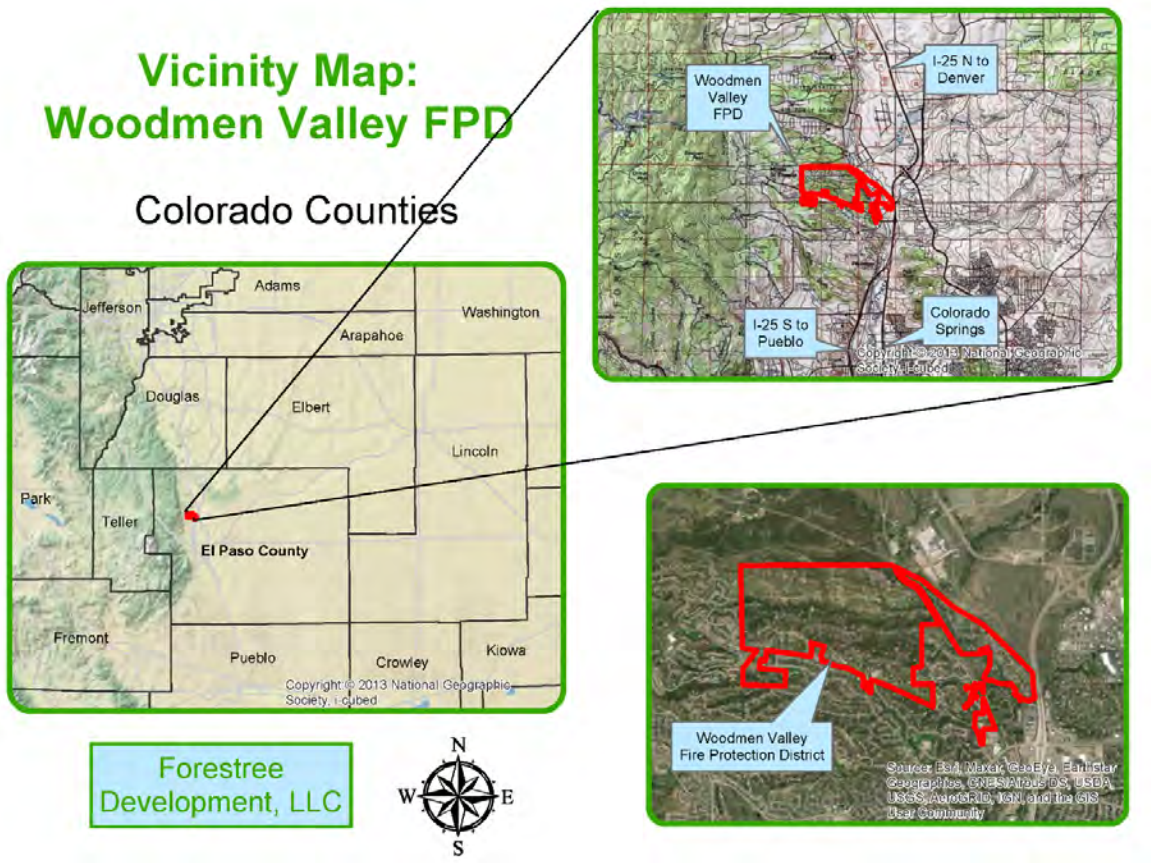


Figure 2. Vicinity Map of WVFPD

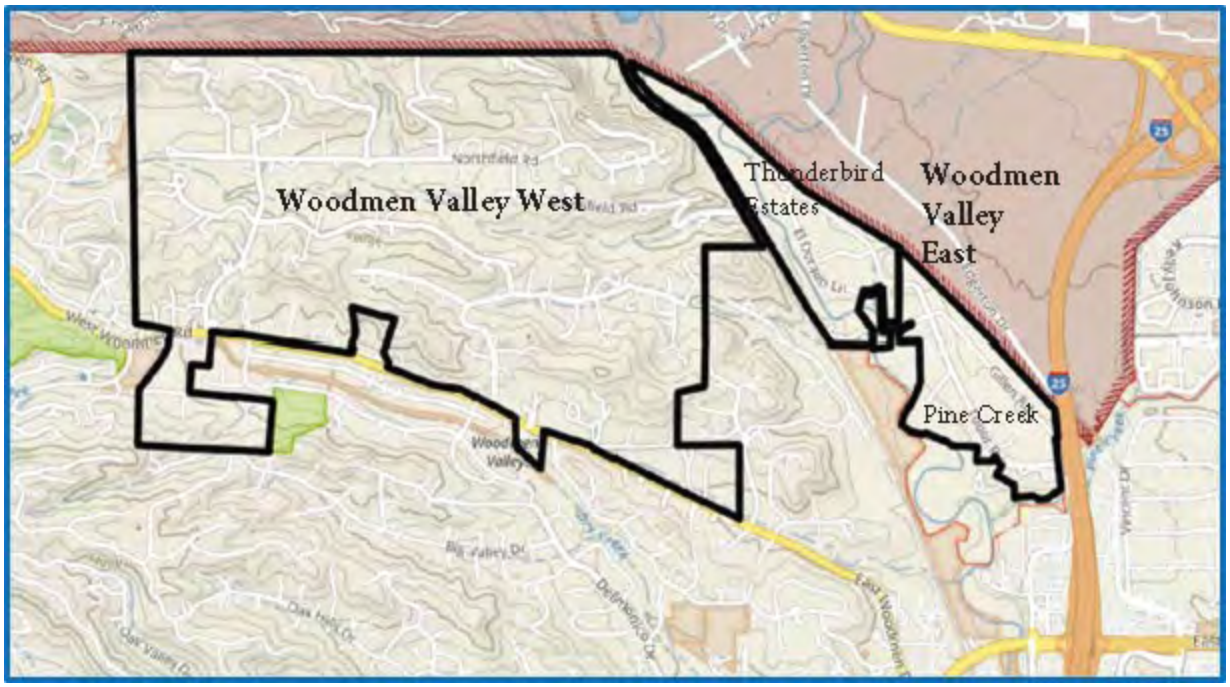


Figure 3. The Woodmen Valley Fire Protection District boundary is shown in black .

Over the years, Colorado Springs grew to surround the south, west and east sides of Woodmen Valley. The Air Force Academy blocked any development north of the community. The Woodmen Valley Volunteer Fire Department was established in 1959, and the Woodmen Valley Fire Protection District WVFPD was established in 2000. Nine years later, the Fire Protection District signed an agreement with the Colorado Springs Fire Department to provide fire and EMS to the District. The Woodmen Valley Fire Protection District is still active and the CWPP will advise the community's wildfire reduction efforts.

Currently Woodmen Valley retains a rural character with large lot sizes, narrow dirt roads, and abundant wildland fuels. Lot sizes vary from two to ten acres. Adjoining developments within the city limits of Colorado Springs were built in the 1980's and 90's and feature urban lot sizes and closely spaced houses. The undeveloped lands of the Air Force Academy still adjoin Woodmen Valley on the north.

East of Monument Creek, the FPD Includes the Thunderbird Estates and Pine Creek Estates areas that this plan will call District-East. This area has homes more closely spaced on urban sized lots of 0.5 to two acres. Commercial retail developments adjoin the Pine Creek Estates section of the District on the southeast.

The intent of this plan is not to simply remove fuel. Rather it is to create healthy forests and promote stewardship of the land. Prescriptions are not simply for defensible space around structures, although that is the highest priority of the plan. As time and funding permit, treatment should extend beyond the 100 foot zone surrounding homes to create a healthy forest throughout the entirety of the community.

WILDFIRE HISTORY

Woodmen Valley has a history of wildfires. In 2006, a 180-acre fire near Woodmen and Northfield required mutual aid from 18 departments and at least one slurry bomber. The Waldo Canyon Fire came within one mile of the community, there is no doubt that the Woodmen Valley area has a long history of wildfire. Native American tribes managed forests as open stands using prescribed burning as their primary management tool. Lightning was also a natural source of fire.

Open forests were vital for Native American survival since game was easier to hunt, enemies had more difficulty mounting surprise attacks, and travel through open forests was easier. Before their removal to reservations, tribes burned the forest every 15 to 30 years, and the pre-settlement forests were shaped by burning over hundreds of thousands of years. Over that time the forest animals, plants and indigenous people became adapted to open forests.

Many millennia of management by prescribed burning ended with the arrival of settlers and removal of Native Americans. For settlers, with homes, farms and ranches in forests, wildfire was a threat to be eliminated. By 1910, the mission of the US Forest Service was to extinguish any wildfire by ten o'clock the next morning.

It worked for a while. However, by the 1980's fuel that would have been eliminated by frequent prescribed burning accumulated until fires became larger and more difficult to control. Add to that more and more individuals are building homes in the high-risk wildfire environment and the cause of our present troubles is obvious.

As a response to the growing threat of wildfire, Community Wildfire Protection Plans (CWPPs) were authorized by Congress in the Healthy Forests Restoration Act of 2003 (HFRA). The Act encourages communities to develop comprehensive wildfire protection plans through a collaborative process.

A particularly important item in the legislation permits communities to establish a Wildland Urban Interface (WUI) boundary surrounding the community. The WUI boundary is the area surrounding a community where a wildland fire would pose a threat to the community. HFRA directs the Departments of Interior and Agriculture to prioritize local community WUI boundaries in fuels reduction treatments.

The HFRA emphasizes the need for federal agencies to collaborate with communities in developing hazardous fuels reduction projects, and places priority on treatment areas within the WUI boundary, municipal watersheds and other local values at risk. An example is shown in ***Figure 3***. HFRA requires agreement among local governments, El Paso County in this case, local fire departments and the Colorado State Forest Service. The CWPP also must be developed in consultation with interested parties and the applicable federal agency managing lands surrounding at-risk communities.

Figure 4. Demonstration of fuel treatments.

II. COMMUNITY ASSESSMENT

CWPP GOALS

- **Protect lives and property from high intensity wildfire.**
- **Provide safe evacuation egress and firefighter ingress in the event of a wildfire.**
- **Establish a wildfire adapted forest within Woodmen Valley.**
- **Establish science based Defensible spaces and Home Ignition Zones to enhance structural protection capabilities.**
- **Create the understanding that embers are the primary cause of home ignition. The aging housing stock will require repairs at potential ember entry points.**

COMMUNITY VALUES AT RISK

The priorities for wildland firefighters are:

1. Life safety of residents and firefighters.
2. Structures, primarily homes.
3. Forest and other natural resources.

Feedback from residents places the highest value on the forest and natural resources- the unique qualities that make Woodmen Valley a special place to live. This makes it even more important that District residents take action to become fire adapted to protect all three priorities.

The following are at risk of loss due to wildfires:

1. Single points of ingress/egress that could lead to entrapment in high fuel zones prone to extreme wildfire behavior.
2. Residential valuation for the 313 properties in the District is currently $253,990,000.
3. Roadways and related drainage improvements:
    a. District- West 6.1 miles of private roads.
    District - East 2.6 miles of public roads.
4. Utility infrastructure includes:
    a. Electrical lines, overhead.
    b. Phone, cable TV, and fiber optic to homes, underground and aerial.
    c. Natural gas lines.
    d. Water mains, hydrants and property service lines.
5. Post-fire reoccupation and site recovery will be dependent on the extent of damage to Items 3 and 4 above. In some cases, aftereffects can linger for many years. Examples are:
    a. Mud, ash and debris flows can destroy culvert road crossings necessary for access to entire neighborhoods.

b. Post-fire erosion may destroy culvert crossings to home sites. Heavy rains can result in washed out or clogged culverts after every storm until vegetation recovers adequately.
c. Utilities necessary for public health and safety, if destroyed, may delay reentry to homes.
d. Depending on burn severity, slopes may be unstable above or below structures.

6. Natural resource values increase property values. These can range from $50,000 to $200,000 per property depending on native vegetation cover, privacy and viewsheds. Native wildlife associated with this special plant community should be included.

EMERGENCY EVACUATION PLAN

The fatalities in both the Waldo Canyon and Black Forest Fires were residents who did not evacuate in time. If a fire threatens the area, it is not necessary to wait for an evacuation order to leave.

Roads within District-West, shown in blue, are privately owned and maintained (***Figure 4***).

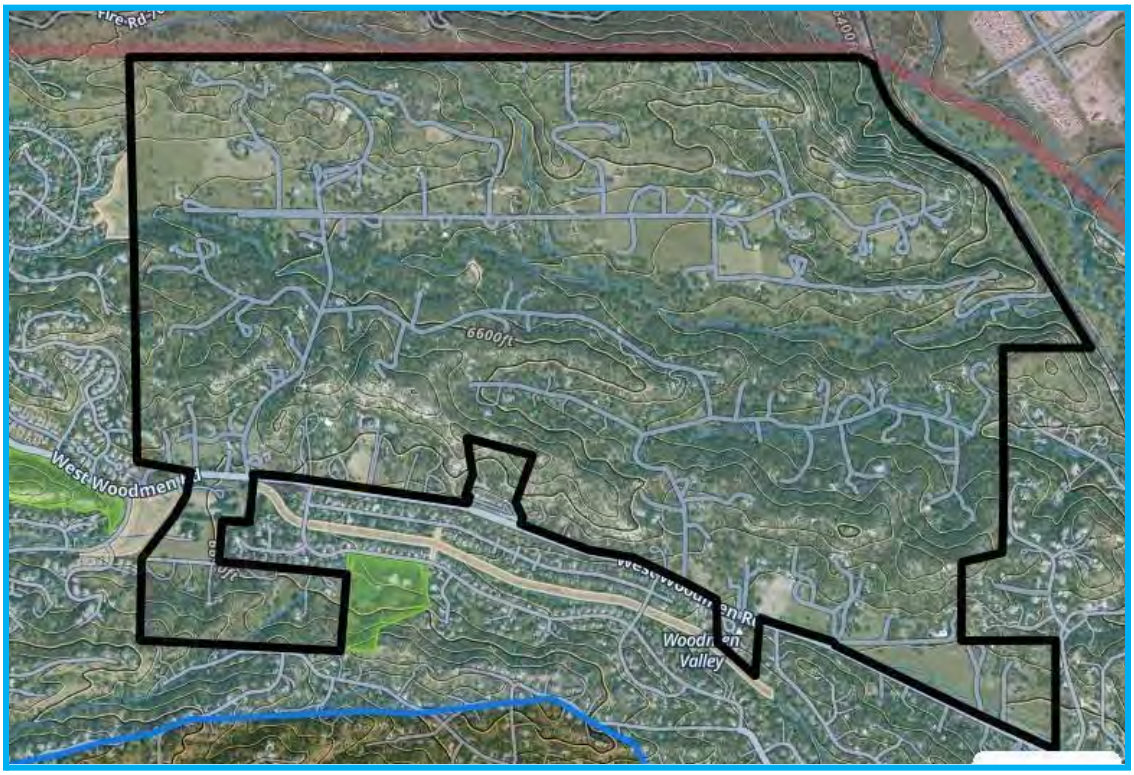


Figure 5. District-West

Public safety officials will issue an Evacuation Order if your area is in imminent danger.

- If you receive an Evacuation Order, you must leave IMMEDIATELY
- If you are not at your home when an Evacuation Order is given, DO NOT try to go home
- Continue to listen to local radio, television, or the official agency social media outlets for further instruction

NOTICE TO EVACUATE. In case of a fire or other emergency, the primary notification to evacuate will be issued by the El Paso Teller 911by **Peak Alerts.**, Residents should follow directions provided in the recorded message. Other notifications may come from local TV and Radio stations.

Emergency notifications are not automatically routed to cellular phones. To be certain of notifications, residents who rely on cellular phones should register their phones at:

Peak Alerts | El Paso-Teller County 911, CO

EVACUATION ROUTES:

Evacuation Planning is an important objective of the Community Wildfire Protection Plans. The consulting team of Keith Worley and Dave Root have completed their assessment of community needs to improve evaluation safety. Both areas of the district will be discussed. Following the naming protocol established earlier, the area of the Fire District west of Monument Creek will be referred to as District-West, and the portion of the district east of Monument Creek will be District-East.

Both areas are one-way-in and out.

DISTRICT WEST:
The following issues were identified:

1. All roads are within access easements on private property, thus limiting actions without permission of the owners. In some areas, roadways were indistinguishable from driveways.
2. Most road widths of drivable surfaces are narrow but will typically allow vehicles to pass oncoming traffic.
3. Some road widths are too narrow to allow passage of more than one vehicle at a time.
4. Heavy fuels are present along many roads, often coming up to the road edge.
5. Community leaders have convinced some owners to manage fuels along portions of the roads with mitigation focused on 20 feet into the abutting properties. However, some areas have not been done due inaction or resistance of abutting owners.
6. Differing levels of road construction and maintenance exist within neighborhoods from paved roads to gravel roads with minimal maintenance.
7. Steep grades and tight turning radii are present in the Red Spring Valley Road area.

8. Street signage, when present, does not meet any recommended standards for lettering size and reflectivity.
9. Access roads and driveways are not clearly defined or differentiated.
10. Some homes do not have reflective address markers at each driveway entrance that are visible from both directions of travel.
11. Dead-end streets or shared driveways are not all labeled as having no outlet.
12. Dead-end streets and driveways do not typically have enough turning area to allow for quick turning of fire apparatus.
13. Westwood serves as the only way in and out of the north half of the neighborhood (north of Timber Valley Road).

The following alternatives were investigated:

1. Develop a second access from Northfield to Timber Valley Road. Several locations were investigated with permission from the owners. However, these were not found to be practical due to road grades, amount of grading required resulting in wide disturbance areas, stream crossing options, and location within zones of heavy fuels. These could possibly be used for installation of fire breaks within future fuel treatment zones. These would only be accessible for firefighting purposes if determined by fire crews to be safe under the burning conditions existing at the time.
2. Manage fuel volumes along all roadways to Colorado State Forest Service criteria following recommendations Colorado State Forest Service Publication "*Fuelbreak Guidelines for Forested Subdivisions and Communities*." A copy is attached to this report. A major concern will be consistent implementation given the diverse levels of participation.
3. Use the Air Force Academy (USAFA) firebreak as an emergency egress. The team inspected the Woodmen Valley access point and drove the entire fire break with AFA staff. This was quickly ruled out because:
    a. Fuel volumes are heavy, consisting of continuous Gambel oak and conifer fuels, along most of the route.
    b. The fire break is in areas with major grade changes with multiple switchbacks.
    c. It is situated in rugged terrain that will add to extreme fire behavior. Valleys, saddles, ridges and chimneys typically increase wind speeds.
    d. Even within the fuel break, heavy fuels are too close to the road to permit safe escape.
    e. No two-way traffic is possible. The current unimproved road is equivalent to a rural ranch road with portions narrowed by vertical embankments on each side.
    f. Unknown fire direction and behavior, either from westerly winds or up-slope winds out of the southeast, can result in entrapment and/or burn-over of vehicles in this zone.
    g. The two track road through the Academy does not permit travel by low clearance vehicles, motor homes or trailers. Evacuations are panic situations, and it is foolish to assume that residents would not attempt to escape over this route in unsuitable vehicles.

h. Burning conditions, like those experienced during the 2012 Waldo Canyon Fire and 2013 Black Forest Fire, will result in major spot fires throughout the fire break area. Embers (firebrands) carried well ahead of the fire front by high winds, contributed to fire spread and structure losses. Containment was not possible. Heavy smoke will limit visibility (***Figure 5***).
i. The fire break is for use by AFA firefighters who will, most likely, be accessing the area from below. These resources have wildland fire training, appropriate suppression equipment and personal protective equipment (PPE).

Figure 6. Smoke, here from a low intensity-controlled burn, substantially reduces visibility along roads. Uncontrolled wildfires produce even greater amounts of smoke, and will reduce visibility to zero.

DISTRICT EAST:
This unit is the portion of the fire district that includes Thunderbird Estates and Pine Creek Estates (***Figure 6***). It has a character distinct from the western portion of the District. It is more urban in character with smaller suburban sized lots, paved streets but no curbs or sidewalks.

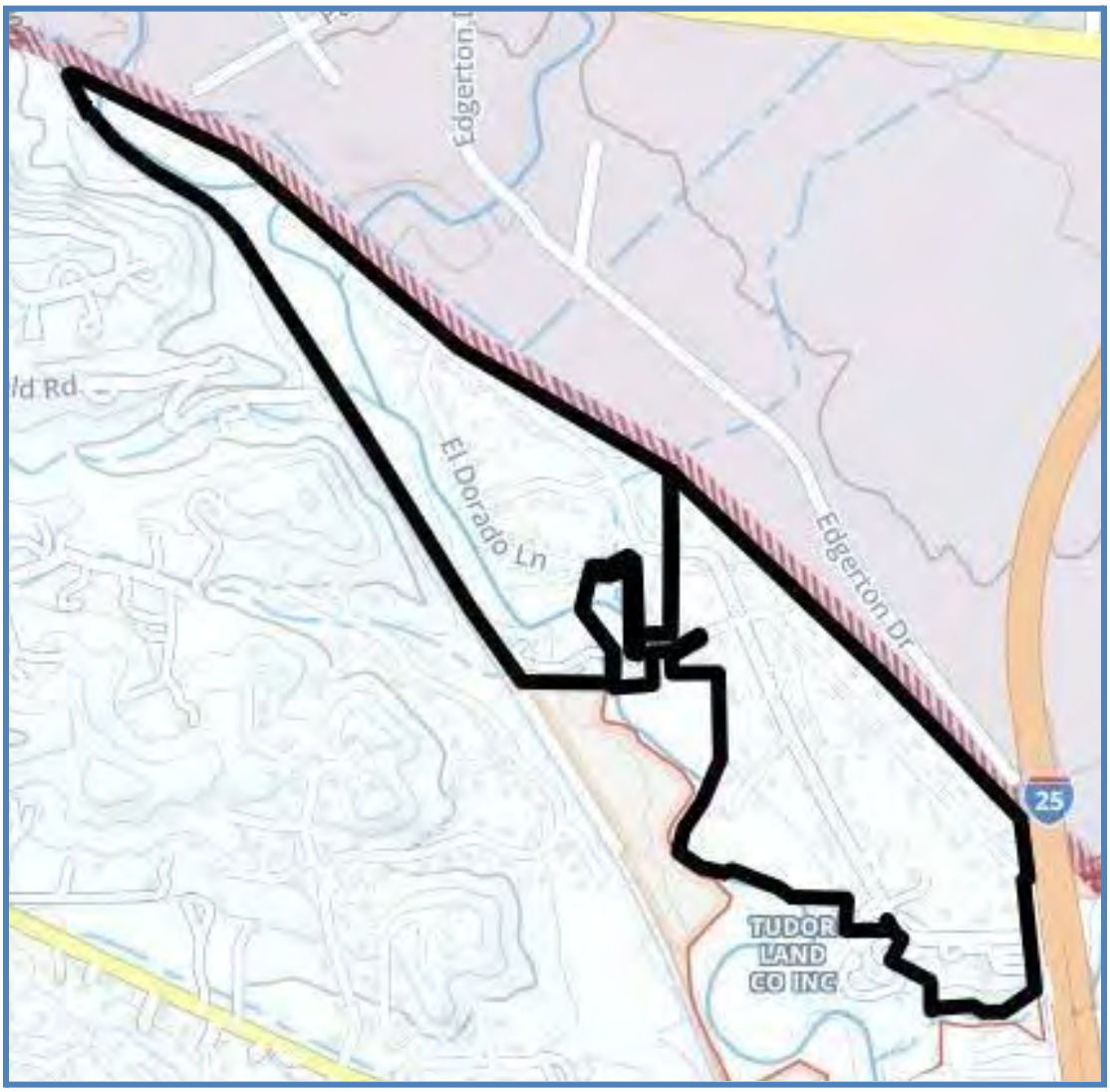


Figure 7. District-East. All Roads are publicly owned and maintained.

