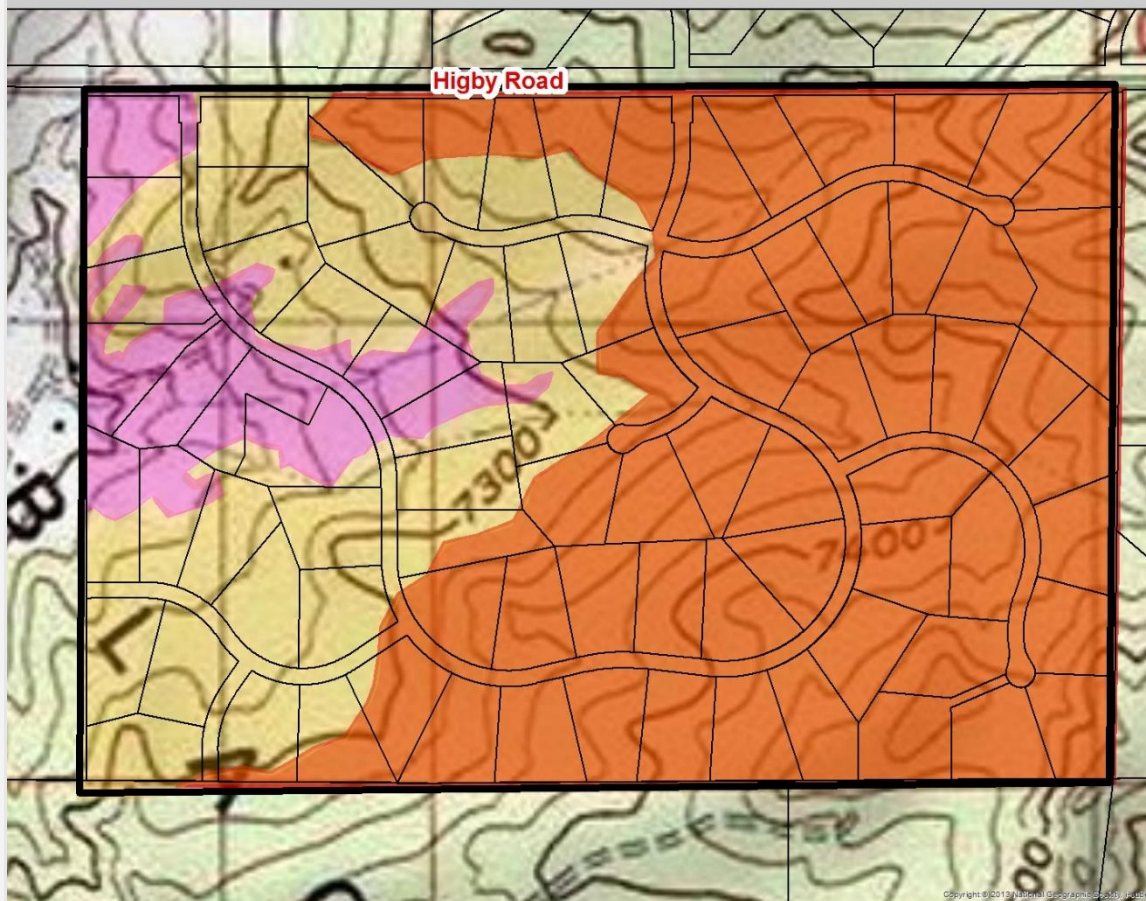







Community Wildfire Protection Plan

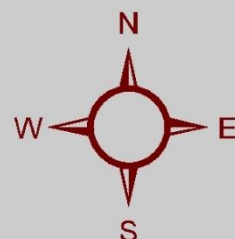
Higby Estates HOA
December 2018

Higby Estates Wildfire Hazard



Legend

-  High Grass 38 ac
-  High Forest 117ac
-  Severe Forest 235ac
-  Higby Estates
-  Parcels



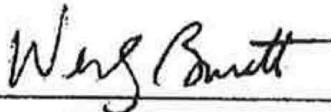
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Higby Estates

COMMUNITY WILDFIRE PROTECTION PLAN

ACCEPTANCE

This Community Wildfire Protection Plan is developed in response to the Healthy Forest Restoration Act of 2003, and is a collaborative effort to guide our wildfire protection. The activities recommended in this plan are appropriate to meet our objectives and will benefit the natural resources and reduce the risk from wildland fire. This plan is voluntary, and where possible, we intend to apply the recommended practices, thus improving our community and increasing public safety.



Wes Barnett,
Higby Estates HOA
President

1/15/2019
Date



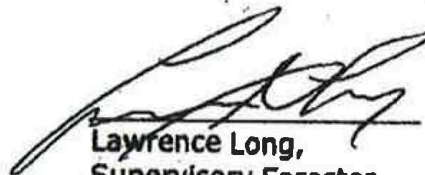
Bob Schilpp,
Higby Estates Forestry
Committee

1/15/2019
Date



Jamey Bumgarner,
Fire Marshall, Tri-Lakes
Monument FPD

1/29/19
Date



Lawrence Long,
Supervisory Forester
Colorado State Forest Service

1/16/2019
Date



Lonnie Inzer,
Deputy Chief of Emergency
Management & Emergency
Emergency Manager
El Paso County

1-30-19
Date

Preface to the Plan

Annual Firewise reports submitted by Higby Estates show that since 2014, when Higby Estates became a recognized Firewise Site, homeowners reported investment dollars and labor valued at a total of \$31,715 toward fuel reduction including about 990 hours of effort. The results are visible throughout Higby Estates, as most homeowners have removed fuel, but more work is necessary to give the community the best possible protection.

One requirement of Firewise Recognition is that the community write a Community Firewise Assessment and Action Plan, or be covered by a Community Wildfire Protection Plan (CWPP). Higby Estates was recognized based on the El Paso County CWPP, a broad plan that contains little analysis or recommendations specific to Higby Estates. In the spring of 2018, discussions between the Higby Estates Firewise Committee and the Colorado State Forest Service (CSFS) lead to a decision to develop a CWPP specific to Higby Estates.

Community Wildfire Protection Plans were authorized by the 2003 Healthy Forest Restoration Act. In short, a CWPP is a written document that analyzes a community's wildfire hazards and provides recommendations to reduce those hazards. This plan was developed collaboratively between the Higby Estates CWPP Core Group, the CSFS Woodland Park Field Office and the Tri Lakes-Monument Fire Protection District.

HIGBY ESTATES VALUES TO BE PROTECTED:

**Safety of people, families,
homes, property and pets.**

**Property values; ability to sell,
freedom to relocate when
needed or desired.**

Home insurability and discounts.

Privacy.

Forest health and beauty.

Wildlife habitat.

**Enjoyment of quiet, serene, ru-
ral residential environment and
lifestyle.**

**Safe ingress and egress for fire-
fighters and emergency re-
sponse personnel.**

Safe evacuation for residents.

CWPP Overview – Key Points

1-The Higby Estates Forestry Committee [formerly the Wildfire Mitigation Team] has been active since 2014. The Goals of the Committee are -

- Protect the community against catastrophic wildfire, and survive the fire.
- Keep lives, homes, and property and community values safe from wildfire danger.
- Provide educational information and resources to promote forest health & wildfire risk reduction, and to help homeowners improve their wildfire preparedness and safety.

2-Higby Estates has been a recognized Firewise Site since 2014.

3-Continued Firewise recognition requires a CWPP [Community Wildfire Protection Plan] specific to Higby Estates. The CWPP—

- defines Community Values to protect.
- assesses & prioritizes wildfire risks/hazards every 5 years.
- defines & prioritizes risk reduction objectives and programs.
- An Implementation Action Plan is reviewed annually and updated every 3 years.

4-The Community Values, Goals & Objectives of the CWPP are shown on pages ii and 1-3.

5-Higby Estates Wildfire Risks/Hazards Assessment [details in Sections II & III] -

A--Key determinants of wildfire risk are: weather, topography and fuel.

-Weather- Is the major, highly variable factor affecting fire behavior. The generally warm, dry climate with prevailing winds from the S/SW increases the wildfire risk for Higby Estates.

-Topography - The terrain in Higby Estates slopes upward from west to east, providing a hotter S/SW exposure & resulting in drier fuel for wind-driven wildfires that burn faster uphill. Also, the steeper terrain in the eastern half of the community would significantly increase the fire spread and intensity of wildfire under any weather conditions.

-Fuel - Three hazard types are present in Higby Estates [See map, page 21]

1-High Hazard Grass - in meadows on the western side of Higby Estates.

Hazard due to the ease with which dry grass ignites and the possibility of a rapid wind-driven wildfire.

2-High Hazard Forest - in the SW and central part of Higby Estates.

Hazard due to dense forest stands with abundant ladder fuels and closed forest canopy. A wildfire could become a crown fire, which would burn intensely in the tree tops across the entire community. Ponderosa can survive a low-intensity ground fire, but not a crown fire.

Crown fires generate large amounts of firebrands [flying burning embers] that can be carried more than a mile by winds during a wildfire to threaten homes. Crown fires are the most destructive fires to homes and property, and during severe weather, crown fires are unstoppable.

3-Severe Hazard Forest – in the eastern half of Higby.

About the same fuel hazard as the High Hazard Forest, but the steeper terrain would likely intensify the wildfire behavior even more.

-The CSFS [Colorado State Forest Service] Annual Forest Inspection reports note that fuel reduction has improved since 2014, but there is still too much fuel/too many trees in Higby Estates. Due to the hazards listed above, Higby Estates is at risk for a catastrophic wildfire, and the only way to reduce that risk is to reduce the fuel in the community.

B--Emergency Evacuation Assessment

-The primary evacuation route is Colonial Park Drive to two intersections with Higby Rd, and then east or west on Higby Rd.