1. There is one way in and one way out of the neighborhood via Commerce Center Drive. This road traverses a congested commercial area before it meets Woodmen Road at a busy intersection west of Interstate 25.
2. Roads are public highways and maintained by El Paso County.
3. The neighborhood has several dead-end cul-de-sacs with adequate room for a type one engine to turn around.

4. Road widths are sufficient for two-way traffic. Grades are mostly flat with few steep areas for short distances.
5. Roads are well marked with proper street signs.
6. Fuel loads adjacent to the pavement are generally good, but there are some areas where unmitigated wildland fuels or landscape plants directly adjoin the road. These patches of dense fuels are usually small but could hamper evacuation or firefighter access.

SOCIALLY VULNERABLE POPULATIONS

Individuals who are socially vulnerable, elderly individuals, disabled persons or those not fluent in english or those living below the poverty level. Some socially vulnerable individuals in the community are known to the fire district, but others keep their vulnerabilities concealed.

Social vulnerability as it relates to wildfire takes many forms. The effort required to mitigate or maintain the defensible space on properties is often too much for elderly people or individuals with disabilities. Those with language barriers or with hearing loss frequently do not receive evacuation information or warnings of wildfires in the area. Individuals with respiratory illness are disproportionately harmed by smoke. Low income residents simply cannot afford the cost of defensible space or home hardening.

The Colorado Forest Atlas Show no socially vulnerable populations within the Fire District. However there are individuals who are disproportionately vulnerable to wildfire, and some may not be known to the fire district. Often vulnerable individuals do not make their condition known for fear of becoming victims of crime. Frequently such people rely on relatives or neighbors for assistance.

El Paso County Social Services is a resource available to the Fire District, and this resource should be employed to find and establish rapport with vulnerable individuals. The Colorado Springs Fire Department has valuable experience working with vulnerable populations and can offer assistance to the Woodmen Valley FPD. Most wildfire related publications are now published in Spanish language versions, and the District will keep publications in both languages when they are available.

III. WILDLAND URBAN INTERFACE BOUNDARY

The wildland urban interface (WUI) boundary on the map in ***Figure 7*** is defined as the area where a wildfire would be a threat to the community. By default, HFRA establishes a one-half mile WUI boundary surrounding a community. Such an arbitrary boundary does not reflect the unique conditions surrounding the District. Communities are encouraged to establish their own WUI boundaries consistent with the fuels and topography surrounding the community.

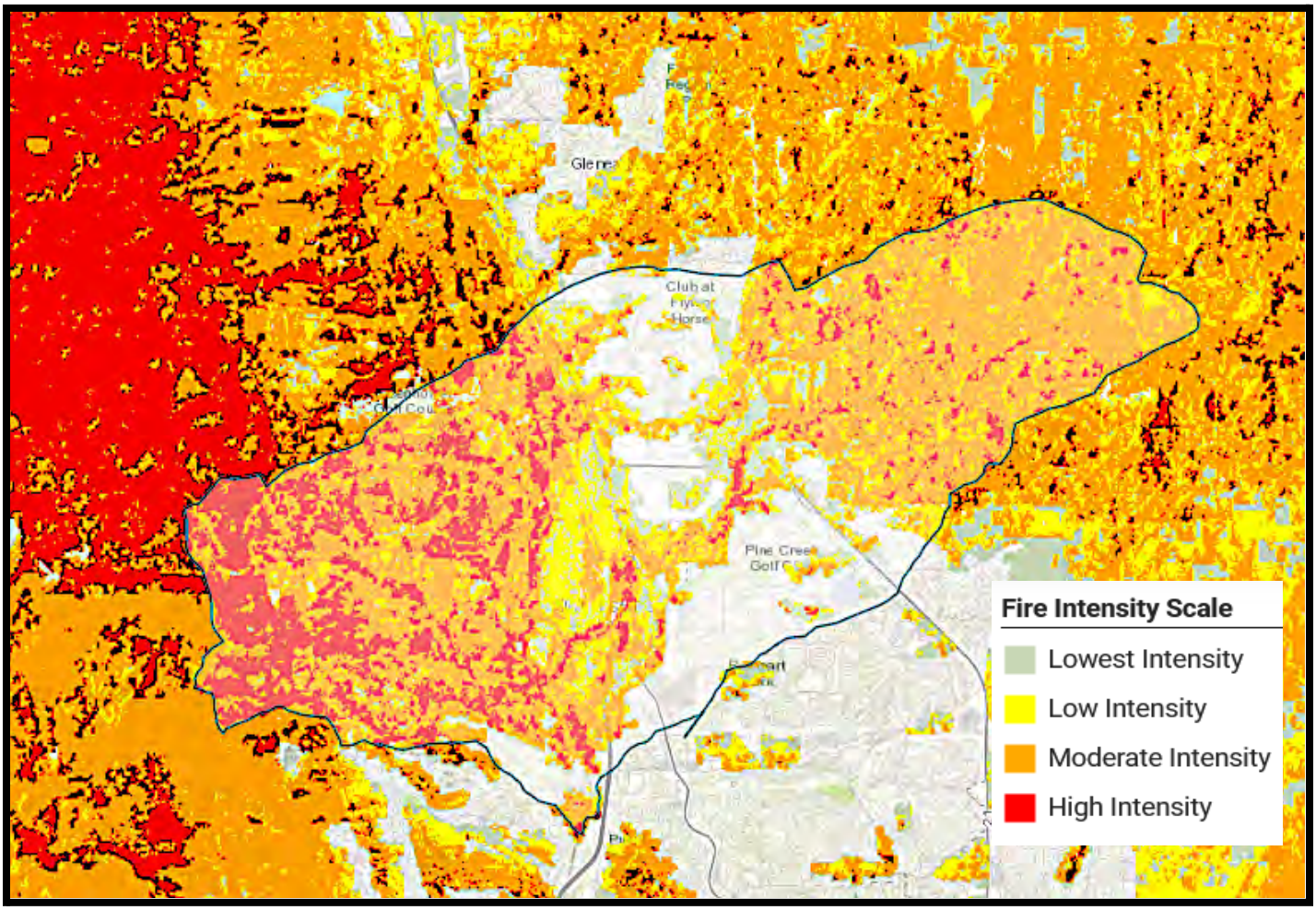


Figure 8. Fire Intensity Scale (Source: Colorado Forest Atlas)

The rationale for the District's WUI is that windborne embers (firebrands) may start new wildfires as far as a mile ahead of the main fire. Also, post fire flooding threatens the community after wildfires anywhere in the various watersheds. The eastern lobe of the WUI boundary includes the watersheds of the dry creek (Toms Gulch) in District-West that flows to Monument Creek from west to east. Kettle Creek, the stream that flows from east to west, meets Monument Creek in District-East.

IV. WILDFIRE RISK

The wildfire risk map in ***Figure 9*** represents the Colorado Forest Atlas analysis of the wildfire risk in Woodmen Valley. The map is a combination of the probability of ignition and the values at risk layers of the Atlas. Eighty eight percent of Woodmen Valley falls into the moderate to highest risk categories. When interpreting Forest Atlas data, it should be noted that predictions are based on the average of historical weather over time. Thus, the Atlas does not predict fire behavior on any given day, and weather conditions at the time of a fire will greatly influence fire intensity, rate and direction of spread. For example, both the Waldo Canyon and Black Forest Fires burned during the most severe fire weather and not on average days. The effect of weather conditions on fire behavior is further explained in the section on fire behavior.

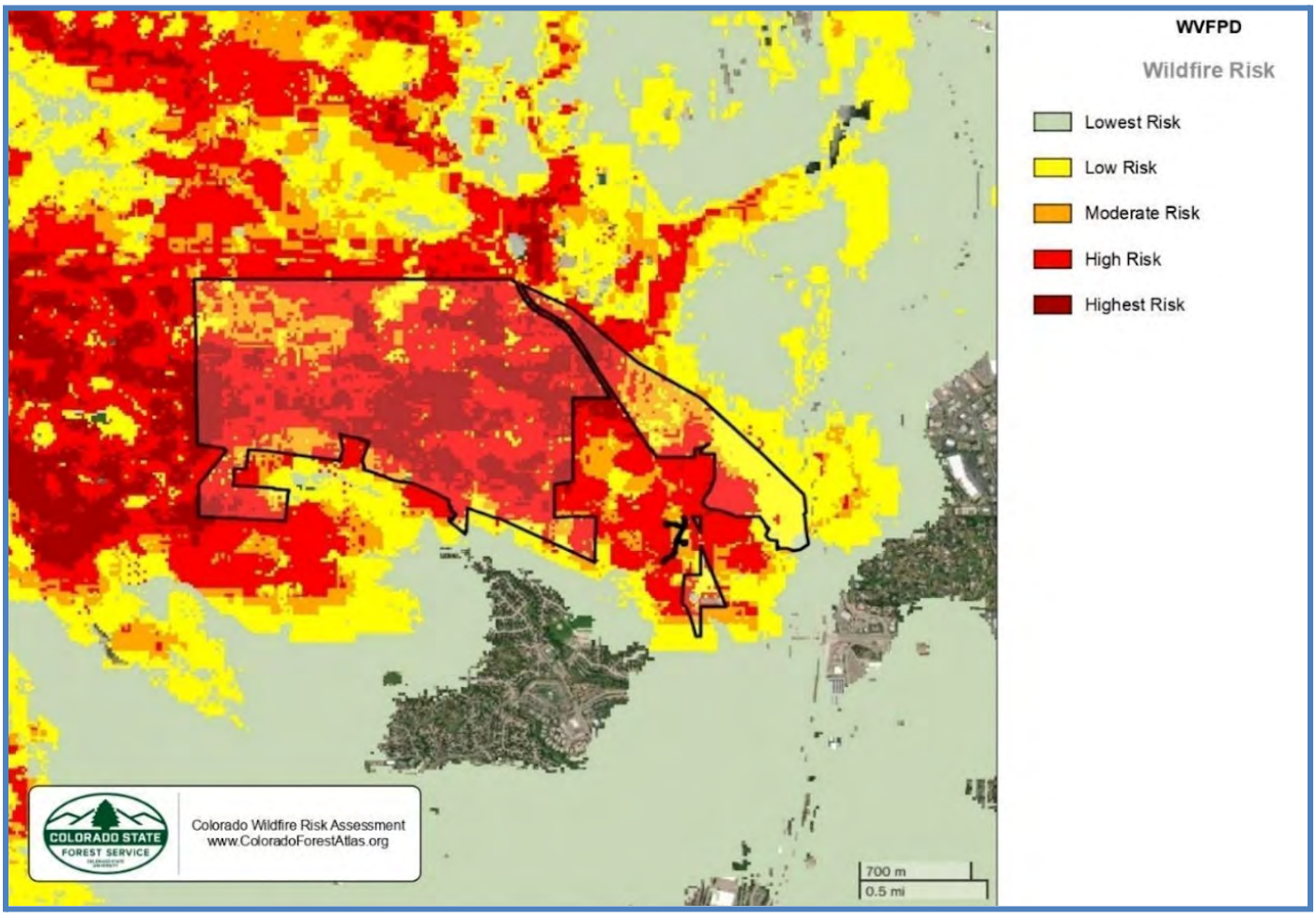


Figure 9. Wildfire Risk to the District. (Co. Forest Atlas)

FUELS

Fuels found in the District are shown in *Figure 10*.

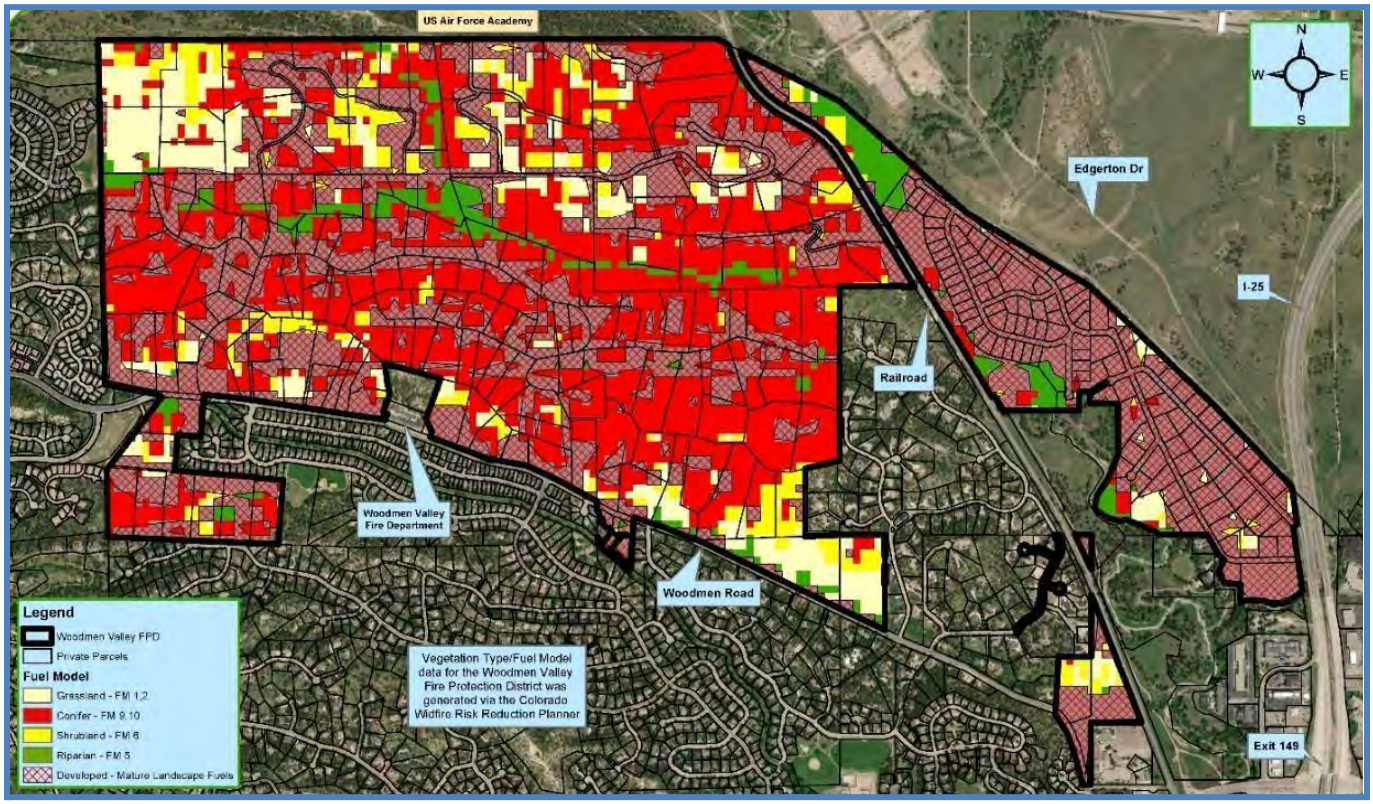


Figure 10. District Fuels

MIXED CONIFER

Vegetation in the study area is dominated by second-growth ponderosa pine, mixed-conifer forests with a high percentage of closed crowns, and dense pine, Douglas-fir or Gambel oak understory shown in ***Figure 10***. Managed fuels are shown in ***Figure 11***. Fuel models for this timber type are:

- FBO Fuel Models **1 and 9**[1]
- NFDRS Models **U** and **L**[2]

Figure 11. Mixed conifer with ladder fuels and a closed forest canopy. A fire in these conditions would be intense and kill every tree.

[1] *Aids to Determining Fuel Models For Estimating Fire Behavior*, Hal E. Anderson, USDA Forest Service General Technical Report INT-122, April 1982.

[2] *Gaining an Understanding of the National Fire Danger Rating System (NFDRS)*, PMS 932/NFES 2665, National Wildfire Coordinating Group (NWCG), 2002.

Figure 12. Fire adapted, mixed conifer forests have ladder fuels reduced and openings in the canopy. Fires here are low intensity and stay on the ground.

GAMBEL OAK

Dense, continuous stands of Gambel oak are intermixed throughout the community. Fire intensity and fast-spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. Stands of mature shrubs, 6 or more feet tall, are typical candidates. Besides flammable foliage, dead woody material in the stands significantly contributes to the fire intensity (***Figure 12***). An example of managed fuels is shown in ***Figure 13***.

- FBO Fuel Models **4** and **7**
- NFDRS Models **B, O, D** or **Q**

Figure 13. Dense stands of Gambel oak are a severe fire hazard in the Fire District. The oak in this photograph retains its dry leaves throughout the winter contributing to the hazard.

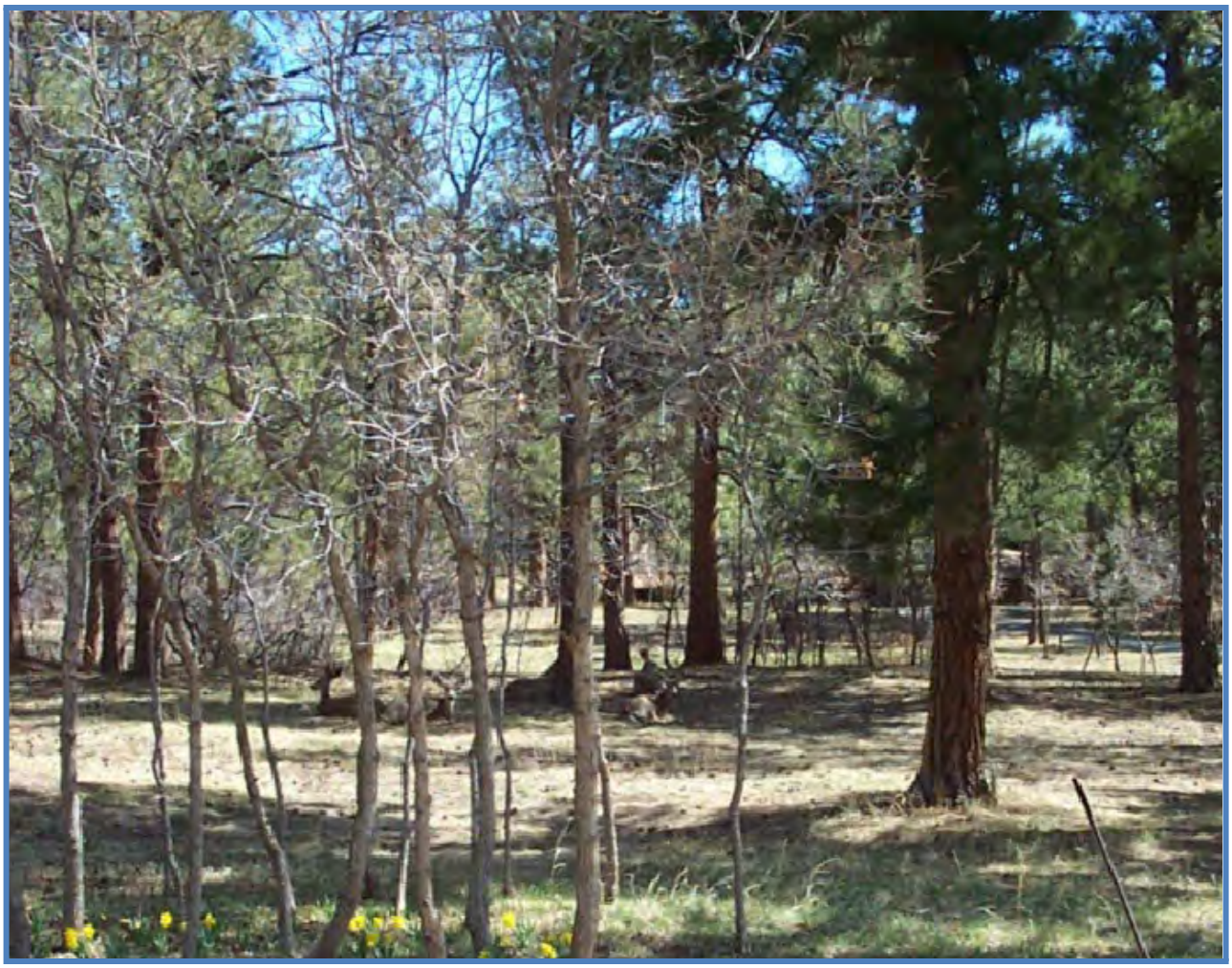


Figure 14. Well mitigated oak has clumps separated and the understory cleaned out. A fire would likely pass under this clump and stay on the ground.

NATIVE GRASSES AND MEADOWS

Much of the community is grassland represented by fuel models as shown in ***Figure 14***:

- FBO Fuel Models **1** and **2**
- NFDRS Models **A**, **C**, **L** and **T**

These fuels have high rates of spread under relatively mild weather conditions. Grass fuels frequently have intense wildfire behavior, but the danger of wildfire in this fuel type is often unrecognized by individuals conditioned to "prevent forest fires". Unmowed grass can produce high Flame lengths and high levels of radiant heat. Furthermore, wildfires in open meadows are frequently wind driven and exhibit rapid rates of spread.

Figure 15. The grass fuel surrounding this home is mowed and well mitigated. Tall grass is highly flammable, and wind driven fires move rapidly.

RIPARIAN FUELS

Riparian zones along waterways and seasonal storm channels are made up of shrub species such as willows and cottonwoods, intermixed with grass fuels shown in ***Figure 15***. These areas are of concern where they abut high density subdivisions, especially under drought conditions. Fuel models for these areas are:

- FBO Model **5**
- NFDRS Models F

Figure 16. Riparian Fuels along Monument Creek are a concern for Woodmen Valley Residents. The corridor is used as a camping area by homeless individuals and as a recreational corridor for many hikers, bikers and walkers.