-Fuel reduction along the streets within Higby has improved the safety of these emergency escape routes for residents, but more improvement is needed.

-However, along Higby Rd, dense fuels adjoin the roadway in either direction, making this escape route mostly unsafe in the event of a wildfire.

-This means planning for emergency evacuation is extremely important, and ignoring or delaying evacuation will be very hazardous.

-Improved safety of primary evacuation routes near Higby Estates should be a joint effort between local landowners and local government.

6-Creating Defensible Spaces to Reduce Wildfire Risk [details in Section IV & V]

A--Home Ignition Zone – the house and its immediate surroundings.

To avoid home ignition, the potential wildfire intensity surrounding the home must be reduced, and the structure itself must be 'hardened' to make it as resistant to ignition as possible.

When firebrands [flying burning embers] land on combustible materials near or on the house, home ignition can occur. More than 50% of homes lost in recent wildfires were lost due to ignition by firebrands falling from the sky. Flammability of roofs, siding materials, decks, vegetation and other materials can impact the risk of home ignition.

B—Defensible Space - Zones 1, 2, and 3

Defensible Space is the area around a structure where existing vegetation is modified to slow the rate and intensity of an advancing wildfire. Vegetation modification includes selective removal [thinning] of trees and pruning up to remove ladder fuels in order to open up the forest canopy, which will help prevent crown fires and reduce the amount of firebrands.

In addition, firewise landscaping is used to increase the effectiveness of defensible space in Zone 1 [closest to the structure].

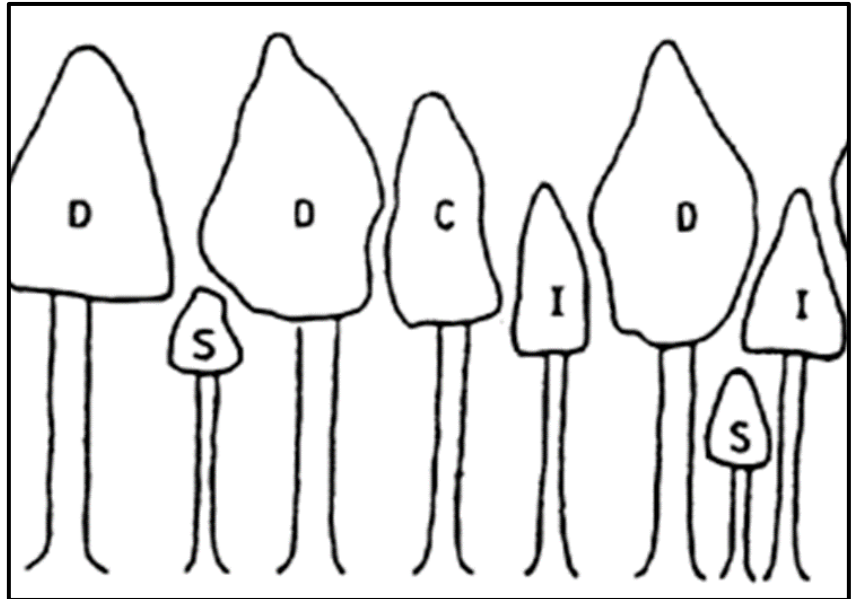
Guidelines for the 3 zones are discussed in several of the attached Appendices.

7-Forest Health and Wildfire Mitigation [discussed in Section V]

The key to Community Wildfire Protection is to have and maintain a healthy forest. Good community-wide forest stewardship should be the focus, with fuel reduction through wildfire mitigation being an essential part of that stewardship. Therefore, effective forest stewardship requires that fuel reduction be done in a way that enhances the health of the forest by removing some trees to preserve the rest of the forest.

Ponderosa pine is a shade-intolerant tree and requires full sunlight for vigorous growth. As trees in a dense ponderosa forest stand compete for sunlight, water and nutrients, the most vigorous trees become the dominant trees in the stand. The other trees in the understory are smaller and weaker, and the result is an unhealthy forest with too many trees, with increased susceptibility and risk due to beetle attack, disease and wildfire.

Before European settlement, frequent, low-intensity wildfires naturally reduced fuel out and thinned the forest. There have been no wildfires in the Higby Estates area during the last century, so our forest is too dense and unhealthy. After a century of fuel accumulation, a fire in Higby Estates would likely be a high intensity crown fire like the Black Forest Fire. So Higby Estates must manage the forest to resemble the natural open forest that existed prior to fire suppression **before** the wildfire occurs.



Trees are classified depending of their position in the forest canopy. The dominant trees (D) are the most vigorous, receiving the most sunlight and water. Co-dominants (C) are slightly crowded by their larger siblings but still receive adequate sun and water. The intermediate (I) trees are do not receive adequate sunlight or water. Overtopped (or suppressed) trees (S) receive little sunlight or water, and are hazardous ladder fuels.

In a mitigation process known as 'thinning from below', trees are removed based on their position in the forest canopy. The dominant [larger/taller] trees are retained, and the smaller diameter, stunted, weaker, less vigorous co-dominant, intermediate and overtopped (suppressed) trees are removed to create openings in the forest canopy. Ladder fuels are also eliminated to reduce crown fire risk by removing shorter/weaker trees, shrubs and pruning-up lower branches of remaining trees. Other candidates for removal are trees infested with dwarf mistletoe, damaged/misshapen trees, and Gambel Oak near or beneath ponderosa pines.

Treating the slash from fuel reduction activity must be done in a way to protect the health of the forest, to avoid increasing the fire hazard or attracting undesirable insects to the area such as Ips and Mountain Pine beetles. Chipping on-site does not significantly add to fire hazard if the chips are spread over the ground. Keep the depth of the chips to less than four inches in order to preserve the productivity of the soil.

Wildlife habitat can be improved with effective forest stewardship. Creating openings in the forest mixed with well-spaced clumps of trees with some lower branches can provide hiding cover for wildlife. A few standing dead trees can be retained as 'wildlife trees' in Zone 3. Isolated down logs in various stages of decay are beneficial wildlife habitat, but large concentrations of down wood are a fire hazard and should be removed or broken up.

8-Maintenance [Details on page 38]

Living in the forest is a way of life that includes forest stewardship, and ongoing maintenance is an essential part of forest stewardship. Ongoing maintenance activity by homeowners includes—

A--Inspect all trees for signs of damage, insect activity or disease. Prune & remove trees as needed.

B-Check recent growth for ladder fuels and canopy closure. Prune & remove trees as needed to maintain forest canopy openings.

C-Thin dense thickets of young trees [regeneration] to promote forest diversity.

D-Pine needles should be removed from any surfaces of the house and other structures and from within 5 ft of the structures. Beyond 5 ft, it is good to leave pine needles on the forest floor, as they help retain moisture in the soil, reduce erosion, and add organic matter to the soil. However, needles should be removed where growth of grasses or other plants is desired.

E-Mitigation of the home and its immediate surroundings. Remove sources of ignition on/near the house to 'harden' it against wildfire, and to reduce the vulnerability to potential ignition by firebrands.

9-Implementation Action Plan [Section VI]

The Plan defines and prioritizes the forest health and wildfire risk reduction objectives and programs. The plan will be reviewed annually and updated every 3 years by the Forestry Committee.

10-Acknowledgements

Higby Estates is extremely grateful to Dave Root and others at the Colorado State Forest Service, and to Jamey Bumgarner and others at the Tri-Lakes Monument Fire Protection District for their assistance in developing this CWPP, as well as for their collective guidance, assistance and support over the years in helping Higby Estates become and remain a Firewise Community.

We also thank the many homeowners in Higby Estates for their interest and participation in the Firewise programs and events provided to help Higby Estates become better prepared for wildfire and a better, safer community in which to live.

Higby Estates Forestry Committee
Higby Estates HOA Board of Directors

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I. COMMUNITY IDENTIFICATION AND DESCRIPTION

As we write this Community Wildfire Protection plan, the tragedy of the fires in California is the continuing saga of the television news. At this writing, neither the number of fatalities nor the loss of homes is fully known.

Yet, in the midst of the destruction, some communities survived. Those who saw the danger in advance and acted to reduce fuels escaped with minimal damage. If they are even briefly mentioned in the media circus or post tragedy blame game, they will quickly be forgotten. Tragedy makes for better television. The reason for developing this plan is so that Higby Estates might be one of the forgotten survivors.

At the foundation of this document is the concept of a Fire Adapted Community. In forested communities like Higby Estates, wildfires are inevitable. One may wish to prevent wildfires, but no one can really do it. A Fire Adapted Community understands that fire in forested areas is a natural part of the forest, and takes proactive measures to survive wildfire with minimal damage.

LOCATION AND GENERAL DESCRIPTION

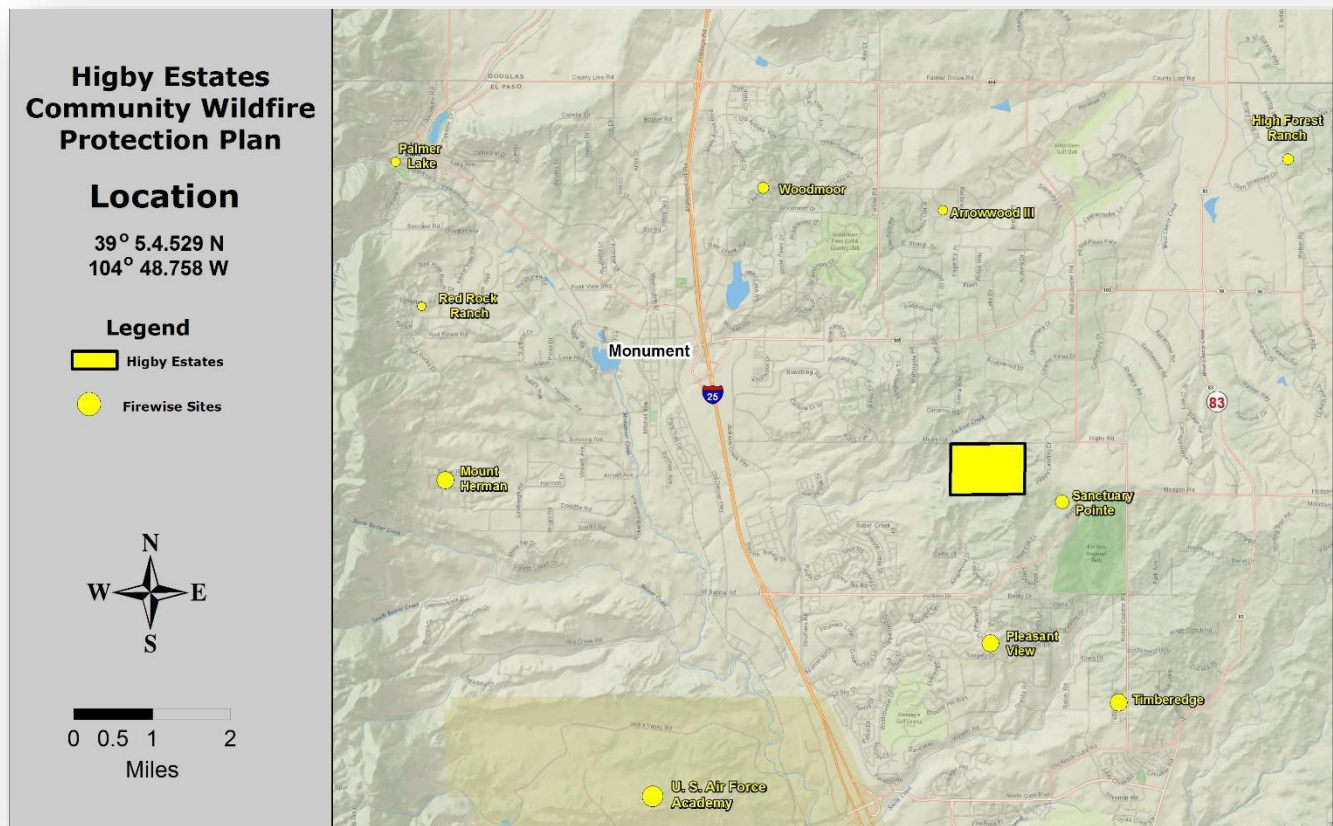
Higby Estates is located in northwestern El Paso County, Colorado about five miles east of the town of Monument. At 7,500 feet in elevation, the community is near the summit of the Palmer Divide, the high ridge that separates the Arkansas River watershed from the South Platte Watershed. A severe fire on the Divide could degrade both watersheds.

The Community is drained by several intermittent streams leading to Jackson Creek and then to Monument Creek. Aspect is west, but the intermittent streams cut much of the neighborhood into north and south facing slopes. Terrain in the western half of Higby Estates is rolling, but becomes steeper in the eastern portion.

Forests are ponderosa pine, with an occasional Douglas-fir, usually on north facing slopes. After a century of fire suppression, forests are unnaturally dense, dangerous fire risks, and in declining health. As more property owners begin to manage their forests, all these hazards will diminish.

GOALS OF THE CWPP:

- ❖ Protect safety of all residents; protect homes, property and community values from wildfire damage by reducing wildfire risk and improving wildfire preparedness.
- ❖ Obtain recognition and buy-in from community protection resources of Higby Estate's efforts to reduce wildfire risk and improve wildfire preparedness, so that they can better provide assistance, resources and support as needed.



- ❖ Engage with neighboring communities to encourage them to assess and reduce wildfire risks in their community to improve their wildfire preparedness, thereby reducing additional wildfire risk to Higby Estates and to the region.
- ❖ Maintain recognition as a Firewise USA site.

OBJECTIVES OF THE CWPP

- ❖ Conduct a risk assessment and prioritize wildfire risks and hazards within and adjacent to Higby Estates that threaten the safety and protection of homeowners and community values
- ❖ Develop and implement a three-year plan that lists and prioritizes wildfire reduction objectives and programs, with measurable action items, to motivate homeowners to reduce wildfire risk and improve wildfire preparedness and safety.
 - Provide educational information and demonstrations to increase awareness and understanding of wildfire hazard, forest health, and the need for continuous stewardship and firewise practices.
 - Provide resources to encourage and help homeowners to take action.
 - Involve all owners and residents to work together to reduce wildfire risk.
 - Develop a community-wide wildfire risk reduction strategy.

- Continue to be a recognized Firewise Site.
- ❖ Improve communication, networking and cooperation with nearby developments to:
 - Address common concerns regarding wildfire risks and forest health.
 - Learn and share information about Firewise guidelines for wildfire risk reduction.
 - Improve wildfire preparedness and safety for everyone.
- ❖ Become a Fire Adapted Community: a community that understands that wildfire cannot be eliminated, but works to protect itself through fuel reduction increasing home fire resistance and neighborhood cooperation. A fire adapted community can withstand a wildfire with little damage and firefighters are able to successfully protect the community.

All lands adjoining Higby Estates are privately owned, and all are developed or soon to be developed properties. To the southwest is Sanctuary Pointe, currently being developed on the old Baptist Camp as a Firewise Site. Building has not yet reached the boundary with Higby Estates at this point, and the forest adjoining Higby Estates is currently unmanaged. This will change as more homes are built. Grandwood Ranch to the north is unmanaged vacant land and a high fire risk. Bent Tree, also to the north, is a developed residential community. Bent Tree has some defensible spaces, but is still a high risk. Finally, the Happy Landings subdivision to the east is a largely unmitigated development with a high fire risk.

Fire History

Higby Estates and the surrounding region have a long history of fire. Before European settlement, Native Americans managed the forest by controlled burning to facilitate hunting, thwart enemies, and facilitate travel. The popular idea of a forest that was without influence of man is largely a myth. Native tribes were aggressive and effective land managers.

Removal of native tribes and arrival of settlers ended thousands of years of prescribed burning, and began the era of fire suppression. An article in the *Colorado Springs Weekly Gazette* on June 19, 1880 illustrates the new arrival's attitude toward wild-fire that burned valuable timber and threatened enterprise:

"MONUMENT, June 17th. Just now the leading subject of conversation here is the terrible drouth that has prevailed so long. . . For several weeks past the mountains west of town have been devastated by fires in the forests inflicting untold damage to the timber resources of the country. Scarcely any punishment would be too severe for those careless freighters and hunters who have been the means of such a wholesale destruction of timber."

Dry years and severe fire seasons are not new. What has changed in the last century is that fuels have accumulated to unprecedented levels, and homes occupy the increasingly

dangerous fuel beds. Only one documented wildfire has been recorded near Higby Estates in the last century, a 40-acre fire on the Baptist Camp, now Sanctuary Pointe, in April, 1965.¹ A camper dumped hot ashes in the dump and high winds fanned the flames threatening to spread the fire to the treetops. The combination of human error, dry fuel and high winds has been around for a long time.

Fire Behavior

Whether a careless human or a lightning bolt ignites a small fire, easily controlled, or a disastrous conflagration depends on three factors: fuel, weather and topography. Wildland fires have been studied in great detail to help predict fire behavior. Predicting a fire's intensity, rate of spread, duration, direction and spot-fire production is important for firefighter safety, and is the basis for tactical decisions made during suppression of a fire.



Fuel: As everyone who ever built a campfire knows, more wood equals a hotter fire. Thus, it is no surprise that wildfire risk reduction emphasizes fuel reduction as the principle strategy. Topography cannot be altered to change fire behavior, nor can weather. Reducing the amount of fuel is the only means to reduce fire intensity in advance of a wildfire.

The arrangement of fuels can also be altered to reduce wildfire risk. Continuous fuels allow a fire to move quickly over the landscape, while openings and gaps in wildland fuels slow fire spread and reduce fire intensity. Effective wildfire hazard reduction requires both reduction in the amount of fuel, and interruption of the fuel continuity.

Weather: is the major, highly variable factor affecting fire behavior (i.e., time, intensity and location).

WIND: Surface winds are the most important element in determining fire direction and rate of spread. Wind pushes flames into adjacent fuels, facilitating rapid ignition. High-velocity, warm, dry, downslope winds such as Chinook winds can cause fuels to dry rapidly, resulting in extreme fire behavior. In the Colorado foothills, winds tend to flow up valleys and slopes in the early hours as the hillsides are heated by sunlight. Winds generally shift to downslope and down valley later in the day as the temperatures cool toward evening.

RELATIVE HUMIDITY: Relative Humidity is a measure of how much moisture is in the air compared to the maximum amount of moisture the atmosphere can hold at that temperature; and it has a major influence on the moisture content of dead fuels. The smaller the dead fuel, the faster it will react to a change in the relative humidity. Cured grass can dry out in less than 15 minutes when a dry air mass moves into an area.

¹ Grass Fire in Black Forest Burns 40 Acres Tuesday. Colorado Springs Gazette Telegraph. April 21, 1965

TEMPERATURE: Before combustion can occur, fuels must reach ignition temperature (approximately 450° F). Fuels heat up to ignition temperature more quickly on hot days, and on a steep slope, fuels can be preheated from flames below and will burn at higher intensities.

CLIMATE: The main fire seasons on the Front Range tend to be split, with most large fires occurring in the late spring or fall; however, large fires can occur anytime conditions are conducive to fire ignition and spread.