Local topography further aggravates fire behavior and control. Prevailing west winds are funneled through the communities involved. Slopes range from ten to over fifty percent with most hillsides ranging from twenty to thirty percent.

DEVELOPED AND LANDSCAPE FUELS

This fuel type includes the areas around buildings where the natural vegetation is altered by residential landscaping and non-native plants. Combustible plants, such as junipers, are found around structures and in close proximity to roads. If ignited, these plants could hinder evacuation. An example of well managed landscaping is shown in ***Figure 16***.

Figure 17. District-East showing a managed mixture of native fuels and landscaping.

In District-East, it includes the yards or entire property surrounding the homes. Landscape fuels make up significant amounts of the fuel while native vegetation exists throughout the neighborhood. Some homeowners have mitigated the native fuels, while others have not. It should be noted these fuels are highly susceptible to ignition by embers blown into the neighborhood from surrounding areas.

One concern in this neighborhood is that a wildfire might spread through the riparian vegetation along Monument Creek into the neighborhoods. The creek is frequently used as a camping area by homeless individuals, and the concern of fire starts from abandoned campfires is a source of fear for the residents.

The homes in this area tend to be separated from one another by wide distances, but there is still a moderate hazard of house-to-house ignitions such as those seen in Mountain Shadows during the Waldo Canyon Fire or during the Marshall Fire.

SOIL DAMAGE AND FLASH FLOODING HAZARDS

The area, both within and beyond Woodmen Valley is dominated by erodible soils. Severe flooding after the Waldo Canyon fire indicates how wildfire within the WUI boundary would threaten the community for several years with flash flooding and erosion. Natural Resources Conservation Service Soil data shows that soils in the WUI boundary are highly susceptible to damage by wildfire (***Figure 17***)

The creek drainage extends west from Woodmen Valley to the ridge at the summit of Blodgett Peak. Steep slopes and erodible soils here present a high hazard of post wildfire flooding to Woodmen Valley. East of the Woodmen Valley East areas, Kettle Creek extends northeast to Black Forest. More rolling terrain in this watershed presents less of a threat, but there is still a possibility of flash flooding and erosion in this drainage as well.

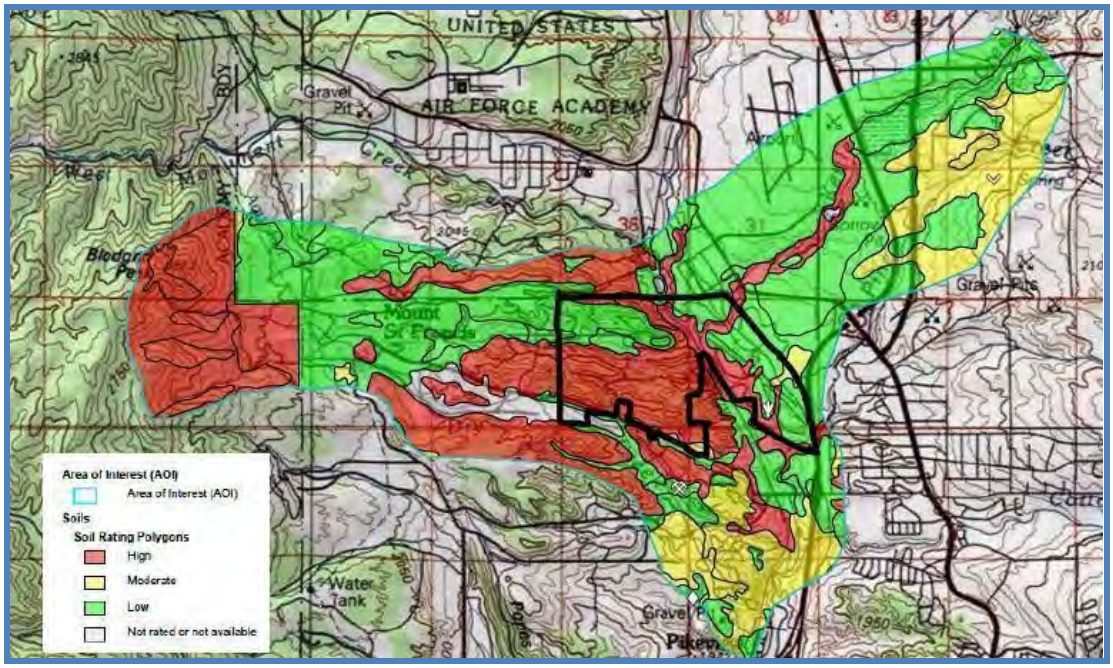


Figure 18. Potential soil damage by fire (Source: Natural Resources Conservation Service Soil Survey of El Paso County, Colorado)

V. PREPAREDNESS TO RESPOND

STRUCTURE PROTECTION AND MEDICAL SERVICES:

Structure fire, wildfire and emergency medical responses to the Woodmen Valley Fire Protection District are provided under contract by the Colorado Springs Fire Department. The closest station is located at 445 Rockrimmon Boulevard. The station is staffed 24 hours a day, and houses two engines. The first is a type one engine with a 500-gallon tank and a 1500 gallon per minute pump. Type one engines are large, designed to respond to structure fires, and are not always mobile enough for wildland fires in inaccessible terrain. Also at station 12, is a type 6 engine, a pickup truck-based brush truck designed for mobility and wildfire response. This has a 300-gallon tank with a 200 gallon per minute pump. Station 12 firefighters are experienced and trained for wildland firefighting.

The Colorado Springs Fire Department Wildfire Mitigation Section supports homeowner mitigation efforts through their community chipping program. As a recognized Firewise Site, Woodmen Valley participates in the Mitigation Section's curbside chipping program. Property evaluation and mitigation advice from the Mitigation Section are also provided to residents. These services to the community result in a high level of awareness and mitigation effort among Woodmen Valley homeowners.

EL PASO COUNTY SHERIFF'S OFFICE (EPCO-SO):

Subject to the provisions of any relevant plans or agreements, the sheriff of every county, in addition to other duties, shale act as fire warden of the sheriff's respective county and is responsible for the coordination of fire suppression efforts in case of prairie, forest or wildland fires or wildfires occurring in the unincorporated area of the county outside the boundaries of a fire department or that exceed the capabilities of the fire department to control or extinguish" CO rev stat *§* 30-10-512 (2024)..

The El Paso County Sheriff's Office (EPSO) is the law enforcement agency for El Paso County and may work with the Colorado Springs Police Department (CSPD) or other municipality law enforcement agencies as needed to facilitate emergency evacuations. EPSO also has the EPSO-Wildland Fire Unit that focuses on wildland fire mitigation efforts across the county, and wildland fire suppression should wildland fires occur in unincorporated El Paso County, or should fire districts request additional aid within the county.[EF1]

The Sheriff, by state statute, is the "Fire Warden" for unincorporated areas of El Paso County. Emergency evacuations are handled by EPCO-SO and may involve coordination with other law enforcement agencies in adjoining areas.

OTHER EMERGENCY RESOURCES:

PIKES PEAK REGIONAL OFFICE OF EMERGENCY MANAGEMENT (PPROEM):
The Pikes Peak Regional Office of Emergency Management is a comprehensive emergency management program that focuses on building resilience for the whole community through disaster coordination, preparedness, planning, and recovery activities. PPROEM activates and operates the Emergency Coordination Center during all-hazard events to support the community, resource management, operational coordination, and information sharing. The ECC Operational Plan and the PPROEM Emergency Operations Plan describes how the ECC is activated, operated, and demobilized along with partner roles and responsibilities.

MUTUAL AID AND AUTO-AID AGREEMENTS:
The Colorado Springs Fire Department, as the initial Authority Having Jurisdiction (AHJ), has long standing agreements in place to allow the Incident Commander or Emergency Manager to call on firefighting resources from outside of its jurisdiction. Outside resources may be used for fire suppression or to temporarily "backfill" the AHJ service areas.

In special circumstances, for example when high risk weather prompts a Red Flag Warning, mutual aid departments may automatically respond to a wildfire dispatch. For example, in the case of Woodmen Valley Fire Protection District, the U.S. Air Force Academy Fire Department might be called upon to assist.

PEAK ALERTS: EL PASO-TELLER 911 AUTHORITY:
The El Paso-Teller 911 Authority is the regional organization responsible for providing and maintaining the Peak Alerts emergency notification system. Incident commanders provide the area of notification to their primary dispatch agency, which then sends out the appropriate message to impacted areas. The messages may be:

- Pre-Evacuation Warning - Be Prepared to Leave
- Evacuation Order - Ordered to Evacuate Now
- Shelter-in-place - Shelter in a safe place away from doors and windows.

The Authority has contracted with Resident Connections to provide a robust database that contains landline, VoIP and mobile numbers associated with addresses in El Paso and Teller Counties. See page 12 for the El Paso-Teller 911 Authority website address.

EL PASO COUNTY DEPARTMENT OF PUBLIC WORKS (EPC DPW):
EPC-DPW is a resource for county-owned and operated special equipment such as bulldozers or road graders etc. This equipment can be utilized in the suppression of wildland fires.

VI. RISK OF IGNITION AND WILDFIRE OCCURRENCE

CAUSES OF WILDFIRE IGNITIONS

The overall risk to the community ***(Figure 19***) from wildland fire is high. This section will discuss the factors considered that led to the overall rating. The WVFPD has no authority to enforce mitigation on unwilling landowners. Therefore, it is important that homeowners in the FPD understand the risks and be able to mitigate them. Any laws requiring mitigation would be passed by either El Paso County or By the State, and would not be enforced through the Fire District.

Reconstruction of fire history and forest dynamics in the neighboring upper South Platte landscape, north and west of the community, reveal (i) an average fire interval of about fifty years during the period 1300-1880, but no major fires between 1880 and 2002; (ii) a mix of non-lethal surface fire and lethal, stand replacing fire in the historic burns (mixed severity fire regime); and (iii) a striking increase in forest density from 1900-2002.

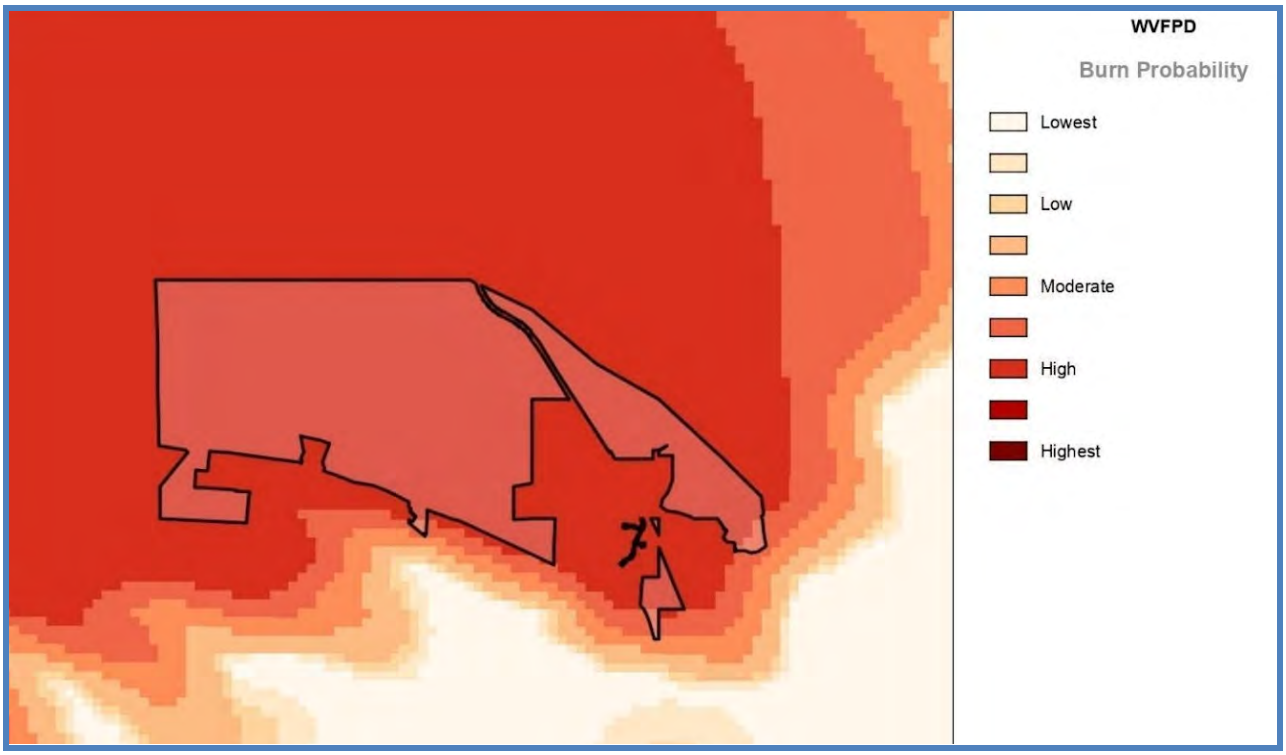


Figure 19. The Forest Atlas prediction of burn probability for Woodmen Valley and the surrounding areas shows a high risk. Wildfires are highly likely and should be taken seriously by residents.

The extent of the high-severity Hayman burn in 2002 was unprecedented in the last 700 years, in part because of the dense forest conditions that developed during the twentieth century, and in part because of the extreme drought and fire weather conditions that existed in 2002. Similar drought conditions contributed to the Waldo Canyon fire a decade later.

Low fuel moistures and relative humidity are common in the area, as are periods of high winds. When dry and windy conditions coincide, the stage is set for large wildfires. Human population is increasing in the area, and all recent large fires have been caused by humans. Except for portions of Florida, this area has some of the highest occurrence of lightning in the continental US.

Fires originating in or near communities are the most immediate concern, but fires well beyond the boundaries of the planning area can have profound effects upon the community. Rapid rates of spread and long-distance spotting are the norms for fires in the vicinity. Areas classified as high to moderate fuel loading are the most worrisome.

Sparks from trains along the railroad tracks are a concern for District residents. The CSFD notes that a significant number of fire ignitions in the area are from sparks from trains. Mitigation along the tracks is a high priority of this CWPP.

FACTORS AFFECTING HOMES IN THE WILDLAND URBAN INTERFACE:

The map below represents the Forest Atlas predicted rate of spread in WVFPD in chains per hour. A chain is 66 feet. Thus, a moderate rate of spread (4 to 12 chains per hour) would equal 264 feet to 792 feet per hour. Extreme rates of spread would equal about three quarters of a mile per hour. Thirty-four percent of the community would have a moderate to high rate of spread under the average fire weather, while 26% would have an extreme rate of spread.

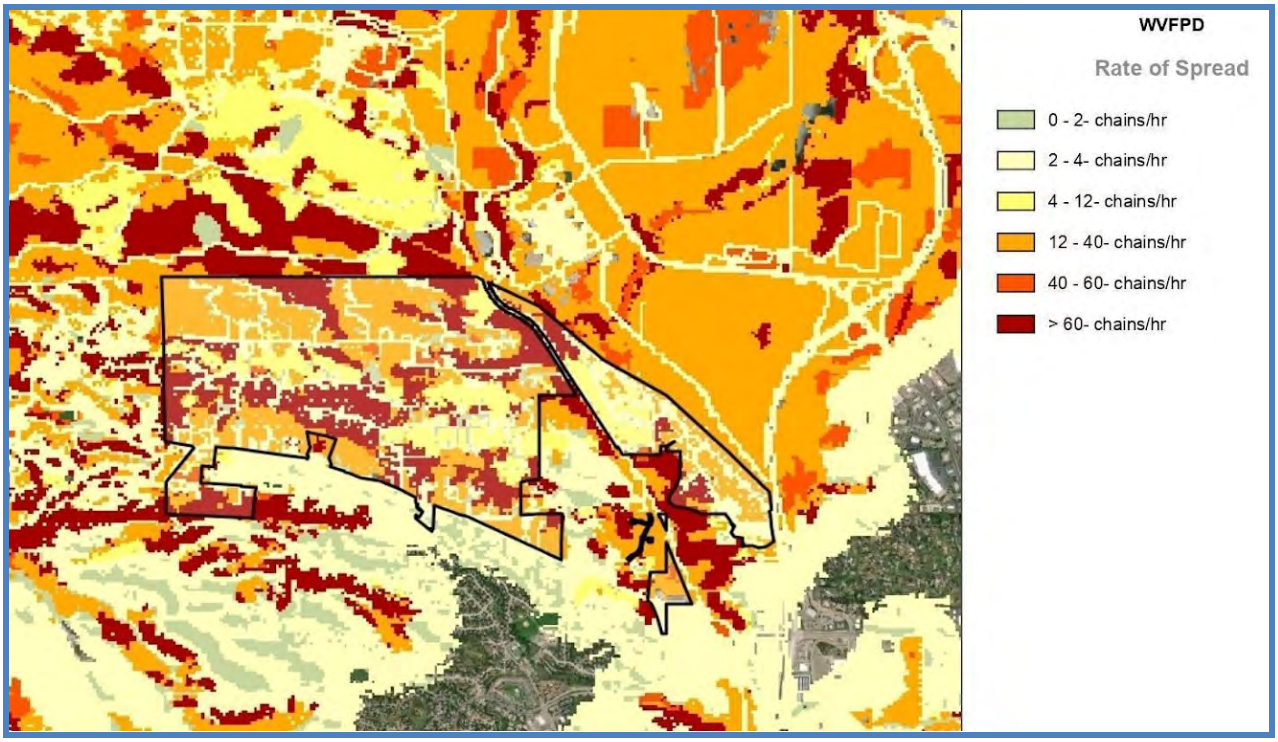


Figure 20. The Forest Atlas predicted Rate of Spread for Woodmen Valley.

Homes in the District have various risks of being destroyed by wildfire. The amount of risk depends on the homeowner's mitigation efforts, vegetative fuels, topography, weather events (***Figure 21***), and the construction of the home itself. It is important to understand these conditions and factors to make appropriate decisions about vegetative fuels reductions.

Figure 21, Fire Behavior Triangle

FACTORS DETERMINING WILDFIRE BEHAVIOR:

Fire behavior at any moment in time is dependent on three factors: weather, topography and fuels.

WEATHER:

Weather influences fire behavior as both a long term and transient phenomenon. Long term weather trends such as extended drought increase the possibility of ignition and increase the rate of fire spread.

Large plants, trees and larger shrubs recover moisture content slowly after a prolonged drought and may remain drier than normal for several years after a drought ends. Grass and herbaceous fuels may recover moisture quickly after a short rain but also lose moisture quickly after short dry periods.

The intensity and spread of wildfire are also affected by the weather conditions at the moment. For example, wind generated by a large thunderstorm 20 miles north of the Waldo Canyon Fire blew embers downslope into the Mountain Shadows neighborhood. High temperatures, low humidity, and strong winds increase the probability of ignition, wildfire intensity and rate of spread. Wind direction at any given moment is the primary determinant for the direction of fire spread.

TOPOGRAPHY:

Topography includes the degree of slope and the shape of the terrain. Hot gases rise in front of the fire along the slope face, pre-heating the vegetation above a fire. As slope increases the effect of the preheating and increased spread increases, and fires may move up to four times faster with flames twice as long as a fire on level ground.

Drainages act as chimneys that funnel heat and wind up the drainage. Homes in drainages, or at the tops of drainages, are particularly vulnerable to wildfires. The direction a slope faces, or its aspect, also influences fire behavior. South and west facing slopes tend to be drier and thus exhibit more intense fire behavior than moister east and north facing slopes.

FUELS:

The two fuel types in a WUI are vegetation and homes. Vegetative fuels consist of living and dead trees, bushes, and grass. Typically, grasses ignite more easily and burn more quickly. Fires can move quickly through grass and herbaceous vegetation, and these smaller fuels are often the kindling that moves fires to larger size fuels.

Any dead or living branches on the lower eight feet of trees or shrubs underneath trees are called ladder fuels. Ladder fuels help convert a ground fire to a crown fire (fire in the treetops) that moves faster and with more heat.

The map below predicts flame length in the District. Flame length is directly correlated with the amount of heat a fire produces. Flame lengths less than four feet can be attacked directly by hand crews, but flame lengths greater than four feet require indirect attack methods where firefighters must work a safe distance away from the flaming front. As seen in the Forest Atlas map below (***Figure 22***), four-to-twelve-foot flame lengths are expected over most of the District. Fuel modification in defensible spaces and fuel treatments is designed to reduce the amount of heat produced by a wildfire.

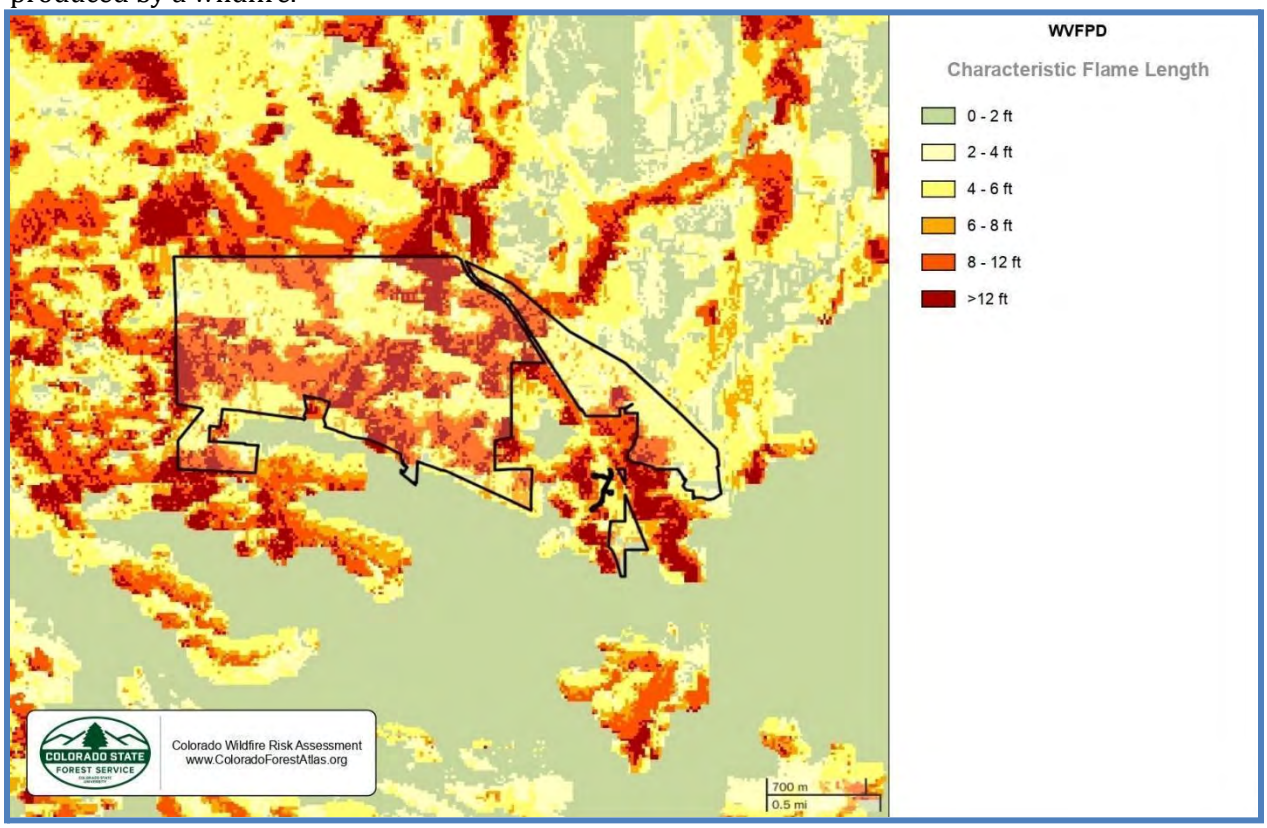


Figure 22 Characteristic Flame Length from the Colorado Forest Atlas.