Topography: *Slope* is defined as the angle of the ground relative to the horizon, commonly measured as the percentage of rise-to-run. On calm days, heated air and flames rise and preheat fuels upslope, which causes an increase in fire spread. Gentle slopes have less effect on fire behavior; steep slopes have a significant impact. Dissected terrain such as incised gullies can cause a chimney effect, increasing potential rate of spread as fire runs up the main channel and sides of the gully. The combined effect of slope and wind can cause extreme fire spread.

ASPECT: Aspect is the direction the slope faces. The community is located primarily on a west aspect, with short-reaching variations in drainages. In general, south/southwest aspects are warmer and drier. Similarly, south/southwest aspects generally have lighter fuels and more sun exposure, and susceptibility to fast-moving fires. North, northeast and east aspects generally have heavier fuels and tend to be susceptible to slower-moving surface fires.

TERRAIN: Topography influences fire behavior principally by the steepness of the slope. However, the configuration of the terrain such as *narrow draws, drainages, etc.* can influence fire spread and intensity. In general, *the steeper the slope or drainage, the higher and faster the uphill fire spread and intensity.* Drainages, even small ones, act like natural chimneys that draw air up the drainage pushing a fire with it. Homes in drainages or at the top or drainages are especially vulnerable to wildfire.

II. COMMUNITY ASSESSMENT

COMMUNITY VALUES AT RISK

The overarching value is to survive a wildfire. This means to keep everyone safe, and keep property intact as much as possible during a wildfire. Specific values to protect are:

- Safety of people, families, homes, property and pets.
- Property values, ability to sell, freedom to relocate when needed or desired.
- Home insurability and discounts.
- Privacy.
- Forest health and beauty, and ability to withstand insect and disease damage.
- Wildlife habitat.
- Enjoyment of quiet, serene, rural residential environment and lifestyle.
- Safe ingress/egress for firefighters and emergency response personnel.
- Safe evacuation for residents.

COMMUNITY OBSERVATIONS

As a part of preparation to develop the CWPP, a drive-through assessment of Higby estates was done on September 19, 2018. Present during the drive through were Jamey Bumgarner, Fire Marshall with the MTLFPD, Dave Root with the Colorado State Forest Service, and Wes Barnett, Mike Cimino, Steve Saye, Bill Shuman, Jim Steward, and Bob Schilpp, of the Higby Estates HOA. No private property was entered during the drive through, but several important observations were made.

- Homes in Higby Estates are newer and built with ignition resistant materials.
- Roofs are constructed of fire resistant (class A) materials, but some homes were observed with combustible debris on the roofs. This dangerous situation will cause a home ignition even with a fire resistant roof.
- Most homes have one or more decks, and homeowners need to be aware of and understand the wildfire hazards associated with decks. Mitigation strategies for these hazards are in Section IV of this CWPP.
- Some gutters were seen with flammable debris in the gutters, another hazardous mistake. Clean gutters anytime combustible material accumulates.
- The material used in gutters and downspouts could not be determined from the road. Plastic gutters and downspouts are flammable and should be replaced with metal.

- Driveways are generally short, but some driveways are hampered by inadequate clearance for emergency fire or medical vehicles. Driveways should have 12 feet of horizontal clearance and 13 feet of vertical clearance for emergency vehicles.
- An emergency vehicle needs adequate room to turn around at the house end of the driveway.
- Driveways are usually well marked with stone address markers and high contrast lettering. Reflective house numbers located at the intersection of the street and driveway will aid emergency responders, to locate the home in the dark or in dense smoke. Quick location of a home is critically important for medical responses.
- Most homes have some sort of artificial landscaping. While the landscaping could not be closely evaluated from the road, homeowners need to understand that some landscape plants are highly flammable and undo all the good of proper defensible space. Landscaping planned along firewise principles will enhance the benefits of defensible space.
- Throughout Higby Estates, small trees in the forest understory contribute to the high fire hazard as ladder fuels. Ladder fuels are any low branches, shrubs, grass or other fuel that will allow a fire on the ground to climb into the treetops. Once in the tree crowns, a fire may burn through the upper forest canopy and be impossible to stop.
- The annual Forest Inspection Report by the CSFS states that Higby Estates still has too much fuel in the forest. This is especially true in defensible space zones more than 30 feet from homes (zones two and three) where too many trees are too close together and the forest canopy openings are inadequate to prevent the spread of crown fires. Section V of the CWPP has prescriptions for fuel reduction for all of the defensible zones.
- Many homeowners have done a good job of removing ladder fuels, in zone one, but more needs to be done in zones two and three to reduce the threat of fire spread through the canopy.
- Many homeowners, who are comfortable pruning lower branches and removing shrubs, find the process of selecting larger trees to remove more intimidating or they believe that it is poor forest stewardship to cut taller trees. Done properly, removal of some of the larger trees reduces the wildfire threat and improves the health of the forest. For example, reducing the density of a forest stand by removing the weaker trees makes the forest more resistant to attack of mountain pine beetle and other insects. Information in section V of the CWPP will help property owners understand how to judge tree vigor and make proper selection of trees to leave and cut. Advice is also available from the CSFS Woodland Park Field Office.
- Higby Estates has no fire hydrants or water sources for firefighters to use during a wildfire or home fire.

EMERGENCY EVACUATION



There are two entrances to Higby Estates, both on Colonial Park Drive. The road makes a long, meandering switchback through the community, and each end intersects Higby Road about one-half mile apart. Four separate cul-de-sacs intersect Colonial Park Drive, and vary in length. The longest is about 0.25 long, and all the cul-de-sacs have adequate space at the ends to turn an engine around. Street signage meets current standards.

NOTICE TO EVACUATE: In case of a fire or other emergency, the primary notification to evacuate will be issued by the El Paso County Sheriff by means of a reverse 911 call. Residents should follow directions provided in the recorded message. Other notifications may come from local TV and radio stations.

Reverse 911 calls are automatically routed to land lines, but not to cellular phones. Residents who rely only on cellular phones should register their cell phones at:

<http://www.elpasoteller911.org/246/Emergency-Notification-System>

EVACUATION ROUTE: It is important to recall that the fatalities in both the Waldo Cañon and Black Forest Fires were of residents who did not evacuate in time. In the event of a fire, the El Paso County Sheriff will determine the best evacuation routes and procedures

based on expected fire behavior. Residents should heed the evacuation instructions given by the Sheriff without delay! If a fire is threatening the area, it is not necessary to wait for an evacuation order to leave.

The primary evacuation route is Colonial Park Drive to Higby Road. The road is a paved subdivision road, but during an evacuation, and the certain panic that involves, it is possible that escape by residents or access by firefighters could be compromised. Higby Estates, in cooperation with fire authorities from Monument-Tri Lakes Fire Protection District, and the El Paso County Sheriff's Office, should conduct mock evacuation exercises to prepare the community.

The safety of streets in Higby Estates as an evacuation routes has benefited by the fuel reduction completed by homeowners, but improvements are still

Evacuation Tips:

In Advance of an Evacuation:

- **Know two ways out of your neighborhood, and be sure everyone in your family knows them.**
- **Practice an emergency evacuation plan with everyone in your family.**
- **Arrange a safe meeting place for separated family members.**
- **Designate a friend or relative as a contact for separated family members.**
- **Assemble an emergency supply kit containing important documents, medications, and personal I.D. Be prepared to stay away for at least 72 hours.**
- **Know how to shut off natural gas or propane at the meter or tank.**
- **Know of any elderly or disabled persons in your neighborhood who may need assistance.**
- **Arrange with a friend or relative outside the area to care for pets or livestock.**
- **Have a pet "go kit" ready.**

When a wildfire threatens:

- **Back the car into the garage with the keys in the ignition, the car door unlocked, and the garage door set for manual operation.**
- **Load your emergency supply kit and pet to go kit into the car.**
- **Keep pets together in a single room.**
- **Keep the family together and take only one vehicle.**
- **Wear long pants, long sleeves, sturdy shoes, work gloves and a handkerchief to cover your face.**

necessary. Reduction of fuel along the roads reduces wildfire intensity along the community's escape and access routes, and creates fuel breaks within the subdivision where firefighters have the best opportunity to halt a wildfire.

Some landowners have done no work along the roads, often because of a desire for privacy, or simply because they do not understand the necessity of safe escape and access. The community's wildfire outreach activities should emphasize the danger to motivate the residents.

Another potential evacuation hazard is the thickets of young trees that have grown along the cut banks of the roads.

These are pockets of fuel that can burn intensely, and as they grow, the hazard will increase. It is not necessary to cut all the trees, but the young trees should be thinned to separate the tree crowns and remove ladder fuels as recommended for small trees. As the trees grow, additional thinning and pruning will be required.

While residents within Higby Estates have shown commendable effort improving the safety of emergency routes within the community, once they exit the community conditions are significantly more hazardous. The only current evacuation route away from Higby Estates is via Higby Road either east to Roller Coaster Road or west towards Jackson Creek Parkway. Higby Road



Heavy fuels right up to the pavement will make evacuation from Higby Estates, or access for firefighters dangerous. Life, safety and property depend on safe ingress and egress.



Evacuation safety does not improve on Higby Road. Both sides of the road are choked with fuel.

is a paved, two lane section road without shoulders. Evacuees from Higby Estates will join frightened individuals from many other subdivisions, more traffic than this road was intended to handle. Firefighters attempting to reach the fire will be delayed by the residents fleeing, causing delays and more hazard.

In either direction dense fuels adjoin the roadway, fuels heavy enough to trap anyone foolish enough to ignore or delay evacuation. The safety of roadways is not simply a matter of clearing flammable vegetation from the rights of way, as the right of way extends only a few feet either side of the pavement. Simply clearing from the right of way will not adequately protect the public. Thinning of brush and trees for 50 to 100 feet, depending on the type of vegetation, from the pavement edges will give the public and first responders the best protection. Safety of primary evacuation routes should be a joint effort between governments and private landowners whose properties adjoin the roads.