Non-vegetation fuels include houses, ancillary buildings, fences, landscaping, scrap lumber and firewood piles. Structures in the WUI can be considered as additional fuel. In fact, a burning structure can ignite a wildfire, and defensible space can prevent a burning structure from spreading fire to the surrounding vegetation as well as preventing a wildfire from igniting a structure.

"Only fuels can be manipulated before a wildfire to reduce fire intensity or influence fire spread."

During wildfires, many homes are lost because of the vegetation planted around the structure. Juniper (Pfizer) shrubs planted near foundations, landscape timbers, wood mulches and wood fences are often sources of home ignitions. Landscapes should be planned with the threat of wildfire in mind.

The important point to remember here is that neither typography nor weather can be altered. Only fuels can be manipulated before a wildfire to reduce fire intensity or influence the fire spread .

VII. HOW STRUCTURES IGNITE

There are three ways that a wildfire can transfer itself from natural vegetation, or burning homes, to other homes. They are through radiation, convection, and firebrands.

RADIATION:
Wildfires can spread to a home by radiating heat in the same way a wood stove heats rooms in the wintertime. Intense radiant heat can ignite combustible materials from 100 feet away.

CONVECTION:
Direct contact with flames, or the wildfire's convective heat column—the hot air and gasses rising from the flames--may also ignite a home. This will most likely occur when trees, brush or landscaping near a structure ignite, and the flames touch a flammable part of the structure.

Figure 23. Home ignited by firebrands (embers) adjacent to unburned forests.

FIREBRANDS:
Firebrands (embers) are burning materials that detach from a fire during strong convection drafts in the burning zone. In most cases, the flame front passes quickly, but a shower of firebrands impinges on the structure for some time before and after the flame front passes. Firebrands are most often the cause of home loss (***Figure 23***). Firebrands can be carried long distances – more than a mile – by the winds associated with a wildfire. Many homes in communities are particularly vulnerable to firebrands.

A 2006 report by Traci Weaver emphasized the danger of home ignitions from embers.[3] Multiple wildfires raged across prairie and shrub land in North Central Texas from Dec. 27, 2005, to April 30, 2006. They killed 17 people, burned 1.6 million acres, and destroyed 440 homes. Many of the destroyed homes were made of brick, stone, and had metal roofs. Investigators pinpointed the main cause of home destruction to embers that fell on top of, or were blown under, wooden porches without screening. Other losses were linked to firebrands entering attic vents, eaves and soffits, or radiant heat of burning grass that ignited wood decks.

The 2002 Hayman Fire burned 138,000 acres and 132 homes in 20 days. After Hayman, the homes burned were thoroughly studied to determine the manner in which they were burned. USDA Forest Service scientists Jack Cohen and Rick Stratton reported on the causes of home destruction in the *Hayman Fire Case Study*.[4] Surprisingly, 662 homes within the perimeter of the fire were not destroyed. Many of the homes that survived did so without intervention by firefighters. The study objective was to determine if there were common factors among these surviving homes that might be helpful in preventing loss of homes in future wildfires.

They found that "torching" or intense crown fires within 30 feet of a structure destroyed 70 homes. If a house was destroyed but the surrounding trees did not burn, they assumed that embers or firebrands ignited it. Based on this logic, they concluded that 62 (47%) of the 132 homes destroyed in the Hayman Fire were ignited by surface fires or firebrands.

Cohen and Stratton found that home destruction was related more to a house and its site-specific surroundings than to the context of the larger Hayman Fire. If the vegetation around a house allowed high intensity fires to burn near them, they did not survive. If the vegetation permitted only low intensity fires, the structures had a good probability of surviving. Flammability of roofs, siding materials, and other house construction features raised or lowered the risk of flames igniting homes.

HOME CONSTRUCTION AND VULNERABILITY TO WILDFIRE:

The construction materials, location and even the shape of a structure influence its vulnerability to wildfire.[5] It is not the intent of this CWPP to suggest extensive alterations to homes that already exist in the community. Understanding how home construction affects the vulnerability of the structure to wildfire helps residents plan defensible space projects to compensate for construction differences. When remodeling or home improvement projects are done plans can be made to reduce the ignitability of the buildings.

[3] Weaver, Traci, (2006): *Texas Fires Shed New Light on What it Meant to be Firesafe.* Texas Forest Service.
[4] Graham, Russell T., (2003): *Hayman Fire Case Study.* USDA Rock Mountain Research Station, Report RMRS-CTR-114.
[5] Slack, Peter, (2000): *Firewise Construction: Design and Materials.* Colorado State Forest Service.

Decks and roofs are the most vulnerable parts of a structure. If either burns, the home will burn with it. They are most likely to catch windblown firebrands, and air currents are more likely to form eddies that trap heat and in the irregular surfaces found in roofs and decks.

Fire resistant roofs are extremely important. *Wood shake roofs have been the cause of many home losses due to firebrands.* Roof material with a class A rating indicates the best resistance to fire. Many roofing materials are available to homeowners, but they vary in cost, weight and longevity. Homeowners should consult with a reputable building contractor to determine which roofing material will best suit their needs.

Even the most fire-resistant roofs require maintenance. The most important item is to keep the roof—and gutters-- free of debris. Combustible debris such as leaves and pine needles may ignite from firebrands and start the home on fire even with a class A roof. Combustible litter is most likely to accumulate in areas where one shape meets another such as gables and dormer windows. Gutters will also accumulate debris. These same areas are most likely to accumulate firebrands because of eddies in wind currents during a wildfire. Combustible debris should be removed anytime it accumulates.

During the extensive travels through the District, no homes were observed that have cedar shake roofs. Not all homes are visible from public roads, and some structures may have dangerous shake roofs

Home autopsies in burned communities show that the small ridges in metal roofs can be openings where fire brands may collect directly on the plywood sub roof and ignite the home. The holes should be plugged with caulking or a similar material. Tile roofs pose a similar hazard where open tiles allow firebrands to contact the plywood. Ends should be plugged with tiles shaped to fill the gaps called bird blockers because they are intended to prevent birds from building nests in the open spaces beneath tiles. Nest, built from dry straw and twigs, are easily ignited by embers.

The eaves (the extension of the roof over the outside wall) are also vulnerable areas. Open eaves, with the roof joists exposed, are particularly vulnerable because the irregular surfaces can trap hot gases and fire brands. Enclosure of exposed eaves (called a soffit) helps prevent this. It is best to construct soffits so that the lower edge of the soffit meets the wall at a 90^{o} angle. This reduces the amount of heated air and fire brands that might be trapped.

Vents, in roofs and foundations, are also areas of vulnerability, but are necessary to ventilate attics and crawl spaces to prevent moisture accumulation. During a wildfire, heated gasses and firebrands can enter attics or crawl spaces through vents. All vents should be screened with metal screening with openings of 1/8 inch or less. Soffit vents should be located as close to the edge of the eve as possible. Vegetation around foundation vents can create unintended vulnerability, particularly on the downhill side. Landscaping with noncombustible mulch within three to five feet of the foundation and underneath decks or porches is essential.

Second only to the roof, decks are extremely vulnerable to fire. The surface is exposed to fire brands and fire brands can collect underneath decks. The worst mistake a homeowner can make is to store combustible material beneath a deck. Countless homes have been lost because of firewood, scrap lumber, even gasoline stored beneath a deck.

Ideally the underside of decks should be enclosed with non-combustible material. If that is not possible, covering the area under a deck with stone, concrete or rock mulch will make the deck safer. When decks are rebuilt use fire resistant materials.

Carefully consider the landscaping in the vicinity of decks as well. Avoid planting flammable shrubs, such as junipers, anywhere near decks. Potted plants or planters on decks may also increase the hazard. Even furniture with cushions or wooden frames may ignite from firebrands. The area of defensible space should be increased near decks, especially on the downhill side.

Fire resistance of windows and doors is important. If window glass breaks, firebrands will enter the house. The most fire-resistant glass is low emissivity, tempered glass which withstands the heat of a fire for the longest period. Double pane windows last longer than single pane windows when exposed to the heat of a fire.

Window frames are also important. Metal frames offer the best protection. Vinyl frames usually do not burn but can warp when exposed to heat. Wooden frames will burn. Metal screening on the outside of windows offers additional protection, but most windows are sold with nylon screening that will melt. Solid metal shutters offer the best protection, assuming the homeowner has the opportunity to close them before evacuating.

Wooden doors are obviously able to burn during a fire. The thicker the door the more resistant it will be. Metal doors are far superior, and glass in doors is subject to the same vulnerabilities as window glass. Well maintained weather stripping in outside doors will help prevent fire brands from entering a home.

VIII. PRESCRIPTIONS FOR WILDFIRE HAZARD REDUCTION

DEFENSIBLE SPACE VS. SHADED FUELBREAKS:

In a broad sense, there are two generalized categories of mitigation. First is defensible space thinning in the Home Ignition Zone around structures to increase the chance that the structure will survive a wildfire. Second, is forest restoration away from structures to reduce severe fire behavior and give firefighters a safer place to work and possibly halt an approaching wildfire. Both approaches require thinning of the canopy and removal of ladder fuels. The approach will vary depending on the forest conditions existing in the area in question.

THE HOME IGNITION ZONE (HIZ):

Modification of vegetation around a structure to reduce fire intensity is called defensible space. The term "home ignition zone" is defined as a structure and the surrounding vegetation. A structure's vulnerability to wildfire depends on the surrounding vegetation, including landscaping, and the structure itself.

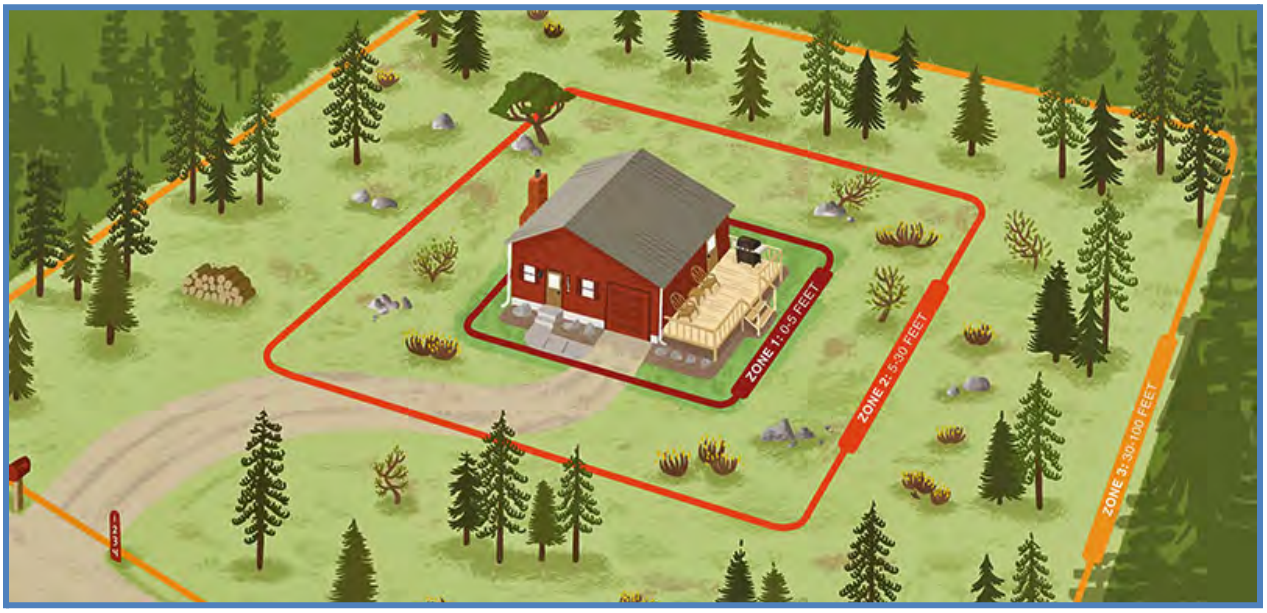


Figure 24. Diagram of the home ignition zone showing the three thinning zones and their approximate width. On slopes, each zone should be widened. Colorado State Forest Service graphic.

PROTECTING HOMES IN THE HIZ:

Thinning around homes is different from thinning for "shaded fuel breaks" (SFB). NOTE: SFBs are not clearcut zones in which all trees and brush are removed. Thinning in the HIZ is designed to protect structures from the heat of wildfires. Defensible space includes both thinning around structures to reduce the heat from burning vegetation and reducing flammability of the structures to protect them from wind born embers, radiant and convective heat. Further information about increasing the survivability of structures is found on the Colorado State Forest Service website at: Home Ignition Zone Guide

Defensible space is defined as an area around a structure where existing vegetation is modified to slow the rate and intensity of an advancing wildfire. This includes selective removal of trees around structures in two or three concentric management zones. On slopes, increase the width of each zone on the downhill side. Fuels are reduced according to prescriptions for each zone.

ZONE ONE:

This is the closest zone to a structure and extends five feet from the outermost edge of a structure including any decks. Zone one is simply a five-foot-wide noncombustible barrier that prevents even low intensity flames from contacting the structure. Bare dirt, landscape rock on a weed barrier fabric, concrete or stone make an effective barrier. Never use a combustible mulch, such as bark or rubber within five feet of the home. The barrier should also extend beneath decks.
Never plant woody shrubs in the barrier. Some herbaceous plants are acceptable, and they should be widely spaced and well irrigated during the growing season.

While it is necessary to remove combustible material in zone one within five feet of foundations and under decks, it is not necessary to do so elsewhere. Needles on the forest floor act as mulch retaining moisture in the soil, reduce erosion, and add organic matter to the soil as they decay. If regeneration of new trees is an objective, however, it is desirable to expose some bare soil since this will promote seed germination and establishment. *Raking up pine needles is not a substitute for thinning and ladder fuel removal.*

ZONE TWO:

The width of zone two depends on the slope around the house. If the average slope angle is less than 5%, zone two extends 30 from zone one. As slopes increase, increase the width of zone two on the downhill side of the house, and increase the spacing between tree crowns. The management goal is to create space between tree crowns and eliminate ladder fuels or shrubs within this zone so that the convective heat will not ignite the structure.

The main fuels reduction guideline for zone two is to thin the trees to an average spacing of 10-feet crown separation. This is the distance from one tree dripline (outer extent of tree branches from the trunk) to another. Clumps of two or three trees may be retained in this zone if the space between the clump and the adjoining trees is at least 30 feet. All ladder fuels under trees should be removed. The branches of large trees should be pruned to a height of 8 feet above ground, but small trees should have at least two-thirds of the green needles remaining.

Small clumps of shrubs are acceptable in zone two if they are at least ten feet from the dripline of trees. Clumps should be no wider than 2.5 times the height of the clump at maturity.

Tall, cured grass can burn even in the winter months. Grass in this zone should be mowed to four inches as needed. Mowing in late fall is also important so that dry grass does not remain through the winter and next spring. Dry grass can ignite from sparks thrown by mowers hitting rocks or by contacting the hot muffler of the mower. Mow grass early in the morning or when humidity is high.

Firefighters must be able to escape quickly if conditions suddenly deteriorate. Zone two should extend along both sides of driveways for a width of 30 feet from each edge of the drive. This is important to allow safe access and egress for emergency vehicles. Adequate clearance should be maintained to allow access for fire trucks or ambulances. Twelve feet of horizontal clearance and 13 feet of vertical clearance should be maintained. At the end of driveways, adequate room for a large fire engine to turn around should be maintained.

ZONE THREE:
The guideline for zone three is to thin the forest as in zone two, but trees can be on a closer spacing of six to ten feet. Ladder fuels should be eliminated in zone three, but mowing is not necessary.

FOREST HEALTH AND WILDFIRE MITIGATION

The true purpose of wildfire mitigation is not to simply remove fuel from the forest. Rather it is to return forests to a healthy state. Removing fuel without a basic understanding of forest health will harm the ecosystem. What follows is a short primer explaining how to mitigate wildfire hazards while creating healthy forest ecosystems.

Foresters manage trees not as individuals but in groups called stands. A stand of trees is defined as a group of trees that are similar with respect to age, species composition and other characteristics. Each stand is different from the ones nearby, and each landowner may have different objectives in addition to wildfire mitigation.

Thus, the information that follows is intended to be a general summary of the basic concepts of wildfire mitigation. It is only intended to give the reader an idea of how foresters approach the process of prescribing treatments for fire mitigation. When planning private fire hazard mitigation, an initial consultation with a forester is recommended. Specific prescriptions for any forest stand are best developed when the existing conditions of the stand and the landowner's specific objectives are known. For example, tree age must be considered (***Figure 25***).

Figure 25. The ponderosa sections in this photo illustrate how tree diameter is not a reliable indicator of age. The center section is 100 years old; section 2 is 99; section 3 is 101; section 4 is 90; section 5 is 85; section 6 is 130; section 7 is 81. ***(Sculpture by Bill Wallace. Photo by Bill Buckman, courtesy of the Black Forest Slash & Mulch Program)***

Although foresters may use many characteristics of trees to categorize them, the most common--and useful when discussing fire mitigation--is the tree's tolerance to shade. Shade tolerance means the ability of a tree to germinate and grow in the shade of other trees. Species of trees vary in their tolerance to shade, but they can be grouped by those that require full sun for germination and those that require shade.

SHADE INTOLERANT TREES

Shade intolerant trees are those that require full sunlight to sprout and grow to maturity. Shade intolerant trees are those that colonize a site after a disturbance, such as wildfire, removes the existing trees. For this reason, ecologists call these pioneer species. Aspen, the

most shade intolerant of local species, will send up new sprouts within days after a fire destroys the old trees. Shade intolerant trees common to this area include aspen and ponderosa pine.

It follows that if the trees in a particular area grow following a disturbance, all the trees in a stand will be roughly the same age. As the trees compete for sunlight, water and nutrients, the most vigorous become the dominant trees in the new stand. The dominant tree soon outgrows its siblings, yet the weak trees remain in the understory stunted and overtopped. In shade intolerant stands, small trees are not young trees but merely suppressed.

Figure 25. Thinning from below on the Black Forest School Section. These trees were first thinned in about 1980, and dense regeneration was thinned again in 2008. Although this area was burned in the Black Forest Fire, the trees survived with no damage.

The most common shade intolerant tree in Woodmen Valley is ponderosa pine. Of all the species of trees in the local area, ponderosa is the best adapted to survive a low intensity wildfire. First, the thick bark of the tree acts as insulation from the heat of the fire. Second, as the upper branches shade the lower branches, the low branches die, and in time, are broken off. Thus, there are fewer low hanging branches to act as ladder fuels. Fires that burn in the grass and litter under a mature ponderosa rarely harm the tree.

SHADE TOLERANT TREES

Shade tolerant trees are those that will sprout from seed and grow in the shade of the existing forest canopy. Shade tolerant trees are usually found on the cooler moister north facing slopes of hillsides and in moist drainages. In fact, most shade tolerant trees require shading for the seedlings to survive. A seedling in direct sunlight will often be burned by the sun. As a result, stands of shade tolerant trees contain trees of many ages. The most common shade tolerant trees in the area are Colorado blue spruce, Engelmann spruce, Douglas-fir, and white fir.

DOUGLAS-FIR:
Typically, Douglas-fir are found on cooler north facing slopes in lower elevations and mixed with spruce in higher elevations. It is in the lower elevation ponderosa pine forests where Douglas-fir has become the most serious concern for wildfire mitigation. After a century of fire suppression in lower elevation ponderosa pine stands the canopy has closed, shading the forest floor. As a result, Douglas-fir has invaded the understory of the ponderosa stands creating dense thickets of ladder fuels.

Douglas-fir are firmly rooted trees and can be thinned much the same as ponderosa pine. In lower elevation ponderosa stands most Douglas-fir should be eliminated, especially the ladder fuels. There is an important exception to this general rule where the ponderosas are infected with dwarf mistletoe. In such situations the landowner may choose to favor the Douglas-fir since they are immune to the ponderosa pine dwarf mistletoe. Special attention should be given to providing adequate separation between the crowns of larger trees and pruning the lower branches from the Douglas-fir to reduce ladder fuels.

Where Douglas-fir is intermixed with less wind firm spruce, they can be favored to maintain forest cover. It is still important to prune the trees to remove ladder fuels.

SPRUCE:
In the District**,** Colorado blue spruce is usually a landscape tree planted by a homeowner. Spruces tend to be shallow rooted and excessive thinning of the upper canopy exposes the trees to stronger winds, causing trees to be blown down. Typically fire mitigation prescriptions for spruce require creating openings of one tenth acre or larger with clumped trees between the openings. Removal of small trees in the understory of the clumped trees reduces ladder fuel.

THINNING AND FUEL REDUCTION

Foresters use many methods of thinning depending on the specific objectives of the landowner. Fuel break thinning is most often accomplished by a process called thinning from below. Trees are usually removed or remain based on their height in the canopy.

For simplicity, trees can be divided into four levels in the forest canopy. The largest trees at the highest level of the canopy are called dominants. These are usually the most vigorous since they have the largest root systems, most leaf area and receive the most sunlight. Next are the co-dominants. These are nearly as tall as the dominants but tend to be smaller in diameter and have smaller crowns because of crowding by the larger dominants. Intermediate trees occupy the middle level of the canopy, overtopped and smaller in diameter. They are less vigorous with smaller root systems and fewer leaves as the result of shading by the taller trees. At the lowest

level of the forest canopy are the overtopped trees. These are completely shaded by the dominant, co-dominant and intermediate trees.