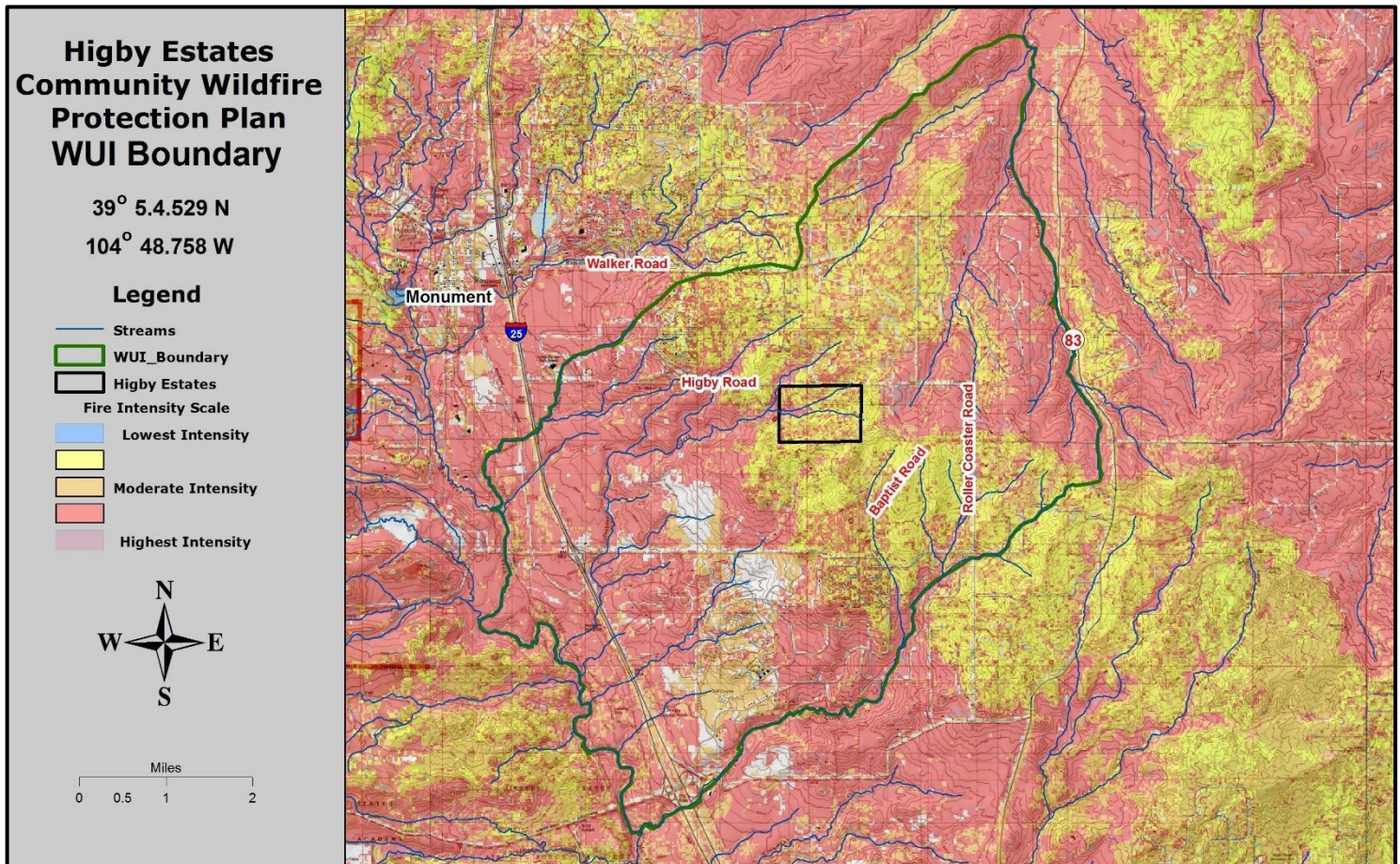
The road conditions during the Black Forest Fire. Imagine this as your evacuation route.

WILDLAND URBAN INTERFACE BOUNDARY

Just as fuel conditions along roads far from Higby Estates effect the safety of the community, so do the fuels in adjoining communities and properties. The fuel reduction done in Higby Estates benefits neighboring communities. Fuel reduction, or the lack of, in adjoining neighborhoods benefits or threatens Higby Estates. The wildland urban interface (WUI) boundary is defined as the area where a wildfire would be a threat to the community. Leadership by example in Higby Estates can lead other communities to follow.

The fire intensity information used for the WUI boundary comes from the Colorado Wildfire Risk Assessment Portal (CO-WRAP), a GIS based program, used to compare wildfire risk across the state. CO-WRAP does not predict fire behavior at a given moment in time, but compares the relative hazard over the landscape. The WUI boundary is determined by considering the three components of wildfire behavior, weather, fuel and topography.

A first consideration when establishing any WUI boundary is firebrands. Firebrands are burning embers generated by the flame front carried aloft by the winds associated with the fire. Under severe conditions, firebrands may be deposited a mile away from the flames. In fact, about half the homes lost during wildfires are never touched by the flames, but are ignited by firebrands falling from the sky. Thus, the minimum WUI boundary must be a one-mile radius from Higby Estates. A simple one-mile radius, however, does not consider the influence of fuel, weather and topography.



Weather is the unknown when predicting potential wildfire behavior. Prevailing winds are usually, but not always, from the west. Fires are most likely to be intense during dry periods, typically late spring and fall, but fires occur 12 months a year. There really is no “fire season”.

When interpreting CO-WRAP data, understand that CO-WRAP predictions are based on the average of historical weather over time. Thus, CO-WRAP does not predict fire behavior on any given day, and weather conditions at the time of a fire greatly influence actual fire behavior and spread. For example, both the Waldo Cañon and Black Forest fires burned during the most severe fire weather and not on average days.

The Palmer Divide dominates topography in the area, and Higby Estates sits near the summit of the Divide. As fires tend to burn uphill and follow drainages, fires on either side of the Divide can pose a threat to Higby Estates. The drainages of Monument Creek on from the west and West Cherry Creek to the northeast can be expected to draw a wildfire close to Higby Estates.

Fuels surrounding Higby Estates are varied. They include open grasslands, Gambel oak and ponderosa pine with a Gambel oak understory. All are capable of high intensity wildfire behavior, and present a serious risk.

Thus, the western WUI Boundary was established as Monument Creek where terrain and prevailing winds would push a fire up the tributary drainages toward Higby Estates. On the north, the boundary follows Teachout Creek. Fire following the tributaries of this creek could come close to Higby Estates. Once across the Palmer Divide the north WUI boundary follows the ridge between two tributaries of West Cherry Creek to the creek itself. The Eastern boundary follows West Cherry Creek south to its origin on the Palmer Divide, then across to the headwaters of Smith Creek. The southern boundary then follows Smith Creek to its junction with Monument Creek.

POST-FIRE EROSION AND FLOODING

It would be plausible to argue that the WUI boundary could extend as far as Pueblo. Fires do not end when the flames are gone and the smoke clears. Often, the worst is yet to come with flash flooding and erosion. Another massive fire along the Palmer Divide would send floodwater and tons of sediment toward the Arkansas River. Higby Estates, at the top of the Palmer Divide would be expected to avoid the worst of flash floods and massive erosion, yet localized flooding and erosion will surely follow any high intensity fire.

A check of the Natural Resources Conservation Service's *Soil Survey for El Paso County Colorado* shows that the soils in the watershed above Higby Estates have a high potential for damage by wildfire. Homes, property and the natural environment are at risk before and after a fire, another strong reason for Higby Estates and the surrounding communities to work together for mutual protection.

PREPAREDNESS TO RESPOND

Higby Estates is in the Tri-Lakes Monument Fire Protection District. The closets Station is located at 18460 Rollercoaster road.

Professional Wildland Fire Response Services: This section of the CWPP details resources available to respond to emergencies associated with wildland fires impacting neighborhood residents and structures. Professional responders are always the front line in addressing wildfire, rescue, and medical emergencies.

For wildland fire emergencies endangering residents, the first line of responders is the Tri-Lakes Monument Fire Protection District (TLMFPD). If this responder finds that the fire is beyond their capability to suppress,

TLMFPD is a member of a mutual aid consortium of eight fire departments. . . Up to 10 trucks and 46 fire-fighters are initially dispatched to every fire.

the Incident Commander on scene will request additional assistance through Automatic Response from both within and outside El Paso County. El Paso County Emergency Services will also provide assistance, and TLMFPD will coordinate these services.

TRI-LAKES MONUMENT FIRE PROTECTION DISTRICT RESOURCES: The TLMFPD is the first responder to a sighted or reported wildland fire threatening the environs surrounding Higby Estates. TLMFPD has three stations: Station 1 at 18650 Highway 105; Station 2 at 18460 Roller Coaster Road; and Station 3 at 1855 Woodmoor Drive.

The current daily staffing of 15 personnel includes 1 Battalion Chief, 3 Company Officers (Captains or Lieutenants), and 11 Firefighters/Emergency Medical Technicians (EMTs). They are organized into teams, or crews, that operate two Advanced Life Support Ambulances, two Engine Companies, and one Truck Company. In the event of a structure or wildland fire, the ambulance crews become members of the Engine, Truck or Brush Truck crews. Fire engine quantities and *National Wildfire Coordinating Group* (NCWG) include: 3 – Type 1 (pumpers) and 4 (Type 6 (brush).

TLMFPD is a member of a mutual aid consortium of eight fire departments in northern El Paso County and southern Douglas County. A fire alarm call to Tri-Lakes automatically goes to the other departments who send at least one truck and crew to the address of the potential fire. Thus, up to 10 trucks and 46 firefighters are initially dispatched to every fire.

TLMFPD WILDFIRE STRATEGY: The TLMFPD response time goal for the department is to reach any location in the Tri-Lakes Monument district in 8 minutes or less. The average response time for Higby Estates is close to 5 minutes. If the severity of the fire warrants, additional personnel and equipment can be requested from other fire departments including those from Colorado Springs, state, and federal agencies.

The El Paso County Sheriff's department will be notified soon after the "Incident Commander" (*officer in charge of the first response team of firefighters*) evaluates the fire situation and determines additional assistance is required. Upon arrival, the sheriff's deputies would receive instructions on which roads should be closed and inform residents to evacuate their homes if recommended by the Incident Commander. Officers from the Monument Police Department, Palmer Lake Police Department, and Woodmoor Public Safety would assist the sheriff's deputies with their duties.

The priorities of the "first responding" firemen are: 1) Insure the safety of the lives of the firefighters and people (residents) in and near the fire ("incident"); 2) Evaluate the fire situation, assign firefighters to specific duties to control and suppress the fire, and notify the sheriff and other agencies on the situation; and 3) Restrict the loss of homes and other property.

TLMFPD EMERGENCY MEDICAL SERVICES: TLMFPD provides first response emergency medical services to the neighborhood. Below is the breakdown of TLMFPD emergency personnel resources and staff.

- 50 firefighters/EMTs/paramedics

- Daily staffing of 15 personnel on call 24/7
- Population served: approximately 24,000 residents over 68 square miles

TLMFPD WATER RESOURCES: TLMFPD currently has emergency water supplies located throughout the district. Other supplies may be available if needed through the use of small bodies of water close to or in the district.

SAFETY ZONES/STAGING AREAS: During emergencies, it may be necessary for residents and emergency services providers to reach a safe place that is outside of the affected part of the community. TLMFPD, in conjunction with other wildfire authorities, recommends establishment of Civilian Staging areas outside the neighborhood. These can be used as reasonable safe areas or temporary refuge from wildfire threat, and can serve as staging areas to allow timely and orderly evacuation of residents, as well as for staging areas or fire fighter safety zones for marshaling resources within the community.

INTERNAL VOLUNTEER SERVICES AND COMMUNICATIONS: Other than staff, TLMFPD does not currently support any volunteer or paid groups that can be used in communication support or augmentation of professionals in the event of a wildfire emergency. It is strongly recommended that the property owners implement operating agreements with TLMFPD that allow for use of properties and facilities during emergencies. Additionally, TLMFPD recommends development of a community emergency and evacuation plan, including a resident emergency communications tree (phone, email, text).

For residents during a wildfire event, lack of accurate and timely information has proven to be a major concern and frustration. Local media is limited in the type, accuracy and timeliness of emergency related reporting they can provide. Residents may be away from home and community during the emergency, yet be extremely concerned about safety and location of family members and pets. Recommended information sources include El Paso County web sites and the El Paso County Sheriff's Office (EPSO); the latter may have an emergency phone line established for providing information.

For 2019, the Firewise Committee intends to develop an emergency response plan for interaction with emergency services providers. This needs to be developed prior to emergencies and allow access for designated representatives to the Incident Command Center or Outpost. In effect, this representative could provide accurate and timely information for distribution over existing community networks (web site, phone trees, and office staff).

El Paso County Emergency Services

Under the El Paso County Office of Emergency Management (OEM) Division, the El Paso County Sheriff's Office provides umbrella incident management and the agency coordination structure for response and recovery from a wildland fire event(s). Every wildland fire emergency incident that occurs in El Paso County utilizes the Incident Command System (ICS) during response and recovery activities, employing multi-agency operational structures.

The OEM mission is to ensure that local governments within El Paso County have the operational capability to survive a disaster, and to manage and conduct essential emergency functions. This capability of managing a survival crisis includes the ability to direct, control, manage, and coordinate emergency operations within jurisdictions in cooperation with other

local governments and liaison with the State and Federal government. To accomplish this, OEM maintains and develops a capability built on people (volunteers), communication equipment, and plans.

EMERGENCY OPERATIONS CENTER (EOC): The El Paso - Office of Emergency Management (EP-OEM) has operational responsibility for the EOC, a highly specialized facility with experienced personnel and equipment that is specifically designated for use in emergency situations. The EOC is a vital management resource that serves as a *command center* with specialized communications equipment; an *operations center* for government officials, volunteers and special agencies; and an *information center* that analyzes and disseminates information. The OEM office develops exercises and scenarios to test staff and communications to ensure the facility and its plans are fully functional.

The Federal Emergency Management Agency

COMMUNITY EMERGENCY RESPONSE TEAM: (FEMA) has multiple training programs and courses for training local residents in dealing with multiple hazards, such as wildland fires. The voluntary *Community Emergency Response Team* (CERT) program provides life-saving knowledge and valuable emergency skills is highly recommended. CERT training can be organized under TLMFPD and EPC-OEM. These voluntary groups are only used when professional first responders cannot respond, and then can only be activated by authorization of the Emergency Services Manager or the Chief of the local Fire Protection District.

El Paso Sheriff's Office Wildland Fire Crew (EPSOWF)

EPSOWF provides engine crews and Type II hand crews for all ranges of wildland fire suppression from initial attack to mop-up, prescribed burns, and urban interface protection. In addition to fire suppression activities, and as a public service, crews can also provide training and education. Each fire department is responsible for "red card" and wildland fire training activities for each fire department throughout the county. They also assist the USFS, BLM, CSFS, Department of Defense (Air Force, Army, National Guard), and National Park Service.

Critical Utilities

In the event of a wildland fire that would impact the neighborhood, TLMFPD or EP-OEM Incident Command dispatcher would notify critical utilities for their support. Specifically, utilities emergency involvement would focus on emergency responder safety, and direct support of mitigating the emergency event.

FOR EMERGENCY RESPONDER SAFETY: Damaged, destroyed or threatened gas services and electrical distribution facilities can pose significant safety issues to the public and emergency response personnel. Direct intervention for disconnection, reconstruction or rerouting would be directed by:

Natural Gas: Black Hills Energy 800-694-8989

Electrical Power: Mountain View Electric Association 800-388-9881

For Direct Support: For northern El Paso County residents, water and communication resources in support of an emergency event will be provided or directed by:

Water Districts:

Town of Monument	719-481-2954
Woodmoor Water & Sanitation	719-488-2525
Tri-View Metropolitan	719-488-6868
Forest View Acres	719-487-1412
Donala Water & Sanitation	719-488-3603

Wire-Line Communications

(CenturyLink)	800-573-1311
Qwest alternate	800-603-6000
Comcast	800-934-6489

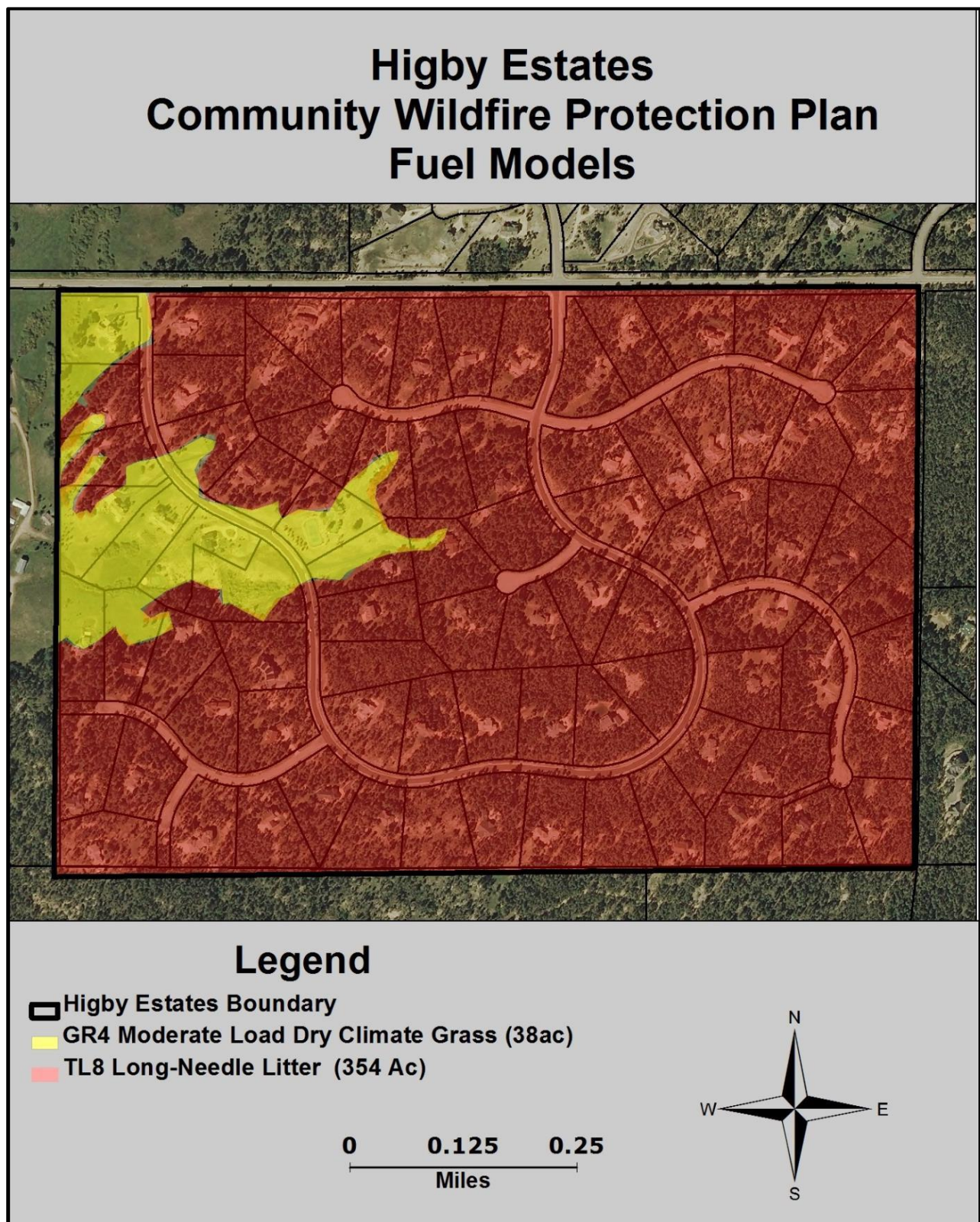
Any request for utilities support in an area impacted by an emergency wildfire event must be authorized by the on-scene Incident Command. Any work performed in an impacted area can be requested only by on-scene Incident Command through the Designated Dispatch Center.