As noted earlier, it is a common misconception in shade intolerant stands that the diameter of a tree is an indicator of its age. Often the co-dominant and overtopped trees are as old or older than the dominants. In pure shade intolerant stands young trees are usually found in openings in the canopy and can be recognized by having a diameter proportionate to the tree height, and a conical shape. If there are truly young trees in the stand it is desirable to leave some to increase diversity. Thickets of young trees should be thinned to give adequate growing space.

Thinning from below removes all the overtopped and most of the codominant trees. It is essential when thinning for fuel reduction to remove ladder fuels and create enough openings in the forest canopy to reduce the crown fire risk. Thinning from below is desirable in fuel reduction projects because it 1) leaves the most vigorous trees on the site, 2) creates openings in the forest canopy by removing the less vigorous co-dominants, and 3) eliminates ladder fuels by removing the overtopped trees, shrubs, and pruning lower limbs of remaining trees.

GAMBEL OAK FUEL MITIGATION

Due to Gambel oak's ability to be renewed by wildfire, mechanical treatment of continuous areas of oak will be the most cost effective and least intrusive method of treatment. In this case, machinery can replicate the post-fire response of rejuvenation without the risk to surrounding structures. This process is called mastication. Objectives are:

- Interrupt the horizontal and vertical arrangement of fuels.
- Eliminate continuous oak canopies in residential areas and open spaces thereby reducing uncontrollable crown fire potential.
- Clear oak at least 30 feet from rear property lines and structures to reduce flame and heat impingement on private properties and critical infrastructure.
- Restore diversity to an unnatural and decadent ecosystem.
- Allow the healthiest oak clumps to be retained in open spaces.
- Where clumps are retained to maintain privacy or screening, ladder fuels will need to be removed and maintained regularly.
- In areas abutting critical infrastructure or residences, resprouted oak should be mowed every three years to interrupt the fire path leading to the structures.
- Shrub clump spacing should follow guidelines per CSU Publication 6.311, Managing Gambel Oak.

Figure 26. A Skid Steer with a masticating head shredding Gambel oak for one of the demonstration projects. The machine leaves shredded oak on the forest floor that breaks down and becomes nearly unnoticeable in a couple of years.

During the post-fire assessment for Waldo Canyon, it was observed that when crowning fire reached the masticated oak, the fire dropped to the surface where fire suppression resources could begin containment. Most importantly, the resprouted oak did not carry fire (contribute to fire spread). Treatment had occurred 2-3 years prior to the fire and vigorous oak sprouting, 18- 24 inches tall, was present. Oak leaves were scorched 20-30 feet into the treated area but were unaffected beyond the scorched zone. And during drought conditions!

A Colorado Springs Fire Department official who had implemented the project also noted that aerial resources were able to differentiate this area from the air and use it for initial water and slurry drops. Thus, buying time for other resources to arrive.

The following are additional specifications for Gambel oak treatment on open spaces:

ZONE ONE WITHIN 30 FEET OF PROPERTY LINES:

1. Remove oak clumps wherever possible when oak clumps are present beyond 30 feet.
2. The preferred method of treatment is by use of skid-steer mounted mastication attachments. When properly masticated, no hard oak stubs (stumps) will be present, and the area will be drivable with rubber-tired maintenance equipment.
3. Cut materials should be processed by the masticator into mulch sized pieces no longer than 1 foot in length. All wood and leaf debris should be in contact with the ground surface.

4. If cut using chainsaws, all stumps should be lower than 2 inches high and cut flat to allow for future maintenance equipment access. Tall or angled stumps will pose a trip hazard and risk of tire punctures.
5. Any "duff" layer (natural humus layer comprised of decaying leaves) should be left in place. If it is determined by the project supervisor that too much organic matter is present, the top layer of loose leaves can be removed using a leaf blower. This will allow minimal disturbance to the duff layer.
6. If an oak clump is retained in this zone:
    a. All ladder fuels should be removed from the clump understory. This includes overtopped live stems within the clump.
    b. The duff layer is to be left in place.
    c. The canopy of the clump is to be kept intact to retain complete shading of the ground surface.
    d. Dead stems and dead upper branches or tops should be removed. However, if the remaining live trunk has evidence of significant internal decay that will not support future branch growth, the stem should be removed.
    e. If more than 50% of the stems in the clump are dead, the clump should be considered for removal.
    f. Oak stems around the perimeter of the clump that lean less than 60 degrees outward from vertical are vulnerable to ignition from burning grass. Such stems should be treated as ladder fuels and removed.
    g. Other shrub species, like chokecherry, currant, hawthorn, and snowberry, are typically present within oak clumps. These species are less combustible and can be retained within the clumps if all dead stems are removed and lower branches are pruned.
7. Clump management for wildfire hazard reduction can be summarized as removal of the dead, dying, diseased and deranged stems (aka the 4 Ds of Pruning):
    a. Dead including tops and stems.
    b. Dying includes overtopped stems that will die due to lack of sunlight.
    c. Diseases include areas with oak bullet gall, witches' broom or visible stem decay.
    d. Deranged are the outer perimeter leaning stems less than 60 degrees vertical (aka ladder fuels).
8. Semi-annual mowing of grass should be done around any clumps retained in this zone. A 30-feet wide zone is recommended.

ZONE TWO WITHIN 75 FEET OF PROPERTY LINES:

1. Shrub clump spacing guidelines should begin in this zone and will apply to Gambel oak and mountain mahogany.
2. The mastication operator should be sufficiently skilled in identification of

individual shrub clumps as individual plants.

3. Smaller oak clumps will typically be removed between larger sized clumps.
4. Utilize the naturally rounded clump edges to avoid straight lines when creating openings.
5. Oak clumps, greater than the 30 feet zone, should not typically need ladder fuel treatments. However, if significant dieback occurs, these stems and tops can be removed from retained clumps and masticated or chipped. It should be noted this is more of an aesthetic issue than a fuel treatment issue.
6. Semi-annual mowing of grass and other fine fuels should be done in this zone.

ZONE THREE GREATER THAN 75 FEET FROM PROPERTY LINES:

1. Implement shrub clump spacing guidelines aggressively.
2. Prioritize removal of drought-killed clumps where possible.
3. Clump removal should appear as random as possible and avoid straight lines. If enough healthy oak clumps are present, these can be opened in a "layered" manner that limits visibility through the open space.
4. No mowing is required in this zone.

MAINTENANCE OF GAMBEL OAK FUEL TREATMENTS::

Gambel oak's response to mastication is to resprout aggressively, like the oak regrowth that occurred after the Cherokee Fire. In effect, the mastication process can be considered "mechanical fire" that renews the oak plant community. It should be remembered, in addition to managing wildfire behavior, that diversity is being restored to a decadent and unnatural plant community. The following guidelines are recommended depending on the zone and level of treatment.

ALL ZONES:

1. Re-treatment is recommended every three years. Resprouted oak is not as combustible as mature oak and allows for scheduling treatment areas on a three-year rotation. If delayed beyond three years, treatment should occur, at a minimum, within five years of initial treatment.
2. Specialized mowing equipment may be required for large areas due to irregular and rough terrain. A skid-steer, with a heavy-duty mower deck, is often required. If the area has been masticated, there are usually no stumps/stubs that will puncture tractor tires and possibly allow use of a tractor mounted Brushhog.
3. Smaller open spaces and private properties can be maintained with:
    a. Walk-behind brush mowers such as DR Mowers™ or Outback Billygoat™ mower (available for rental at Home Depot® and referred to as a Brushhog mower.). These will handle up to 1 ½ inch oak stems. Other brands of comparable mowers are available.
    b. Weed eaters equipped with a saw or brush blade will manage oak sprouts up to ¾ inch thick. Professional models can be equipped with blades that cut

up to 3- inch oak stems.

c. Caution: Cutting oak sprouts with a chainsaw can be hazardous. These stems are too flexible and do not cut cleanly and pose a risk of saw kickback or saw blade binding or the chain coming off the bar.
d. #1 homeowner recommended tool for sucker pruning: Battery powered reciprocating saw. No kickback, narrow blades fit into tight spaces, no sharpening, and blades are cheap enough to stick in the dirt and cut off stems below ground level.
e. If homeowners have an opportunity to take the "Extreme Gardening" class, they will see more basic tools such as pruners, loppers, pole saws, hand saws, etc. and learn about the appropriate "personal protective equipment" (PPE).

4. Climatic events will continue to have an impact on the health and aesthetics of Gambel oak.
    a. Drought dieback- Remove dead stems, tops and clumps as part of the three-year maintenance program in Zones 1 and 2. It should be remembered that this is occurring within a fuel treatment area that factors in both live and dead fuels. If horizontal and vertical fuel arrangements are maintained, no immediate action is required. If within Zone 3, only remove entire clumps that have died.
    b. Snowstorm damage- Wet fall and spring snows will continue to damage mature, decaying stems. These can interrupt the horizontal and vertical fuel arrangement and should be cleaned up (removed) if in Zones 1 and 2. Cleanup should be done by mid-summer following the event. If in Zone 3, cleanup can occur as part of the three-year retreatment.
    c. Defoliating insects- Periodic outbreaks of defoliating insects occur given optimal spring conditions for their survival. Typically, defoliation occurs in the spring with minimal impact on the oak. Leaves resprout quickly and no action is required. While alarming, no pesticide controls are recommended. If within Zones 1 or 2, the abutting owner can provide supplemental watering to hasten leaf regrowth. NOTE: These outbreaks are a boon to bluebirds and robins during the nesting season.
5. Noxious weed control- Treated areas will be prone to noxious weed invasion due to soil disturbance. Spot treatments may be required to keep these in check. Broadcast application of herbicides will not be possible due to their impacts on Gambel oak. If control is desired, the public or special district ownership may qualify for biological control agents through the Colorado Department of Agriculture's Palisade Insectary program.

CONIFER FORESTS WITH GAMBEL OAK OVERSTORY:

Gambel Oak is a "full sun" loving plant that grows best in open areas with no tree overstory. This can be problematic in thinned or opened conifer stands with an oak understory. Oak that was

previously shaded and suppressed will begin to accelerate its growth rate resulting in a potentially worse fuel loading and vertical fuel arrangement.

This phenomenon was observed over the course of 25+ years when ponderosa pine stands were thinned in 1982-1983. The oak understory was not treated at the time of thinning. And by 2006, Gambel oak "released" by the overstory removal became the dominant fuel. This was prior to the introduction of mastication treatments.

Ideally, prescribed fire should have been used, post-harvest, to keep oak in check. With second growth, high canopy forests, this is a practical option. However, if prescribed fire is not possible, as in this case, then regular mowing or herbicide treatment should be considered.

In forest management thinning and shaded fuel break prescriptions over the past 20 years, mastication of the oak has occurred along with conifer thinning. After 10-15 years, post treatment, the oak has begun to form continuous fuels again. It is not known if or when this will become a fire suppression issue. And a second mastication process is required. Land managers should plan on retreatment at 15-20 years if no maintenance (mowing, herbicide, goats, etc.) has occurred.

The renewed oak is technically within the time frame for periodic renewing fires and affords the opportunity to retain more of the oak plant community that is in locations where vertical fuel separation from the overhead forest canopy can be maintained.

It is only recently that masticators were required to retreat shaded fuel breaks on several of the author's managed properties. Oak was retreated to: 1) remove fuels under and ten feet beyond conifer driplines; 2) restore shrub clump separation but retaining renewed clumps in openings; and 3) remove dead, dying, decadent and drought impacted clumps previously retained at "Shaded Fuel Break" implementation. Retreatment costs were less than one-half of the original treatment costs since only oak was being treated, and conifer tree crown closure had not occurred.

Some rules of thumb to consider are:

- If the overhead canopy is opened, the oak should be treated as a ladder fuel and managed accordingly to interrupt both horizontal and vertical fuel continuity.
- Retain as many renewed oak clumps as possible to allow for diversity and recreation of a mosaic of different oak age classes.
- In the absence of managed fire, mechanical fire (mastication) will be required.
- Wildlife cover, edge and browse should be part of any prescription. Again, it is about restoring diversity and a multi-layered ecosystem currently absent in a monochromatic and declining landscape.
- Favor other shrub species when present. Chokecherry, wild plum, serviceberry, currants, hawthorn, wild rose, snowberry and other wildlife food sources are essential parts of ecosystem restoration.

- Retain some mature clumps large enough to become nesting and resting sites. Even in decline, these are part of restoring diversity.
- In nature small differences in location, north vs. south facing slopes, for example, can have different growing conditions. Take advantage of these micro-sites when restoring diversity.
- Do not be afraid of experimenting if the wildfire mitigation objectives are met.
- Be prepared for harsh criticism upon completion of any mastication project. It is a radical change (harsh) for WUI dwellers but often softened within one growing season when they see wildlife flocking to treated areas.

TIMING FOR MAINTENANCE:

Timing will depend on where the oak is located in relation to structures. For example, fall is usually the best time to re-mow Gambel oak in open spaces and zones beyond a structure's defensible space and within the HIZ. Fall mowing, from this practitioner's experience can:

1. Sprouts (suckers) have completed their full seasonal growth and minimize any late summer regrowth.
2. Fall mowing removes both leaves and stems that might carry fire given that fire season is now year-round.
3. Gambel oak sprouts later in the spring after cool season grasses and wildflowers have already begun to grow. These plants can, over time, help suppress Gambel oak resprouting resulting in restoration of meadows and plant diversity. NOTE: This restoration process can be accelerated by two to three years of annual oak mowing.

Oak clumps and sprouts within 30 to 70 feet of structures should be kept maintained to a higher level per recommendations for all plants within this zone:

1. Regular mowing or weed eater use can begin to slow down plant recovery. This is especially effective where meadow grasses become established. Usually, three annual mowings are necessary. The author's theory is that cool season grasses begin growing ahead of oak sprouting, thus cooling the soil surface enough to slow oak's fire adapted response of resprouting after wildfires burn off all vegetation. The post-Cherokee Fire photos show how quickly exposed soils allow aggressive resprouting.
2. Maintain a closed canopy in the clump to reduce suckering within clumps. Similar to the practice above, if the soil is kept cool and shaded, less suckering occurs. The exception to this is along the exposed southern edges of managed oak clumps that receive more full sun. Note: Auxins produced in the apical meristems naturally inhibit most suckering. If oak clumps are "topped" (top canopy removed), suckering and stem "water sprout" growth will be aggressive.
3. Ripping it out of the Ground. Some property owners hate Gambel oak enough to literally rip it out of the ground. Thus, removing the entire root system. And with great success. Entire properties can become oak free using tractors, ATVs and shovels/grub hoes, etc. An exception is the guy who tore off the

bumper of his pickup.

SLASH TREATMENTS:

Slash treatments will always be needed to clean up the residue from any forest thinning treatment. Untreated slash will only increase the fire hazard, possibly undoing all the good of thinning. It can also attract undesirable insects to the area—primarily ips beetles and turpentine beetles. Slash treatment may be the most labor intensive, and thus expensive, part of any fuel mitigation project.

LOP AND SCATTER:
This treatment consists of using saws or equipment to cut the slash into smaller pieces so that the height of the remaining slash is reduced, usually less than 12 inches high by 24 inches long. It may be the only practical treatment in areas where chippers are unavailable, prohibitively expensive, or in inaccessible locations. It is usually the lowest cost treatment since no special equipment, other than a chainsaw, is required.

The treated slash is left to decompose, and until it breaks down it will be unsightly. Over the course of several winters, snowpack pushes the slash down and it decomposes. Decomposition usually requires three to five years or longer if larger material was present. It also creates an extremely flammable fuel bed until it decomposes, which can be easily ignited, and burns with high intensities. It should not be used adjacent to high values, such as homes, or areas prone to regular fire occurrence.

Lopped and scattered slash can also lead to problems with ips or turpentine beetles. The beatles may lay eggs in green slash and the brood may emerge to attack living trees. This problem can be alleviated by doing any forest restoration treatments requiring this method in the fall and winter when the beetles are not active and by cutting slash into small pieces that dry out quickly.

CHIPPING AND MASTICATION:
Chipping is the grinding up of the slash into small pieces, usually less than a few inches in diameter. Material can be chipped and left or removed for off-site disposal or as a product. Mastication leaves all material on the site.

It requires mechanized equipment to perform the chipping. The slash must be brought to the chipper, unless it is an expensive mobile chipping piece of equipment. Either way, it can quickly become a very expensive operation.

Chipping is a common method of slash disposal in the defensible zones around structures. Chips do not significantly contribute to fire hazards around structures since they produce low intensity fire behavior. Large piles of chips should be avoided as they could smolder for a significant amount of time, however. Chips should be spread along the ground to a depth of less than four inches.

Chipping is an effective means of treating wood infested with bark beetles since the insects will not survive in the small bits of wood. Green slash that is promptly chipped will not harbor infestations of ips, turpentine, or other bark beetles. Chips also can pull nitrogen out of the soil, reducing the productivity of the ground.

COMMUNITY CHIPPING PROJECTS:
Woodmen Valley homeowners are enthusiastic participants in the Colorado Springs Fire Department's Neighborhood by chipping program. Landowners are quite willing to undertake the effort of thinning trees if there is a simple low-cost way to remove the slash.

MAINTENANCE

Survivable space, fuel break thinning, or any type of forest management does not end when the initial project is finished. Continual maintenance is an essential part of any forest management program. Even in well managed forests trees will die, storms and wind will damage trees, and new trees will germinate.

Trees should be inspected every spring for any sign of damage from winter or spring snow or wind. Prune any broken branches if they are not too high in the tree, and trees bent by heavy winter snow should be removed. Check for any signs of insect activity or disease.

Late October is the best time to inspect trees for attack by mountain pine beetles. Beetles have finished attacking trees at this time, and there is adequate time to cut and treat the tree before the adult beetles fly the next July.

At five years check the canopy closure, especially in zones one and two. Remove any trees necessary to maintain openings in the canopy. Do any additional pruning or removal of trees and shrubs to eliminate ladder fuels.

After ten years, dense thickets of young trees (regeneration) may have become established, and these will need to be thinned. Not all regeneration should be cut since trees of various ages are important for forest diversity. Young trees in openings with adequate room to grow should remain. Regeneration that is likely to become ladder fuel or crowded by other trees should be cut. Depending on their objectives, landowners may want to consider removing some of the larger trees to make room for the younger ones.

POST FIRE REMEDIATION:
In the event wildland fire should burn significant acres above or in the Fire District, Woodmen Valley FPD In cooperation with Colorado Springs and El Paso County will need to immediately direct efforts to reclaim or stabilize areas above homes. Burned areas will be prone to mudslides, debris flows and/or rock fall hazards. These can have an impact on surviving residences and the District road network. The denuding of slopes may release sediments and ash into existing drainage ways resulting in clogged culverts and overtopping of roadways by storm flows. If flows are heavy and concentrated enough, road surfaces can be washed away. An alert system similar to that used in the Hayman Fire Burn area may be required to warn residents of impending storms that have the potential to cause severe run-off. El Paso County The Monument FPD should be prepared to:

1. Immediately retain the services of an engineer or geologist to assess potential storm and debris flows after a wildfire of significant size.

2. Establish a stand-by contractor list of licensed and insured heavy equipment operators for clearing of roads, cleaning of culverts and construction of potential diversions or road repairs. This should be coordinated through El Paso County DOT.
3. Hire a reclamation contractor to stabilize areas above homes and critical infrastructure with a combination of temporary and permanent erosion control measures. This should be coordinated through EP Environmental Services, Natural Resource Conservation Service (NRCS) and local soil conservation district.

Post-fire issues can linger on for many years after fire occurrence. The Woodmen Valley FPD should annually assess its risks and budget accordingly for remediation.

IX. IMPLEMENTATION AND MONITORING

IMPLEMENTATION

A table in Appendix A lists mitigation projects identified, their priority rankings and the lead agency for the projects. In addition to the projects in Appendix A, home sites are rated as high or extreme wildfire hazard and are in critical need of defensible space improvements.

All roads are considered as primary evacuation routes from zones of high fuel volumes (timber) and typically lead to zones of lower fuel volumes (prairies).

Critical Infrastructure is also identified in Appendix A. This includes water and sewer systems, roadways (including bridges, culverts, storm pipes, spillways), electric, phone, natural gas and cable services. All are considered high priorities.

The following are suggested fuel treatments:

- Shaded Fuel Breaks (SFB): Major collector roads are critical for emergency evacuation. These should follow Colorado State Forest Service guidelines where possible.[6] Connection of homeowner HIZ's to SFB areas is recommended. These areas are also referred to as "Fuel Treatment Zones" (FTZ) in which tree crown separation is increased to manage crown fire behavior. SFBs should not be confused with "Fire Breaks". Fire breaks are paths, driveways or roads in which all vegetation is removed to a non-combustible surface.
- Forest Management and HIZ overlap zones (Fuel Treatment Zones): These are on private property, typically in Defensible-space Zones 2 and 3. Ladder fuels should be reduced or removed, and forests thinned to promote forest health. Where possible, the long-range goal should be the establishment of an uneven aged forest.

The map below shows suggested areas for fuel treatment zones and potential shaded fuel breaks. All locations will require cooperation between multiple owners. In some cases, cooperation of owners outside of the fire district boundaries may be required. It should be noted that all suggested fuel treatments will not just benefit individual owners. These will assist with fire containment and control across multiple ownerships and neighborhoods given that wildfires do not respect property lines. The fire district and its constituents must understand the justification for district and grant funded projects on private properties. Especially if necessary to protect the community.

KEY INTERSECTIONS:
Road intersections will be critical during a wildfire for:

- Safe egress of residents during evacuation.

[6] Fuel Break Guidelines for Forested Subdivisions and Communities. Frank C. Dennis, Colorado State Forest Service.

- Residents may be required to wait at intersections temporarily while evacuation is staged from areas of greatest wildfire threat.
- Safe ingress of emergency services.

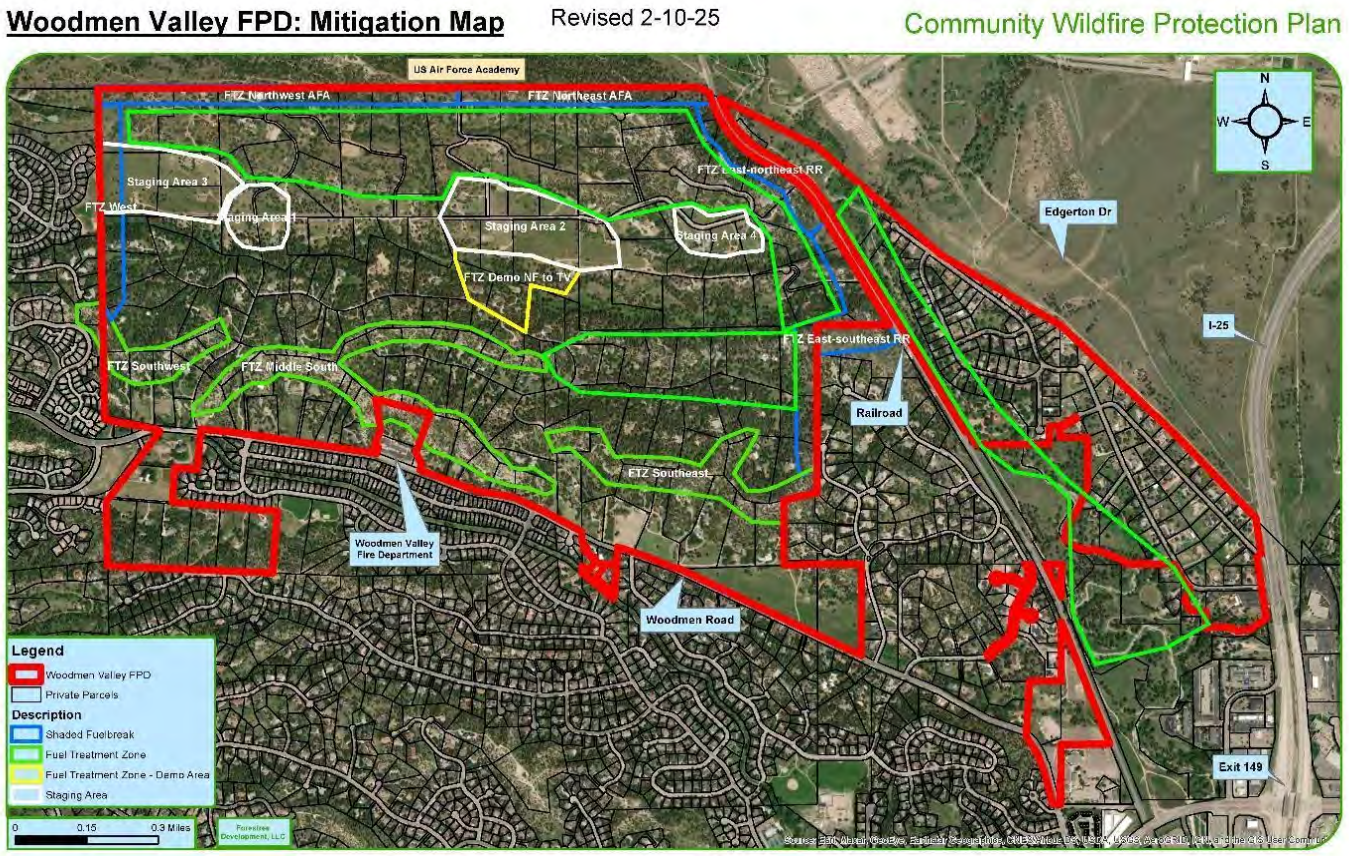


Figure 27. Mitigation units in the Woodmen Valley FPD

- Staging of fire apparatus and other equipment
- Safe staging by law enforcement personnel who may be directing traffic.
- Dead end roads must be marked with adequate signage.
- Establish turnarounds large enough to accommodate a type one engine at dead end roads.

Figure 28. Fire and smoke impinging on right-of-way during the Black Forest Fire.

POTENTIAL COMPARTMENTS AND SUB COMPARTMENTS:

The fire district has the potential to be divided into compartments to either contain or exclude wildfire. The District's future planning and implementation, using the **Mitigation Map** above, can be used to develop compartments, in partnership with USAFA and surrounding neighborhoods. Then continue to break these down into "sub-compartments" at a neighborhood scale. The objective is to create zones of both fire adapted ecosystems and structurally hardened homes.

Coordination with CSFD, USAFA and EPCO fire management staff may be required to develop cross-boundary projects that benefit all ownerships. These types of projects will typically score higher when competing for grant funding.

Shaded fuel breaks and fuel treatment zones, using natural and manmade barriers to wildfire such as roads, rock formations, lakes and ponds, riparian areas and zones of low fuel volumes, should eventually be connected to each other. These should be revisited to identify any gaps containing heavy fuel volumes that may allow wildfire to jump from one compartment to another. Once implementation is completed, neighborhood scale areas should be prioritized to connect home ignition zones that meet the definition of Firewise; meaning homes stand a good chance of survival with minimal intervention of the fire services.

Note: Compartment and sub-compartment lines are not shown in the plan. These will be dependent on property owners working together to potentially create their own compartments. Again, these are intended to allow containment or exclusion of wildfire. If implemented with professional guidance, these can be an effective way to manage wildfire behavior.

MONITORING:
Monitoring is an important part of follow-up to the implementation of projects. The Healthy Forest Restoration Act instructs participants to establish, where interest is expressed by the communities, a collaborative multi-party monitoring process. This process should address reporting of accomplishments, need for maintenance of treated areas, tracking of burned areas and the positive and negative ecological and social effects of the projects. This can be incorporated into the annual reporting, and/or become a budget line item as an annual reminder to the entire community. In-kind tracking will be one way to gauge levels of participation.

Monitoring of the WVFPD CWPP calls for an annual field review by the partners (participants) of accomplishments and need for maintenance. Based on this review, needed adjustments in the next year's plan should be made, as appropriate.

RESIDENTIAL COMMUNITY ACTION PLAN:

During the CWPP process, the following actions were suggested:

- Develop a community evacuation map for distribution to all residents and send it to all residents.
- Maintain current evacuation route signs at critical exits from neighborhoods.
- Develop a template for installation and maintenance of community street signs, and mail kiosks to prevent damage by wildfire. All private road signage should be reflective and visible from all directions of travel.[7]
- Provide reflective address markers at entry points of shared driveways, to assist firefighters and deputies with door-to-door evacuation notifications. Numbers should be at least four inches high, noncombustible, and mounted on a metal post. NOTE: WVFPD has implemented this program with an estimated 80% participation rate.
- Private roads and shared driveways should use metal culverts. Corrugated plastic or PVC culverts are combustible and can burn underneath an egress route. This could lead to civilian or firefighter entrapment. NOTE: An exception to this can be considered if fire rated material is used. A minimum of "B" fire rating is recommended.
- Coordinate with Colorado Springs, USAFA and Colorado State Forest Service and/or adjacent landowners on identification and implementation of joint fuel treatment projects along boundaries, open spaces and roads.
- Coordinate with abutting property owners to allow for the thinning of trees and/or removal of ladder fuels within and adjacent to rights-of-way, to reduce fire starts along roads and enhance the fire containment qualities of the roadway.

[7] It is recommended to follow Manual of Uniform Traffic Control Devices (MUTCD) requirements for all street signs.

- Implement at least two examples of fuel treatments or forestry projects on private lots or Colorado Springs created HOA open spaces.
- For subdivisions with private roads, develop an overall drainage map showing locations of culverts and major drainage swales that might be impacted by post-fire sediment runoff. Erosion control contractors should be contacted to obtain pricing for post-fire mitigation.

Implement an educational program, in cooperation with Colorado Springs Utilities (CSU), Comcast, StratusIQ fiber t and Centurylink for all above ground utilities. Vegetation and fencing placed around utilities should be avoided to prevent damage by wildfire. The same should apply to large residential propane tanks.[8]

- Establish community guidelines for Firewise construction in cooperation with the Regional Building Authority to include Firewise landscaping, and forestry practices, including disposal of woody debris within the community.
- Continue the slash chipping program to allow both initial residential mitigation and necessary maintenance of defensible spaces and home ignition zones.
- Where roads are too narrow to allow passing traffic, work with adjoining landowners to develop turn out at critical choke points.

MAINTENANCE:
The following are actions homeowners can incorporate into routine yard work to manage wildfire risks. These are broken down into categories that allow for seasonal activities.

Seasonal

- Mowing:
    - Roadsides and roadside ditches- Monthly or as warranted by fire danger.
    - Re-inspect all intersection sight distances for cleared sight triangles.
    - Clear all grasses and fine fuels 3-5 feet from around street signs, light poles and mailbox kiosks using weed eaters or non-selective herbicides.
    - Open Spaces along evacuation routes – Mow roadsides once per year.
        - One mowing midsummer after wildflower bloom and before grass curing (browning).
        - If last summer rains result in significant grass regrowth, a second mowing may be necessary in the fall after grass curing (to reduce wildfire rate of spread during fall/winter fire season, and allow new, green re-growth in the spring).
    - Spring cleanup to remove all dead materials (twigs, leaves, needles, etc.).
    - Remove storm damaged trees and branches.
    - Mid-summer re-inspection to again remove fine fuels within 5-10 feet of all combustible materials.

[8] Propane tanks are susceptible to "boiling liquid expanding vapor explosion" (BLEVE). Older tanks may not be equipped with proper venting devices and more prone to BLEVE that may pose a risk to firefighters. Property owners should contact their propane provider to ensure updated tank protections are in place.

    - Once masticated, Gambel oak resprouts prolifically, and needs to be mowed at least every three years. There are mowers available from equipment rental businesses that will mow the sprouts. Mowing cand be done as an individual project by homeowners or as a community project among neighbors. Many homeowners find that frequent (several times a summer) mowing of young sprouts with a weed eater is the easiest way to control sprouting.
- Education/Awareness:
    - Spring alerts/mailings for:
        - Emergency notification system signups and updates.
        - Family evacuation plans.
        - Home inventories.
        - Home assessments by local fire agencies.
    - Early to mid-Summer:
        - Firewise classes with emphasis on structural ignitability and forest health.
- Community Implementation Activities:
    - Annual/seasonal slash disposal program is currently in place with CSFD.
        - One of the largest expenses of a project is the cost of moving equipment in and out. When neighbors work together to schedule projects at the same time, the costs are substantially reduced. Coordinate/facilitate property-to-property (neighborhood) fuel treatment projects.
        - Obtain bids from contractors for multiple and/or adjoining properties to lower prices/quotes (wholesale vs. retail rates.).
        - Conduct “Masticator Days” for mechanical treatments at a lower rate and to avoid contractor mobilization fees and project minimum prices. The Treatment projects along the creek bed and along roads in Woodmen West are examples of bundling properties to reduce costs.

Annual

- Renew Firewise Community status:
    - Firewise Day, meeting or special event.
- Coordinate cross-training between all committees (Parks and Open Space and Fire Mitigation, etc.)
- Update annual operating agreements with local fire agencies for emergency use of common areas and water supplies.
- Continue to encourage neighboring property owners to implement lot-to-lot mitigation projects that enhance all home ignition zones (HIZ).
- Review operating plans to determine annual project needs:
    - Apply for grant funding as available.
- Contact all partners to update any wildfire mitigation needs related to critical infrastructure.
    - Colorado Springs Utilities- Power line clearance needs along all utility easements.
    - Utility Pole Inspection and Replacement.
    - Right-of-way mowing along public roads.

- Inspect all fuel treatment areas to identify any maintenance needs, such as dead tree removal, storm damage cleanup, or insect/disease control.
- Meet with abutting ownerships and communities to coordinate fuel treatment projects.
- Continue community wide educational programs through classes, meetings, and annual events. Topics may include:
    - Evacuation Planning.
    - Roads in Woodmen Valley are easements across private lands. Homeowners need to understand the importance of roadside mitigation and fuel reduction. Education and outreach are essential programs to develop support and participation among landowners.
    - **Peak Alerts** 911 Notification System program signup (target of 100% participation).
    - Forest Health and related topics.
    - Noxious Weed prevention and control.
    - Wildlife habitat restoration.
    - Insurance coverage for "being made whole again" in the event of home loss.
    - Neighborhood Watch, and "phone trees" (cascading phone call plan to ensure all residents are notified).
    - Special Needs Populations.
    - Evacuation Planning for Pets and Livestock.

Every Three/Five/Ten Years

- Inspect all fuel treatments for:
    - Tree crown closure in all areas
        - Shaded Fuel Breaks and D-Space Zone 2: 10 feet between crowns (20 feet between crowns of tree clumps).
        - Forest Health Thinning D-Space Zone 3: 3-5 feet between crowns and/or to allow full sun to tree crowns for optimum tree growth/health.
    - Seedling tree invasion/encroachment
        - Mow or cut seedling and sapling size trees when located within the drip line of mature trees, or not in full sun locations.
        - Where trees establish in open areas, thin out trees to promote full crown development, and reduce crowning potential. Consider removing most encroaching trees from meadows to maintain biological diversity.
        - Prune as necessary to reduce torching potential.

X. RECOMMENDATIONS

This section provides recommendations for the many stakeholders who can have an impact on wildfire and public safety.

WOODMEN VALLEY FIRE PROTECTION DISTRICT (DISTRICT)

All properties in the District are privately owned, and the responsibility of mitigation lies with the landowner. The District can assist landowners in several different ways.

- Obtain grants or other funding sources that may be administered by District for use on private lands within and abutting Woodmen Valley to meet objectives of this plan.

- Develop a Five-Year Plan as a guide to the District board of directors that should be reviewed annually. This plan should include priorities and estimated costs. Implement the Five-Year plan with an annual work plan developed during the winter to reach goals of the longer plan. The Annual Review should include:

    - Review of the past year's activities with attention to what activities went well and what were unsuccessful or can be improved.
    - Assessment of pressing hazards that need to be addressed.
    - Sources of potential grant funding and cost share opportunities over the coming year.
    - An annual operating plan to guide activities for the following year.

- Encourage the Regional Building Authority to adopt wildfire mitigation regulations for all new construction.
- Coordinate with abutting public agencies and private organizations for implementation of joint fuel treatment projects.

- Coordinate with private landowners, both in and abutting the community, for implementation of mutually beneficial fuel treatments and forest restoration projects. CSFD can provide assistance through its ongoing contacts with forest landowners. There are major landowners with forested properties in Zones 1-3 that can have an impact on Woodmen Valley. These are:

- Continue to include wildfire mitigation and maintenance as an annual line item in the District budget.

- Conduct annual "Clean Up Days" to promote wildfire mitigation, noxious weed control and junk (yard art) removal.

- Continue to promote **Peak Alerts** with a goal of 100% participation by District residents.

- Education is a powerful tool for changing behavior. District has an ongoing wildfire awareness program in place. It is imperative for the District to reach out to existing residents and organizations as an active partner for wildfire mitigation and education.

- Areas within the community with high percentages of undeveloped lots will be a challenge to abutting owners. The District should use its resources to reach out to these vacant landowners to reduce fuel volumes. Grant funding should be sought to aid in this effort.

Many of the items listed above can be incorporated into current District operations. Some may require additional financial support. The District should set a goal to meet all items within five years.

COLORADO SPRINGS UTILITIES ('CSU")

Colorado Springs Utilities is the most important agency in The District responsible for all water services. Its facilities are critical for firefighting and habitability of the community. If damaged or destroyed, evacuated residents may not be able to return to their homes until critical services are repaired. Many of the recommendations provided are inexpensive and help protect infrastructure from ember blizzards.

Examples include:

- Install a five-foot wide border of non-combustible material around all structures.
- Harden all combustible structures to prevent ember ignitions.
- Include annual maintenance of vegetative fuels as part of its routine maintenance.
- Investigate alternative funding sources for mitigation upgrades. These will fall into the category of "emergency preparedness" that may not be related to wildfire specifically.
- Identify critical infrastructure that could be affected by post-fire flooding. Facilities in or near drainage areas will be at high risk by mud and debris flows.

EL PASO COUNTY

El Paso County is the governmental entity covering unincorporated areas of the county. The following are recommended:

- County Road rights–of-ways (ROW) should be cleared and kept free of invading conifer species. Conifers, ponderosa pines, contributed significantly to fire spread and heat transfer across roadways during the Black Forest and Lower North Fork Fires. Evacuation of civilians and firefighter safety were compromised. Ditch maintenance and mowing practices are also impeded. The one exception to total tree removal is if trees are adequately spaced as part of a "shaded fuel break"[9] extending 150 feet from the ROW edge. This is a public safety issue that should be addressed as it relates to the county's charge of protection of life, safety, and welfare of its citizens.

[9] See document "*Fuel Break Guidelines for Forested Subdivisions and Communities*", Colorado State Forest Service, F. C. Dennis

- Plastic corrugated culverts are not currently allowed in public ROW due to their susceptibility to total consumption during wildfires. Several instances of firefighter safety being compromised during the wildfire have been reported. In one instance, a fire truck was stuck after a burnt-out culvert collapsed and nearly resulted in a burn-over of the engine and crew[10].

- El Paso County should not allow creation of any private open spaces or lots within any future subdivisions in or abutting the District in which the ecosystem or forest has not been restored to a fire adapted condition. Refer to the *Black Forest Fire Assessment*, and its sections "Cathedral Pines Assessment" and "State School Land Section 16 Assessment"[11] [15] as good examples to follow.

- Provide all County law enforcement and Road and Bridge personnel with Personal Protective Equipment (PPE), and entrapment avoidance training.

- Perform door-to-door evacuations, only if safe to do so, while maintaining life/safety of all first responders as the first priority.

- Consider providing NWCG wildland fire training and/or certifications for county personnel and equipment (required for use on state or federal fires).

FIRE JURISDICTIONS

Multiple challenges exist. Recommendations are:

- Continue to work toward better communication coordination. The Firefighter Survey noted poor radio communications during the Black Forest Fire that placed firefighters at risk. Communications were hampered by irregular terrain that created "shadowed" areas with little or no coverage.

- Educate elected officials and the public on the continued need for improved water supplies. At the same time, it is critical to stress that cistern water supplies are for structure protection when one structure is on fire at one time, or for containment of smaller wildfires with normal weather conditions. Extreme wildfire behavior threatens hundreds of structures at one time.

- Educate elected officials and the public on the use and limitations of aerial firefighting resources as an effective tool if property owners have managed their fuels. The public must understand that aerial resources are a valuable tool but are not a substitute for inaction by property owners.

- Continue efforts to educate WUI residents on their responsibility to manage their fuels so firefighters can work safely and effectively to protect their lives, properties, and forests.

- Continue and expand the number of home and community assessments.

[10] Black Forest Fire Assessment Report. Pikes Peak Wildfire Prevention Partners, 2014, www.ppwpp.org
[11] Black Forest Fire Assessment Report. Pikes Peak Wildfire Prevention Partners, 2014, www.ppwpp.org

RESIDENT RESPONSIBILITIES

Multiple large fires have occurred in this area, resulting in the loss of homes. Additional fires are certain to occur in the future. Residents and property owners should be put on notice that:

- Wildfire mitigation is the responsibility of the property owner who is the sole owner of his/her fuels. An Australian saying bluntly states, "You own the fuel, you own the fire." A model for homeowner responsibility is shown below.
- Secondary responsibility falls on neighbors who must work together to manage their collective wildfire risks. Property owners who do not mitigate their fuels place their neighbor's lives, homes and forests at risk.
- Thinning trees to provide good spacing between individual or groups of trees, and pruning dead and lower branches, reduces wildfire risk as well as improves forest health, vigor, growth and aesthetic value.
- Structural hardening against ember ignitions and flames must be done on all structures constructed in wildfire prone environments. This will be critical to maintain access to affordable homeowner insurance.
- Property owners must recognize their responsibility to firefighters by providing a safe working space. Firefighters will attempt to protect all homes, if given a chance. Owners should also be aware that failure to mitigate their structures and native fuels may negate the time and expense invested by those who mitigated their fuels.
- Structure protection by firefighters during an incident is not guaranteed.
- Property owners must learn that traditional firefighting resources are based on one house on fire at one time. Wildfires, especially with extreme burning conditions, place hundreds of homes at risk at one time. Property tax assessments are predicated on the traditional model- not the wildfire model.
- Firefighters are trained to understand two important "triangles". The first is the Fire Triangle representing Fuel, Heat and Oxygen. The second is the Fire Behavior Triangle representing Fuel, Weather and Topography. Homeowners should adopt the triangle shown below since they are responsible for their vegetative fuels, structural fuels, and maintenance of both.

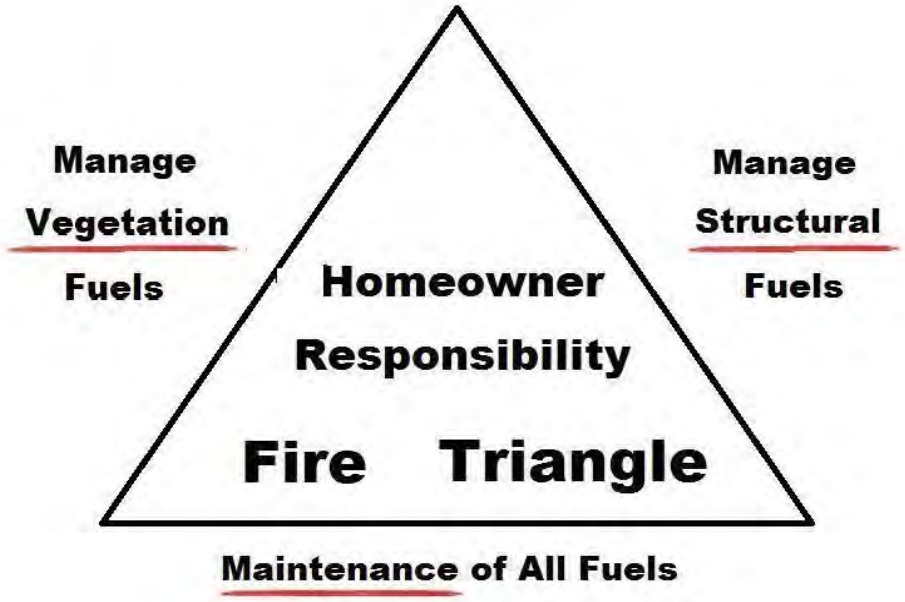


Figure 18. Homeowner Fire Triangle in which property owners take personal responsibility for their private property

POST FIRE PREPAREDNESS

Post-fire flooding can occur when large areas of forests are severely damaged or destroyed. Heat baked soil can become hydrophobic causing loss of soil stability that often results in severe runoff containing silt, ash and debris. All the agencies listed previously will need to work together to protect the habitability of the community. Examples are:

-
- Roadways that cross drainages, even dry ones, will be at greatest risk.
- Infrastructure and utility lines contained within these drainageways will be at risk.
- Mud and debris flow from severely burned hillsides above homes can result in home losses. **NOTE: Losses caused by flooding are not typically covered by homeowner insurance.** Homeowners may need to acquire insurance through federal flood insurance programs.
- Home protection measures may be required to divert storm flows around homes such as sandbags, concrete diversions, and construction of embankments.
- Severe storm alerts should be monitored for many years after damage occurs. Even today, twenty years after the 2002 Hayman Fire, storm warnings alert the public to potential flooding in the burn area.