Railroads

EP-OEM, through its dispatcher, provides direct contact with the railroad in the event trains should be stopped to allow evacuation of civilians.

Burlington Northern & Santa Fe	800-832-5452
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III HIGBY ESTATES WILDFIRE RISK



Weather, topography and fuel are the basis to determine the fire hazard within Higby Estates as well, but with the smaller scale within the community a more detailed analysis than the large scale CO-WRAP data is possible. Determination of the wildfire hazard began by typing fuels on an aerial photograph. Fuels were grouped using standard fuel models developed by Scott and Burgan.² Fuels of similar types, such as grass or dense conifer, are expected to burn with predictable intensities under similar weather conditions and topography.

FUEL MODELS

The fuel model outputs used here, rate of spread and flame length, serve to estimate the severity of a wildfire. Rate of spread is straightforward. It is how fast the fire will move across the landscape when the mid-flame wind speed is 20 miles per hour.

Flame height requires more explanation. The heat produced by a flame is related to flame length, and longer flames produce more heat. When flame lengths exceed four feet, lethal amounts of heat are produced, and firefighters cannot dig control lines next to the fire. The firefighting strategy then becomes one of indirect attack, and firefighters fall back to a safer area and work to halt the fire when it reaches them. Everything between the control line and the flame front is sacrificed for safety.

Two fuel models are found in Higby Estates:

GR4: MODERATE LOAD **DRY CLIMATE GRASS:**

(Corresponds to National Wildfire Coordinating Group Fuel Model 2) The fire burns through a continuous fuelbed of grass, and may spread rapidly depending on wind speed. The model predicts that in



The grass fuel type is located in the meadows in the northwest. Grass presents a threat unless it is mowed as around this home.

² Scott, Joe E. and Robert Burgan. 2005. *Standard fire behavior Fuel Models: a comprehensive set for use with Rothermel's surface fire spread model*. General Technical report RMRS-GTR-153. Fort Collins, CO U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

dry grass fuel and winds speeds greater than 20 MPH, the fire would spread at 6.0 miles per hour. With flames lengths in excess of 25 feet.

Fire behavior of grass fuel is greatly affected by long and short-term weather. The moisture content of live or dead grass changes rapidly with weather. Dry grass may be able to ignite and burn within hours of a rain or snow shower. The amount of grass fuel present depends on long-term weather. Wet springs will encourage dense growths of grass, which by fall will cure and create a large amount of dry fuel.

Grass fuels present another hazard not considered by fuel models. Homeowners often assume that grass fuels do not pose as serious a wildfire threat as timber or brush, but many homes have been lost in grass fires. Grass fires are often wind driven and move with frightening speed. Fuel reduction around homes in grass is as necessary as in forests fuels.

TL8 LONG-NEEDLE LITTER: (Corresponds to National Wildfire Coordinating Group model 9) These are the dense forest stands with a closed forest canopy. Fire burns through the litter, fallen needles and downed wood, on the forest floor. If the fire stays on the ground with wind speeds of 10 MPH, the model predicts moderate rates of spread at 0.6 MPH, and flame lengths of ten feet.

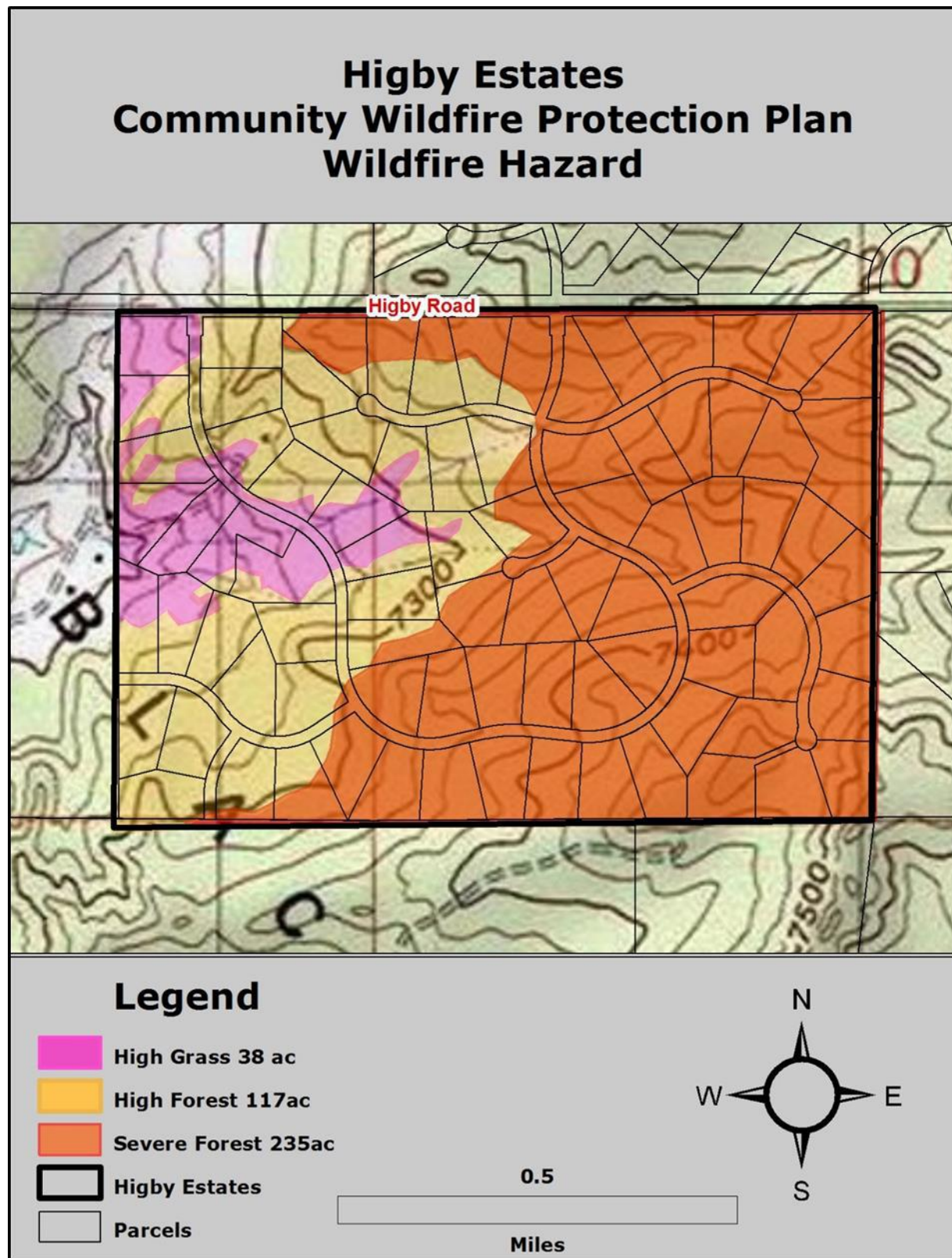


Doghair, or trees that are thicker than the hair on a dog's back, make up much of fuel model TL8. They are extreme hazards both as large concentrations of fuel and as ladder fuels.

But the greatest hazard in this fuel type is that the fire will climb into the canopy and spread through the trees with flame lengths in excess of 100 feet. This forest type has abundant lower limbs that will act as ladder fuels, fuel that allows a ground fire to reach the tree tops. This type of fire, a crown fire, generates large amounts of firebrands that threaten homes far from the fire front and is fire that is the most destructive to property and resources. During severe weather, crown fires are unstoppable.

WILDFIRE HAZARD

The fuel types were then transposed to topographic maps to determine how topography would interact with fuel to produce a level of fire behavior. The steeper terrain in the



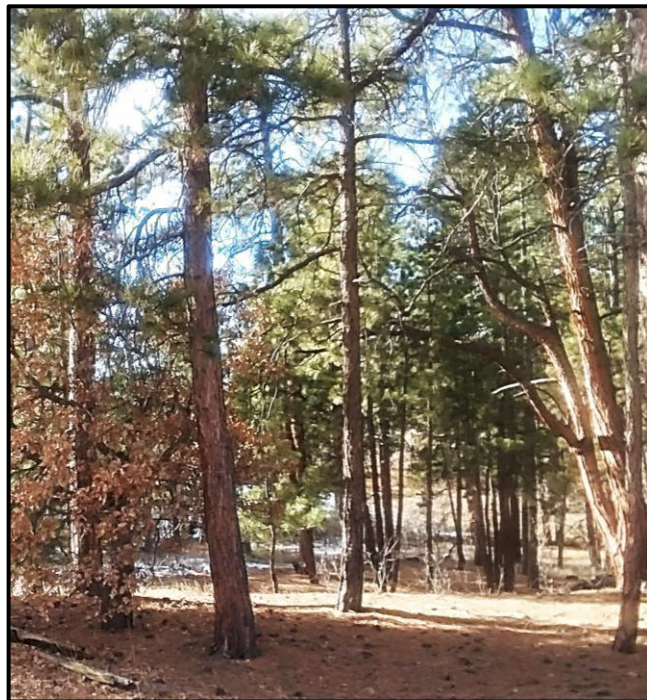
eastern half of Higby Estates would significantly increase the intensity of a wildfire under any weather conditions.