CRITICAL LESSONS LEARNED

No amount of fire engines, firefighters, bulldozers, slurry bombers or helicopters could have stopped the Waldo Canyon or Black Forest Fires. Unmitigated forest fuels combined with upsloping terrain and high winds immediately overwhelmed any attempts at containment. Unfortunately, four residents lost their lives in the ensuing firestorms.

Critical lessons learned were:

- Defensible spaces are critical for ensuring firefighter safety and effectiveness.
- Defensible spaces and Home Ignition Zones can be overwhelmed by wildfire from unmitigated adjoining properties.
- Where forest fuels have been treated, tree losses and resource damage are significantly reduced.
- Fire is an ecological process. Fire adapted communities are more resilient and result in reduced risks.
- Structural hardening to prevent ember ignitions is just as important (if not more important) as treatment of surrounding native fuels.
- Unregulated construction in areas prone to extreme wildfire behavior will continue to result in similar disasters.

XI. IMPLEMENTATION

The table below lists all of the mitigation projects identified, their priority rankings and the lead agency for the projects. In addition to the projects in *Table 4*, Homes have been rated for wildfire hazard by the Colorado Springs Fire Department. Individual home ratings are available at: https://gis.coloradosprings.gov/Html5Viewer/?viewer=wildfiremitigation Currently no mitigation projects have been identified and may depend on grant funding.

Fuel Treatment Table, District Community Wildfire Protection Plan:

Treatment Area	Acres	Miles	Ownership	Priority	Time Frame	Lead Agency	Treatment

XII. MONITORING

Monitoring is an important part of follow-up to the implementation of projects. HFRA instructs participants to establish, where interest is expressed by the communities, a collaborative multi-party monitoring process. This process should address reporting of accomplishments, need for maintenance of treated areas, tracking of burned areas and the positive and negative ecological and social effects of the projects.

Monitoring in the District Community Wildfire Protection Plan calls for an annual field review by the partners (participants) of accomplishments and need for maintenance. Based on this review, it calls for needed adjustments in the next year's plan, as appropriate. Thirdly, it calls for a determination of interest and meeting by the partners for monitoring the ecological and social effects of projects. These tasks are identified in the table on the next page .

Action Plan for the Woodmen Valley Fire Protection District Communities

Task	Lead Agency	Date	CO State Forest Service (CSFS)	U. S. Forest Service	Fire Depart-ments	Air Force Academy	El Paso County	Neighbor-hoods
Community Wildfire Protection Plan								
Finalize Plan								
Review Draft Plan			x	x	x	x	x	x
Approve Final Draft	CSFS							

Appendix A:

The following pages contain projects the Woodmen Valley Fire Protection District (WVFPD), its partners and all private owners should undertake to manage wildfire risks to WVFPD. These should all be considered high priority projects to complete within the next five years. Any fuels mitigation on ownerships within a ½ mile wide area should be included as a priority. Partners may include:

City of Colorado Springs

Colorado Springs Utilities (CSU)

Colorado Springs Fire Department (CSFD)

El Paso County- (EPCO)

El Paso County Sheriff's Office- EPCO-SO (includes Office of Emergency Mgmt.)

El Paso County Public Works

Colorado Dept. of Transportation- (CDOT)

Colorado State Forest Service- (CSFS)

United States Air Force Academy (USAFA)

USDA Forest Service, Pike National Forest- (USFS)

Abutting Subdivisions to include open spaces and lots.

Abutting private ownerships and businesses.

Special Districts

Woodmen Valley

Critical Infrastructure	Action	Partnerships
Water System	Implement water system upgrades to include construction of additional storage tanks as may be determined by CSU.	
	Install five feet wide noncombustible border around all water facilities and structures.	
	Implement defensible space and HIZ fuel treatments around all structures.	

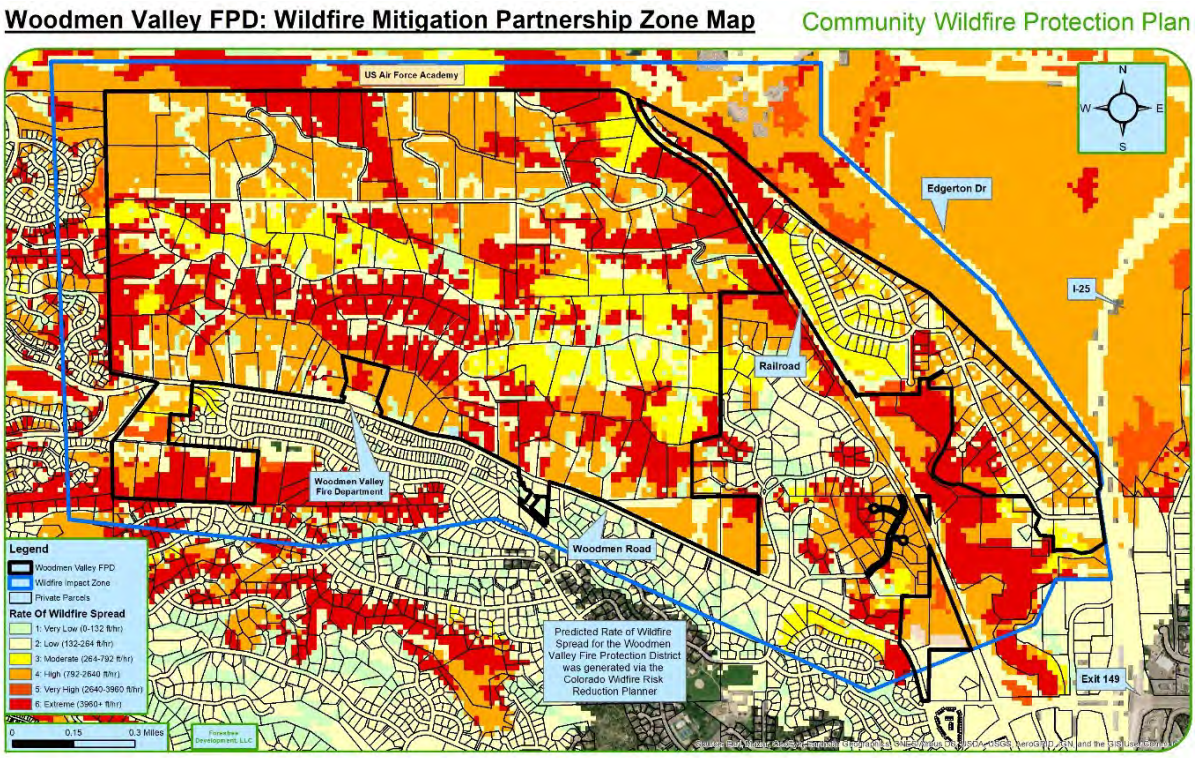
	Maintain access to fire hydrants with 10' of clearance of all fuels. Ensure engine accessibility at roadsides.	
	Install vehicle turn-outs at hydrants that will allow fire engine connection and accommodate passing vehicles.	
Sewer System WV-East	Install five feet wide noncombustible border around all buildings and structures.	
	Mitigate all fuels within 200 feet of all buildings and structures.	
CSU- Electrical	Upgrade aging facilities. Maintain line clearances.	
Black Hills Energy (CSU?)	Protect above ground facilities. Educate homeowners on meter protection	
CenturyLink	Upgrade system-wide improvements	
Comcast	Maintain pedestals and provide service to unserved areas.	
Other	Participate in the development of additional cell coverage within the community.	
Critical Ingress/Egress Routes		
	Encourage all private road maintenance districts to adopt minimum road widths that will accommodate two full lanes of travel. 24 feet of drivable all-weather surface is recommended.	
	Install additional street signage to aid responding firefighting resources that will not be familiar with the community. Signs are needed at intersections, irregular street configurations (Timber Valley and Hidden Valley), and all dead-end roads. Single-lanes, steep grades, sharp curve radii, and lack of sufficient turn-around areas at dead ends pose a risk to evacuees and responding firefighters.	
	Road sections with only one lane of travel should have vehicle turn-outs that can accommodate multiple vehicles. Locations	

	should be at: 1) Road sections where the on-coming traffic is visible; 2) No more than 400 feet apart on long stretches; or 3) where any impediment to travel may exist (steep grades, deep roadside ditches, tight curves, or private improvements.	
	Treat all native vegetation to shaded fuel break specifications along all main egress route streets to minimum width of 150 feet, each side.	
	In areas with prairie fuels, these should be mowed 30 feet wide on both road sides at least twice per year to a maximum height of 6 inches.	
	Partner with the City to widen all two-lane sections of Woodmen Road to a minimum of three lanes of drivable all-weather surfaces.	
All Structures (High Priority)		
	Structural hardening against embers required for all structures in WVFPD.	
	Implement Home Ignition Zones around all structures.	
	Develop “fire adapted” fuel treatment zones as proposed on the attached map using zones of low/no fuel volumes as boundaries.	
	Interconnect HIZs from home to home and to areas of lower fuel volumes (rock formations, pastures, meadows, etc.	
Critical Forest Fuel Treatments	All properties treated to mitigate ladder fuels and implement forest restoration with goal of fire adaption.	
	All forest lands and shrublands within 600 to 1,000 feet of district boundaries. See the attached “Partnership” map. This includes subdivisions, open spaces, public lands, businesses, and other private properties abutting the community.	
	Manage fuel loading on vacant lots that abut residential areas utilizing grant funds.	
Annual and ongoing events	Educational programs	

	Develop a Five-Year Plan outlining priorities and potential costs to be updated annually by the WVFPD or Firewise Committee.	
	Maintenance of prairie fuels along egress routes	
	Maintenance of fuel treatments along egress routes	
	Apply for grants or other funds to assist with fuel treatments both inside and outside of the community. This may include distribution and administration of funds.	
	Annual cleanup projects around businesses and residences.	
	Continue slash chipping or other comparable slash removal program in cooperation with CSFD.	
	Peak Alerts Signup to receive emergency notifications.	
	Access and Functional Needs Registry for those with special needs (homebound, handicapped, infirm, etc.). NOT currently available.	
Pre and Post-fire Planning		
Monument Creek	Begin engineering of crossing point at Westwood, north of the Timber Valley intersection, to withstand 100+ year flood event. (Toms Gulch)	
Internal drainage channels	Begin engineering of any other storm channel crossing points to withstand 100+ year flood event.	
All Roads	Analyze all culvert crossings and roadside ditches for ability to withstand post-fire mud flows. Pre-plan for silt/ash cleanup.	
Utilities Crossing Major Storm Channels	Plan for emergency repairs. Harden all crossing points if road crossings are upgraded to handle 100+ year events.	
All Neighborhoods	Identify areas most prone to post-fire mud and debris flows. Recommend to owners in these areas acquisition of FEMA Flood Insurance.	

The following pages contain maps of the project areas described above:

- Major Landowners within half mile wide buffer zone around Woodmen Valley East and West.
- Watershed Compartments
- Past and future forest project areas administered by CSFS or CSFD.



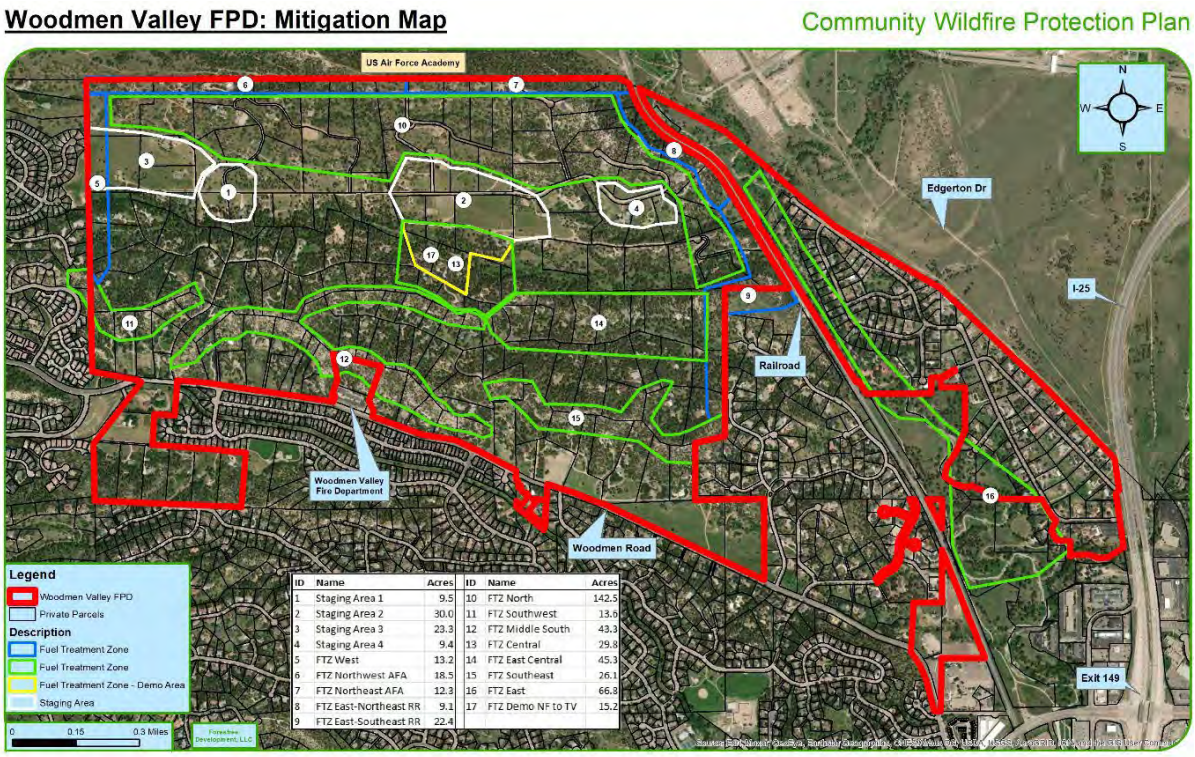
Fire District Boundary (black line) and Partnership Zone (blue line) Areas between the black and blue lines should be treated as wildfire impact zones. Wildfires occurring in these areas pose an imminent threat to the community. Acreage covered by this CWPP:

Woodmen Valley West: 855.3 acres

Woodmen Valley East: 191.4 acres

Partnership/Impact Zone: 802.6 acres

Total High Priority Acres: 1,849.3 acres



Potential Fuel Treatment Zones (FTZ) in and around WVFPD

High Priority Areas within green and white lines #1-17: 455.2 acres

All areas abutting or surrounded by an FTZ are High Priority Areas as extensions or connections to Home Ignition Zones to achieve future “Fire Adaption”.

Appendix B:
Further Information
Websites:

Natural Resources Grants Database:
https://csfs.colostate.edu/natural-resources-grants-database/
Colorado State Forest Service:
http://www.csfs.colostate.edu/
Colorado State University Extension:
https://extension.colostate.edu
Pike National Forest:
http://www.fs.usda.gov/psicc
Bureau of Land Management, Royal Gorge Field Office:
https://www.blm.gov/office/royal-gorge-field-office
Natural Resources Conservation Service :
http://www.co.nrcs.usda.gov/

Publications:

***Best Management Practices to Protect Water Quality*:**
https://csfs.colostate.edu/wp-content/uploads/2024/01/BMP_WaterQuality_2023_Web_CMP.pdf
Wildfire Mitigation *CO Dept. of Revenue Tax Subtraction*:
https://tax.colorado.gov/sites/tax/files/documents/ITT_Wildfire_Mitigation_Measures_Feb_2024.pdf
Fuel Break Guidelines for Forested Communities:
https://static.colostate.edu/client-files/csfs/pdfs/fuelbreak_guidellines.pdf
Protecting Your Home from Wildfire: Creating Wildfire Defensible Zones:
https://csfs.colostate.edu/wildfire-mitigation/protect-your-home-property-from-wildfire/
Low Flammability Landscape Plants:
https://csfs.colostate.edu/wp-content/uploads/2023/05/CSFS_CSU-Ext_Fact-Sheets_LFLP_FINAL_web.pdf
Low Water Use and Fire-resistant Native Plant Materials for El Paso County:
https://elpaso.extension.colostate.edu/wp-content/uploads/sites/44/2022/09/Low-Water-Fire-Resistant-Plant-Materials-0712-2022-1.pdf
***Firewise Principles*:**
https://csfs.colostate.edu/wp-content/uploads/2016/09/MVFS-HIZ-Presentation.pdf
Grass Seed Mixtures to Reduce Wildfire Hazard:
http://csfs.colostate.edu/pdfs/06306.pdf
Colorado Property& Insurance Wildfire Preparedness Guide:
https://csfs.colostate.edu/wp-content/uploads/2023/05/Wildfire_22x8.5_2021.pdf
Forest Home Fire Safety:
https://csfs.colostate.edu/wp-content/uploads/2024/01/Forest-Home-Fire-Safety-Fact-Sheet-6.304.pdf

Forest Health and Management

Gambel Oak Management:
https://csfs.colostate.edu/wp-content/uploads/2024/01/Gambel-Oak-Management-Fact-Sheet-6.311.pdf

Forest Insect and Disease Information

Mistletoes in Colorado Conifers:
https://csfs.colostate.edu/wp-content/uploads/2024/01/Mistletoes-in-CO-Conifers-Fact-Sheet-2.925.pdf

Bark Beetles are Your Trees at Risk?:
https://static.colostate.edu/client-files/csfs/pdfs/Bark-Beetles-Brochure.pdf

Mountain Pine Beetle:
https://csfs.colostate.edu/wp-content/uploads/2024/01/Mountain-Pine

Ips Beetles:
https://csfs.colostate.edu/forest-management/common-forest-insects-diseases/ips-beetle/

Piñon Ips Bark Beetle:
https://csfs.colostate.edu/wp-content/uploads/2020/06/2020_Pinon_Ips_CSFS_Quick_Guide_Web.pdf

Western Spruce Budworm:
https://csfs.colostate.edu/wp-content/uploads/2014/02/Western_Spruce_Budworm_QG_10May2016.pdf

Emerald Ash Borer:
https://csfs.colostate.edu/wp-content/uploads/2016/04/FINAL_EAB_QuickGuide_Revision_25APRIL2016.pdf

Protecting Trees During Construction:
https://csfs.colostate.edu/wp-content/uploads/2024/01/Protecting-Trees-During-Construction-Fact-Sheet-7.420.pdf

Appendix C
Glossary of Forestry Terms

Abiotic Factors: The non-living components of the environment, such as air, rocks, soil, water, peat, and plant litter.

Afforestation: The establishment of trees on an area that has lacked forest cover for a very long time or has never been forested.

Aerial fuels: Standing and supported live and dead combustibles not in direct contact with the ground and consisting mainly of foliage, twigs, branches, stems, cones, bark, and vines: typically used in reference to the crowns of trees.

Cambium: A single layer of cells between the woody part of the tree and the bark. Division of these cells result in diameter growth of the tree through formation of wood cells (xylem) and inner bark (phloem).

Canopy: The forest cover of branches and foliage formed by tree crowns.

Chain: A measuring tape, often nylon, 50 meters or 75 meters in length, used to measure distances. This term is derived from an old unit of measurement (80 Chains = 1 mile).

Chimney: A topographical feature such as a narrow drainage on a hillside or the upper end of a box canyon that could channel wind, smoke or flames up the slope; acting as a fireplace chimney would to draw smoke and heat upward.

Class A Roof: Effective against severe fire test exposures, as classified by the Universal Building Code (UBC). Under such exposures, roof coverings of this class are not readily flammable, afford a fairly high degree of fire protection to the roof deck, do not slip from position, and are not expected to produce flying brands.

Class B Roof: Effective against moderate fire test exposures, as classified by the Universal Building Code (UBC). Under such exposures, roof coverings of this class are not readily flammable, afford a moderate degree of fire protection to the roof deck, do not slip from position, and are not expected to produce flying brands.

Class C Roof: Effective against light fire test exposure, as classified by the Universal Building Code (UBC). Under such exposures, roof coverings of this class are not readily flammable, afford a measurable degree of fire protection to the roof deck, do not slip from position, and are not expected to produce flying brands.

Clearcut: An area of forest land from which all merchantable trees have recently been harvested.

Climax Forest: A forest community that represents the final stage of natural forest succession for its locality, i.e. for its environment.

Coarse Woody Debris (CWD): Sound and rotting logs and stumps that provide habitat for plants, animals, and insects, and a source of nutrients for soil development.

Colorado Champion Tree: The largest known tree of its species in the state. Trees are ranked by a point system based on three measurements: trunk circumference in inches at 4.5 feet above the ground, tree height in feet, and the average crown spread in feet.

Commercial Thinning: A silviculture treatment that "thins" out an overstocked stand by removing trees that are large enough to be sold as poles or fence posts. It is carried out to improve the health and growth rate of the remaining crop trees.

Competing Vegetation: Vegetation that seeks and uses the limited common resources (space, light, water, and nutrients) of a forest site needed by preferred trees for survival and growth.

Conifer: Cone-bearing trees having needles or scale-like leaves, usually evergreen, and producing wood known commercially as "softwoods."

Conservation: Management of the human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations. It includes preservation, maintenance, sustainable utilization, restoration, and enhancement of the environment.

Crown Fire / Crowning: A form of extreme wildland fire behavior consisting of fire that advances from top to top of trees or shrubs independent of a surface fire. Crown fires are sometimes classed as running or dependent to distinguish the degree of independence from the surface fire.

Deciduous: Perennial plants that are normally leafless for some time during the year.

Defensible Space: An area within the perimeter of a parcel, development, neighborhood, or community where basic wildland fire protection practices and measures are implemented, providing the key point of defense from an approaching wildfire or defense against encroaching wildfires or escaping structure fires. The perimeter as used herein is the area encompassing the parcel or parcels proposed for construction and/or development, excluding the physical structure itself. The area is characterized by the establishment and maintenance of emergency vehicle access, emergency water reserves, street names and building identification, and fuel modification measures. In simplest terms, it is adequate space between structures and flammable vegetation which allows firefighters a safe working area from which they can attack an oncoming wildfire. Defensible Space is the best element of fire protection for individual property owners.

Defoliator: An agent that damages trees by destroying leaves or needles.

Dripline: The outermost leaves on a tree define its dripline and the ground within the dripline is known as the drip zone; also defined as the area defined by the outermost circumference of a tree canopy.

Deforestation: The removal of a forest stand where the land is put to a non-forest use.

Eave Opening: A vent located in an eve or soffit which allows airflow into the attic and/or walls of a structure.

Ecosystem: A functional unit consisting of all the living organisms (plants, animals, microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size a log, pond, field, forest, or the earth's biosphere but it always functions as a whole unit. Ecosystems are commonly described according to the major type of vegetation; for example, forest ecosystem, old-growth ecosystem, or range ecosystem.

Escape Route: A preplanned and understood route firefighters take to retreat from an unsafe or fire threatened area and move to a safety zone or other low-risk area**.**

Extreme Fire Behavior: A level of fire behavior that ordinarily precludes firefighting methods involving direct attack on the fire. One or more of the following is usually involved: high rate of spread, prolific crowning and/or spotting, presence of fire whirls, strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.

Felling: The cutting down of trees.

Firebrands: Flaming or glowing fuels lofted into the air during intense burning by strong upward convection currents. Also referred to as airborne embers.

Fire break: A natural or constructed fuel-free barrier used to stop or check fires that may occur, or to provide a control line from which to work.

Fire front / Flame front: The part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified, the fire front is assumed to be the leading edge of the fire perimeter.

Fire Dependent: Requiring one or more fires of varying frequency, timing, severity, and size in order to achieve optimal conditions for population survival or growth.

Fire Hazard Mitigation: Various methods by which existing fire hazards can be reduced in a certain area, such as fuel breaks, non-combustible roofing, spark arresters, etc.

Fire Management: The activities concerned with the protection of people, property, and forest areas from wildfire and the use prescribed burning for the attainment of forest management and other land use objectives, all conducted in a manner that considers environmental, social, and economic criteria.

Fire Suppression: All activities concerned with controlling and extinguishing a fire following its detection.

Firewise: A National Fire Protection Association's (NFPA) program encouraging local solutions for wildfire safety by involving homeowners, community leaders, planners, developers, firefighters, and others in the effort to protect people and property from wildfire risks.

Forest Fire: Any wildfire or prescribed burn that is burning in forest, grass, alpine, or tundra vegetation types.

Forest Type: A group of forested areas or stands of similar composition (species, age, height, and stocking) which differentiates it from other such groups.

Fuel: Any living or dead material that will burn.

Fuel break: An existing barrier or change in fuel type (to one that is less flammable than that surrounding it) or a wide strip of land on which the native vegetation has been modified or cleared, that acts as a buffer to fire spread so that fires burning into them can be more readily controlled. Often selected or constructed to protect a high value area from fire.

Fuel 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.

Fuel Treatment Zone: An area similar to a fuel break but not necessarily linear, in which fuels have been reduced or modified to reduce the likelihood of ignition and/or to reduce fire intensity thereby lessening potential damage and resistance to control.

Germination: The development of a seedling from a seed.

Home Ignition Zone (HIZ): An area including the home and its immediate surroundings within which burning fuels could potentially ignite the structure; usually considered to be an area extending out roughly 100 feet from the home. The HIZ is often used to describe the area in which fuel modification measures should be taken to protect the home.

Ladder Fuels: Fuels that provide vertical continuity between the surface fuels and crown fuels in a forest stand, thus contributing to crown fires.

Lines of Effort: Tasks or sets of actions that are linked or coordinated with other task sets to accomplish a larger mission or reach a desired end state. Lines of effort allow leaders and decision makers to direct a variety of separate actions toward a unified result.

Maximum Density: The maximum allowable stand density above which stands must be spaced to a target density of well-spaced, acceptable stems to achieve free-growing status.

National Fire Protection Association (NFPA): A private, non-profit organization dedicated to reducing fire hazards and improving fire service.

Phloem: A layer of tree tissue just inside the bark that conducts food from the leaves to the stem and roots.

Pitch Tubes: A tubular mass of resin that forms on bark surface at bark-beetle entrance holes.

Prescribed Burning: Controlled application of fire to wildland fuels, in either their natural or modified state, under certain conditions of weather, fuel moisture, soil moisture, etc. as to allow the fire to be confined to a predetermined area and at the same time to produce results to meet planned land management objective.

Ready, Set, Go (RSG): A program, managed by the International Association of Fire Chiefs (IAFC), seeking to develop and improve the dialogue between fire departments and residents. The program helps fire departments teach individuals who live in high-risk wildfire areas how to best prepare themselves and their properties against fire threats.

Regeneration: The act of renewing tree cover by establishing young trees, naturally or artificially note regeneration usually maintains the same forest type and is done promptly after the previous stand or forest was removed.

Saddle: A depression, dip or pass in a ridgeline; significant in wildland firefighting because winds may be funneled through a saddle, causing an increase in wind speed.

Safety zone: An area essentially cleared of flammable materials, used by firefighters to escape unsafe or threatening fire conditions. Safety zones are greatly enlarged areas in which firefighters can distance themselves from threatening fire behavior without having to take extraordinary measures to shield themselves from fire/heat.

Sapwood: The light-colored wood that appears on the outer portion of a cross-section of a tree.

Serotinous: Pertaining to fruit or cones that remain on a tree without opening for one or more years, note in some species cones open and seeds are shed when heat is provided by fires or hot and dry conditions.

Shaded fuel break: A fuel break built in a timbered area where the trees within the break are thinned and limbed up to reduce crown fire potential, yet retain enough crown canopy to provide shade, thereby making a less favorable microclimate for surface fires.

Silviculture: The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands. Silviculture entails the manipulation of forest and woodland vegetation in stands and on landscapes to meet the diverse needs and values of landowners and society on a sustainable basis.

Snag: A standing dead tree or part of a dead tree from which at least the smaller branches have fallen.

Stand: A continuous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit.

Spot Fire / Spotting: Fires ignited beyond control lines or outside the perimeter of a fire by firebrands landing on/among flammable material. Spot fires/spotting are a form of extreme fire behavior typically resulting from high wind conditions.

Structure Protection: A defensive strategy in wildland firefighting in which firefighters are assigned to evaluate, prepare and, when possible, defend structures/homes that may be threatened by a wildfire.

Structure Triage: Evaluating and sorting structures/homes into categories based on their relative likelihood of surviving a wildland fire threat (*defensibility*). Triage decisions are based multiple factors and conditions occurring during an actual fire - weather, fire behavior, home ignition potential, defensible space, presence of escape routes, and availability of firefighting resources, among others - with the goal of doing the most good with the resources available.

Succession (or Ecological Succession): The replacement of one plant and/or animal species over time by another in progressive development toward climax vegetation.

Surface fuels: Fuels lying on or near the surface of the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low-lying live vegetation.

Survivable space: A term typically used to describe the area around a structure/home indicating that fuels in the area have been reduced to the point that there is little or no serious fire threat to the structure; the structure has a high probability of surviving a wildland fire without anyone on scene providing active protection.

Thinning: A cutting made in an immature crop or stand primarily to accelerate diameter increment, but also, by suitable selection, to improve the average form of the tree that remain.

Torching: The burning of the foliage of a single tree or a small group of trees, from the bottom up. Sometimes, also called candling. Torching is an extreme form of fire behavior, similar to but less extreme than crowning in that crowning affects larger numbers, even entire stands of trees.

USDAFS: United States Department of Agriculture - Forest Service, what is commonly known as just "The Forest Service"

Windbreak: A strip of trees or shrubs maintained mainly to alter wind flow and microclimates in the sheltered zone, usually farm buildings.

Wildland-Urban Interface or Wildland-Urban Intermix (WUI): The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Although ***Interface*** is the more general, more commonly used term; it technically refers specifically to the area where development and wildlands meet. ***Intermix*** indicates the presence of wildland vegetation/fuels intermingled throughout the developed area.

Appendix E:
INSECT AND DISEASE INFORMATION

Literally thousands of insects and diseases are present in the forests surrounding Manitou Springs or any other forested area. Fortunately, like the common cold, most do no serious or lasting damage. But when in poor health, trees, like humans, are more prone to infection from other causes; the concept of preventive medicine applies to forests, as well as to humans. Maintaining forests in good health will prevent problems in the future. For the most part, forest insect and disease issues are typical for the region.

Well maintained forests have a multitude of bene They are resistant to catastrophic fires, insect an disease, sustain wildlife populations and pleasant places to be.

Every summer, insect and disease specialists from the USDA Forest Service and Colorado State Forest Service (CSFS) survey Colorado's forests from the air to monitor insect and disease outbreaks. These flights are an excellent means of finding new areas of insect and disease activity and monitoring trends in existing outbreaks. Maps of the previous year's findings are published in January and can be found on the CSFS website at

http://csfs.colostate.edu/pages/common-insects.html.

This link also contains more detailed information on the insect and disease issues presented here.

The unnaturally dense forest conditions that cause the potential for hazardous fire also create the potential for cyclical insect and disease outbreaks. Trees weakened by overcrowding and severe competition for water and sunlight are susceptible to invasion by insects and disease. When planning wildfire hazard mitigation projects, it is important to address current insect or disease issues and prevent those that are likely to become a problem. Following is information on some of the common forest insect and disease problems that have been identified in the region.

DWARF MISTLETOE

Dwarf mistletoe is a parasitic plant that robs moisture and nutrients from the host tree. Over many years, it causes the tree to decline in vigor and eventually may cause death. More commonly, the tree declines to the point where bark beetles attack and kill it.

A ponderosa pine with advanced dwarf mistletoe infection. Note the heavy contorted "witches' brooms" in the lower branches. After long periods of infection, the needles become sparse and shorter.

Three common species of dwarf mistletoe are found in the region, each named after its principle host – ponderosa pine, lodgepole pine and Douglas-fir. Locally, ponderosa and lodgepole varieties grow on any pine species, but Douglas-fir dwarf mistletoe is exclusive to Douglas-fir trees. Spruce, true firs and deciduous trees are immune to all three species of dwarf mistletoe.

The most obvious symptom of dwarf mistletoe infection is the dense, distorted growth of the branches, called witch's brooms because they appear to be twisted or tied in knots. The shoots of ponderosa dwarf mistletoe are visible on the branch as thick fingerlike growths extending out of the branch or trunk.

Mistletoe shoots are only reproductive structures with no photosynthetic function. Removing the shoots from a branch does not control dwarf mistletoe, except to temporarily halt seed production. Structures called sinkers, (analogous to roots in plants) embedded in the wood cause the damage, and the mistletoe plant continues to absorb the host tree's water and nutrients. Shoots that are removed grow back in two or three years.

During the growing season, dwarf mistletoe shoots develop berries containing a seed. In August, the berries fill with water and explode, shooting the seed as far as 40 feet. Most seeds strike branches of the host tree and do not travel the full 40 feet, so the expansion of dwarf mistletoe pockets averages two feet per year.

When the seed strikes a branch, it germinates, and the sinkers penetrate the bark into the tree's conductive tissues. The growing mistletoe begins to steal the tree's food and water. The first visible symptom of infection is swelling in the branch at the site of the growing mistletoe plant, but nubs of the emerging shoots won't be visible for three years and a shoot won't bear its first seeds until seven years after. As seeds spread, all susceptible trees in the vicinity may become infected; it is extremely rare to find an isolated infected tree in the forest.

The tendency of mistletoe to infect all trees in a stand makes eradication difficult. No effective chemical treatment exists for mistletoe, and the only way to kill the parasite is to kill the host. In stands where only the susceptible species of tree exists, total eradication of the mistletoe would require a clearcut, which is unacceptable to most landowners.

Fortunately, mistletoe kills trees slowly, so it is not necessary to eradicate the parasite. The disease can be controlled by a program of thinning to increase tree vigor. Pruning the more heavily infected branches also helps, even if not all the mistletoe is eliminated. The final step in the process is to replant with non-susceptible species so that new trees will grow before the mistletoe kills the remaining trees.

The spread of mistletoe can be halted by a minimum 40-foot buffer zone between infected and non-infected trees. In this situation, cut 20 feet into non-infected trees to remove any mistletoe that is not yet visible; cut the remaining 20 feet into the infected stand. Non- infected trees outside the buffer should be checked each spring for mistletoe and any infected branches should be immediately pruned before seeds develop.

In forest stands with mixed tree species, it may be possible to eliminate all mistletoe by retaining only non-susceptible trees if they are in good health.

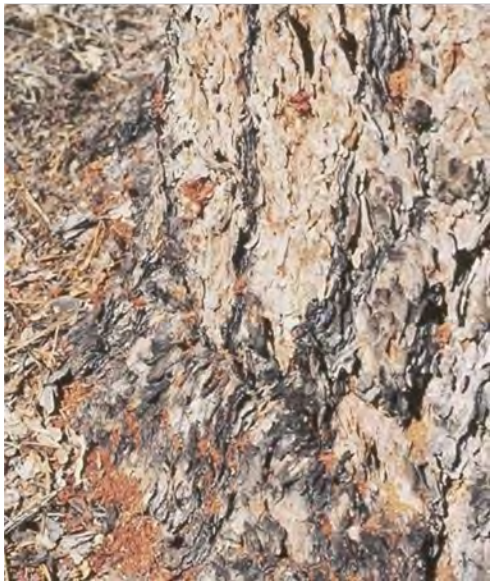
Dwarf mistletoe treatment is a complicated process that depends on the site conditions and the landowner's tolerance for cutting trees. In most cases, a combination of treatment methods will best suit the landowner's objectives. Consultation with a qualified forester is recommended to develop an effective and acceptable treatment plan.

MOUNTAIN PINE BEETLE

Mountain pine beetles are at endemic levels in the Black Forest. Most beetle activity is in stands with heavy infections of dwarf mistletoe that are weak and vulnerable to beetle attack. Beetles are also active in the burn scar where the fire weakened but did not kill the trees outright. Elsewhere in the forest, beetles kill isolated trees here and there.

Adult beetles fly and attack new trees from midsummer through the first frost. Females seek a large, weak tree in which to mate and lay eggs. Vigorous trees generate enough pitch to prevent the female from burrowing through the bark, and this attempt by the tree to prevent entry creates the pitch tubes symptomatic of beetle attack. Pitch tubes are **not** a particularly reliable indicator of a successful attack. If

pitch tubes are seen, check for reddish boring dust (fine sawdust) at the base of the tree and in the bark crevices. Boring dust is a more reliable indicator of successful attack.



Boring dust on a ponderosa pine after bark beetle attack. The reddish-brown sawdust at the base of the tree and in the bark crevasses is a strong indication of successful beetle attack. *Colorado State Forest Service photo by David Leatherman*

Once a female penetrates the bark, she hollows out a circular mating chamber between the bark and the wood, releasing a pheromone (scent) to attract a mate. The pheromone also attracts additional females to the tree and the tree is attacked in mass. After mating, the female burrows up the trunk between the bark and wood laying eggs. She inoculates the tree with spores of bluestain fungus, which provides food for the larvae. The fungus clogs the tissues that conduct water throughout the tree, leading to death within a few weeks.

Eggs hatch within a few days. The developing larvae feed horizontally from the maternal gallery over winter. The vertical maternal gallery and horizontal larval galleries are characteristic of the mountain pine beetle. The feeding larvae spread the bluestain fungus horizontally through the tree, and it becomes visible in the wood around February. The presence of bluestain is

absolute confirmation that beetles have successfully entered the tree. Woodpeckers feed on the larvae through the fall and winter. The holes made by woodpeckers are a visual clue to an infested tree. Untrained observers often are confused by the holes woodpeckers make when they feed on beetle larvae and sapsuckers feed on the sap. Woodpecker feeding is characterized by random holes about one-half inch in diameter that make it appear as though the tree was peppered with a shotgun. Sapsuckers, on the other hand, make a small hole about one-eighth inch in diameter, and the holes are in straight lines or a grid pattern. Sapsuckers do not indicate the presence of beetles in the tree.

Although the tree is dead within a few weeks of successful attack, needles remain green until the following spring. Within the space of a few weeks, in late May or early June the tree will turn straw yellow and then reddish-brown. Once beetles invade a tree, nothing can be done to save it; the tree must be cut and disposed of in a way that will kill the beetles. No insecticide is available to kill beetles under the bark; thus, some sort of mechanical treatment is necessary. Any wood greater than four inches in diameter may harbor beetles and must be treated.

The following are treatment options for beetle-infested trees:

- The sawmill on the property is an effective treatment for any bark beetle (MPB or Douglas-fir beetle). Larval beetles are between the bark and the wood. When the trees are squared in the mill, the slabs dry and the beetles perish.
- Move all wood to a landfill or bury it under at least eight inches of dirt.
- Completely debark any wood that is larger than four inches in diameter.
- Chip or masticate the tree. Many tree services have chippers capable of chipping large diameter trees. The beetles are killed when the wood is chipped.
- Cover wood with at least six-mill clear plastic. This method, known as solar treatment, warms the wood to temperatures Lethal to the larvae, and increases moisture, encouraging mold growth in the logs, which kills the beetles. Treat the wood properly for successful control. Cut into firewood lengths and stack no more than two logs high. Be sure there are no exposed stubs or sharp edges that might tear the plastic. Trench around the pile and, if possible, wet down the pile to encourage mold growth. Cover the pile with plastic, push the edges of the plastic into the trenches, and seal the edges with dirt. Check periodically to be sure the plastic has not torn. If torn, it can be repaired with duct tape.

Mountain pine beetle galleries under the bark of a ponderosa pine. The maternal beetle burrowed straight up the tree creating the central gallery. Larve feed horizontally creating the smaller side galleries A larvae is in the upper right and a pupa is in the lower left. Note the blue stain in the wood.

It is best to check for infested trees in October of each year – remember that infested trees, although dead, are still green at this time. Pitch tubes and boring dust will be the most obvious clues. If infested trees are located early, there is adequate time to treat them.

While no insecticide effectively treats infested trees, spraying with insecticides such as carbaryl or permethrine prevents attack. Preventive sprays will not kill beetles under the bark. Spray trees between May 1st and July 1st each year for maximum effectiveness. It is not practical to spray every tree on a large tract of land, so choosing which trees to spray depends on the landowner's budget and the value of individual trees to the landowner. It is advisable to solicit bids from several different spray companies, as prices can vary widely. It also is wise to request and check references.

Preventative spraying should be done only if there is a serious threat from infested trees within a mile or less of the property. Preventative sprays kill predators of aphids. These predators keep aphids at low levels and trees can easily tolerate their feeding. Frequent preventative spraying

allows aphid populations to increase to concentrations where they may do serious injury or kill a tree outright.

Thinning forests for increased health and vigor by far is the best preventive measure for mountain pine beetles. Because trees require several years to respond to thinning, it is best done before beetles reach epidemic levels. Follow thinning guidelines for wildfire mitigation to reduce susceptibility to MPB.

IPS (ENGRAVER) BEETLES

There are several species of these small bark beetles that may infest ponderosa pine piñon pine or spruce. Piñon ips is active along the Highway 115 corridor south of Colorado Springs. The other species are always present in the forest but are not currently at epidemic levels. Ips beetles usually attack trees less than four inches in diameter and, in such circumstances, may be useful in thinning dense stands of young trees. Thus, it usually is not considered as threatening mountain pine beetle. Ips will attack larger trees if they are severely weakened by disease (most often dwarf mistletoe), or are damaged by construction, lightning strikes or in horse corrals where soil compaction injures the roots. Like the mountain pine beetle, ips burrow beneath the bark and inoculate the tree with bluestain fungus, and they often follow mountain pine beetles into larger trees.

The differences between mountain pine beetle and ips are significant to anyone implementing a forest management program. Ips become active in spring when the weather exceeds 50 degrees F, developing from egg to adult within eight weeks, and they continue to attack trees until the first frost. For this reason, preventive spraying should be done with permethrine or carbaryl in April and repeated in July. When spraying preventively for ips, it is important to spray the branches, as well as the trunk.

ponderosa pine slash indicates it has been invaded by ips beetles. Adult beetles will emerge in eight weeks if the slash is not properly treated. The reddish-brown boring dust on this branch indicates that it is infested with ips beetles.

Ips attack causes no pitch tubes to form on live trees, so the only visual clue is boring dust or woodpecker holes in the trunk. Smaller trees quickly turn reddish-brown, but when they attack larger trees, ips often infest only the upper portion of the tree. The first symptom is browning of the top, but subsequent generations emerge and continue down the tree.

Ips will infest green slash and downed logs from forest management projects. If slash is not promptly treated, ips will emerge to attack living trees; treat slash within four to six weeks after cutting. If weather conditions permit, thinning trees in winter when ips are dormant will prevent

problems with beetles in slash. However, slash cut after March 1 may still be green enough to attract ips when the weather warms.

Chipping slash will kill ips beetles. Lopping and scattering slash into lengths less than 24 inches promotes rapid drying and prevents infestation. Untreated slash left over the winter will produce live broods the following April. Due to their short lifecycle, solar treatment of ips-infested logs is ineffective. Bucking larger diameter logs and promptly splitting them into firewood accelerates the drying process and usually is effective in preventing ips infestations.

Many high value trees have been lost as a result of the common, and ultimately costly, practice of stacking firewood against green trees. Ips beetles will burrow out of infested firewood directly into standing trees.

DOUGLAS-FIR BEETLE

During the forest inventory, no Douglas-fir beetle infested trees were observed on the property, but the potential of attack is present. Some similarities exist between Douglas-fir beetle and MPB, but there are important differences that require different treatment strategies for infested trees.

Both species burrow under the bark to lay eggs and both carry blue stain fungus that kills the tree within a few weeks of infestation. Each beetle prefers dense stands with large diameter, low vigor trees; thus, thinning Douglas-fir for wildfire mitigation also reduces susceptibility to beetles.

Adult Douglas-fir beetles emerge in mid-June, and a few adults may overwinter in trees and emerge as early as April. There are no insecticides available for treatment of beetle infested trees. Infested trees should be treated prior to April of each year to prevent emergence of overwintering adults. Other effective treatments are whole tree chipping, debarking of all wood greater than four inches in diameter, transportation to a safe site or landfill, and burying under eight inches of dirt. Solar treatments should begin in the fall, preferably early fall.

Preventative spraying is an option for high value trees. Permethrin or carbaryl are effective as Douglas-fir beetle preventatives, but, because of the earlier emergence of overwintering adults, spraying should be done in April. Preventative sprays are not an effective treatment for infested wood.

Pitch streamers on the bark of a beetle-infested Douglas-fir. Not all infested trees will exhibit pitch. Trees should be checked for boring dust in the early fall.

Unlike MPB-infested trees, Douglas-fir trees do not form pitch tubes when attacked, so there may not be an obvious visual indication of infestation. Some Douglas-fir bleed sap when attacked, resulting in rivulets of sap on the trunk; however, this does not occur in all infested trees. Trees should be checked carefully for boring dust in early October. Later in the year, woodpecker holes may provide a visual clue that trees are infested.

Trees partially defoliated by western spruce budworm (see the following section) are particularly susceptible to attack by Douglas-fir beetles. Injury, overcrowding or any conditions that adversely affect the vigor of the tree will make it more susceptible. Managing the forest for open, vigorous stands of Douglas-fir is the best prevention.

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