Weather is always an unknown, and the weather assumed to reach the final hazard rating was hot, low humidity and strong winds. The labels for fire hazard here are the worst-case scenario.

Finally, the preliminary hazard map was reviewed and ground-truthed by the CSFS, Tri-Lakes Monument Fire Protection District, and the Higby Estates Firewise Committee during a joint tour of the community held on September 19, 2018. Based on the on-the-ground observations, several alterations were made to produce the final map seen on the previous page. Three hazard ratings were observed:

HIGH HAZARD, GRASS: The meadows in the northwestern portion of the community were deemed a high hazard because of the ease with which dry grass ignites and the possibility of a rapid wind driven fire.

HIGH HAZARD FOREST: Overall, the closed forest canopy and abundant ladder fuels give these areas a high risk. A wildfire, once in the crowns would find continuous fuels and burn intensely. Individual lots with open canopies and reduced ladder fuel may have a lower risk.



The high wildfire hazard forests are characterized by dense doghair ladder fuels in the understory and a closed forest canopy above.

Wildfires will have an easy path to the upper canopy and can become raging crown fires.

The doghair should be heavily thinned both to increase safety and to develop a healthy forest.

SEVERE HAZARD, FOREST: The amount and arrangement of the forest fuels differs little from the high hazard forest, but the steeper terrain is enough to intensify the fire behavior over the flatter areas of the community.

IV Risk of Home Ignition

THE HOME IGNITION ZONE

When preventing home loss, the wildfire hazard in surrounding vegetation is only one half the equation. The other half is the home itself. Home survival during a wildfire depends on reducing the intensity of the fire in the surrounding fuel, and the ignition resistance of the structure itself.



Higby Estates is located in a wildfire prone environment. Wildfire exclusion is not a choice. The variables in a fire scenario are when the fire will occur and where. A house burns because of its interrelationship with everything in its surrounding home ignition zone----the house and its immediate surroundings. To avoid a home ignition, a homeowner must reduce the wildfire intensity surrounding the home, and make the home as resistant to ignition as possible.

HOW STRUCTURES CATCH FIRE

There are three ways that a wildfire can transfer itself from natural vegetation, or from 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 radiator heats rooms in the wintertime. Radiated heat is capable of igniting combustible materials from a distance of 100 feet.

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 or brush near a structure ignite and the flames touch a flammable part of the structure.

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

A 2006 report by Traci Weaver emphasized the danger of home ignitions from burning embers.¹ 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 burning 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 unburned trees in the background show that no flames touched this home destroyed in the Black Forest Fire. Windborne firebrands falling on combustible material on or near the home caused the loss.

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*.² 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, fires burning up to the foundation in the grass and herbaceous plants, or by 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.

¹ Weaver, Traci, (2006): *Texas Fires Shed New Light on What it Meant to be Firesafe*. Texas Forest Service.

² Graham, Russell T., (2003): *Hayman Fire Case Study*. USDA Rock Mountain Research Station, Report RMRS-CTR-114.

Flammability of roofs, siding materials, and other house construction features raised or lowered the risk of flames igniting homes.

HOME IGNITION:

The construction materials, location and even the shape of a structure influence its vulnerability to wildfire.³ 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 a wildfire helps residents plan defensible space projects to compensate for construction differences. When remodeling or home improvement projects are contemplated, plans can be made to reduce the ignitability of the buildings.

**Decks and
roofs are the
most vulnerable
parts of a
structure.**

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

The only fire safe material beneath a deck is bare earth or rock mulch. Countless homes have been lost because of firewood, scrap lumber, even gasoline stored beneath a deck. Even motorized equipment, when left under a deck, with gas in the tank has caused home losses. Ideally, the underside of decks should be enclosed by a non-combustible material. When decks are rebuilt, use fire resistant materials.

The National Fire Protection Association (NFPA) has published new research on the vulnerability of decks, and the NFPA recommendations based on the new research follow on the next page.

Carefully consider the landscaping in the vicinity of decks as well. Avoid planting flammable shrubs, such as junipers, anywhere near a home. 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 restive roofs are extremely important. 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.

³ Slack, Peter, (2000): *Firewise Construction: Design and Materials*. Colorado State Forest Service.

AUGUST 2017 EDITION



WILDFIRE RESEARCH FACT SHEET



Reduce the Vulnerability of Your Deck to Wildfire

MANY HOMES LOCATED IN WILDFIRE-PRONE AREAS HAVE ATTACHED DECKS, WHICH CAN POTENTIALLY SPREAD FIRE TO THE HOUSE WHEN IGNITED DURING A WILDFIRE.

A burning deck can ignite siding or break the glass in doors or windows, allowing fire to gain entry into the house. Consequently, making decks less vulnerable to wildfire also makes your house less vulnerable. Reducing the deck's vulnerability requires an approach that focuses on the materials and design features used to build the deck, and creating a noncombustible zone around and under the deck.

EMBER EXPOSURE AND IGNITION

Walking surfaces of decks are either solid surface or constructed using deck boards (with between board gaps). Solid surface decks are commonly light weight concrete or tile. Combustible deck board types include: solid wood and wood-plastic composites (these products are more widely used than noncombustible deck boards). Noncombustible deck board types include: metal and fiber cement.

Recent testing at the IBHS Research Center showed embers mostly lodge between deck board gaps and where deck boards rest on joists. Embers can accumulate and potentially ignite decking and combustible joists. Embers can also fall through board gaps and land on materials stored beneath the deck. It's critical to remove all combustible materials from the under-deck area to minimize the opportunity for ignitions; where resulting flames would impinge on the decking (some wood-plastic decking products are vulnerable to flaming exposures).

IBHS tests also showed that even without vegetative debris in between deck gaps, medium density softwood decking products, such as redwood or western redcedar are vulnerable to ember ignitions. Most wood-plastic composites, along with higher density tropical hardwood, and fire-retardant treated decking products are less vulnerable to embers. The vulnerability to embers in these locations is a reminder to remove debris that accumulates in these areas.

BUILDING CODE REQUIREMENTS

The International Wildland Urban Interface Building Code (IWUIC) and the California Building Code are the most commonly referenced construction codes for wildfire-prone areas; both include requirements that focus on the walking surfaces of decks. Noncombustible products are allowed by both codes.

The California Code provides provisions for accepting combustible decking products. These types of products are more commonly used by homeowners living in wildfire-prone areas across the country. Their requirement governs the amount of heat released when

combustible decking is ignited by a gas burner. This mimics burning debris that could be located under the deck, or burning vegetation impinging on the underside of the deck, but does not mimic ember exposure. Combustible decking products that comply with the California Code can be found at: http://osfm.fire.ca.gov/licensinglistings/licenselisting_bml_searchcotest.

The IWUIC prohibits common combustible deck boards with the exception of fire-retardant treated decking (rated for outdoor exposure) and other materials

Photo Captions:

- A** Embers that pass through deck board gaps will land on the ground, or on combustible materials stored under the deck, as shown during this IBHS test.
- B** The near home noncombustible zone that surrounds the foundation should include a noncombustible area underneath the deck.
- C** Vegetative debris in between deck board gaps will make this location even more vulnerable to ember accumulation.

RECOMMENDATIONS FOR YOUR DECK:

- 1** Combustible materials should not be stored beneath decks. This will effectively create a noncombustible zone under the entire footprint of the deck.
- 2** Routinely remove debris that accumulates in between deck board gaps and debris that can accumulate at the intersection between the deck and house.
- 3** If the deck is a non-fire-retardant treated softwood deck, consider removing and replacing deck boards within a few feet of the house. Be careful to match the deck board thickness.
- 4** When building new decks, select deck boards that comply with the California Building Code requirements. If using wood joists, cover the top and part of the sides with a foil-faced bitumen tape product.

that meet the requirements of an Ignition Resistant Material. However, as of this date, no other materials meet these requirements. The IWUIC allows an enclosed deck option that uses a horizontal construction attached to the bottom of the deck joists. This option should only be used with a solid surface deck. Using this option with deck boards (and the associated gaps), will cause moisture-related degradation problems (corrosion of fasteners and wood rot). Water from rain or melting snow will easily get into the enclosed space and will have a much harder time getting out.



FIREWISE USA®
RESIDENTS REDUCING WILDFIRE RISKS

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 or 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, dormer windows and gutters. Where wind currents and eddies deposit combustible debris, firebrands will also be deposited. Combustible debris should be removed from roofs and gutters whenever it accumulates.

A few homes in Higby Estates may have metal roofing, a class A fire resistant material, however, home autopsies have shown that the small ridges in metal roofs where one panel over lays another can be openings where fire brands may collect directly on the plywood sub-roof, leading to ignition of the plywood. The holes underneath such ridges should be plugged with caulking or a similar material.

Any home with a wood burning stove or fireplace should have a well-maintained spark arrestor on the chimney.

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 gasses 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° angle. This reduces the amount of heated air and fire brands that might be trapped.

Vents in attics 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 eave as possible. Vegetation around foundation vents can create unintended vulnerability, particularly on the downhill side of the home, so landscaping with noncombustible mulch within three to five feet of the foundation and underneath decks or porches is essential.

Fire resistance of windows and doors should be considered. 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 resist cracking longer than single pane 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 to ignition it will be. Metal doors are far superior, and glass in doors is subject to the same vulnerabilities as window glass. Weather stripping in outside doors will help prevent fire brands from entering a home.

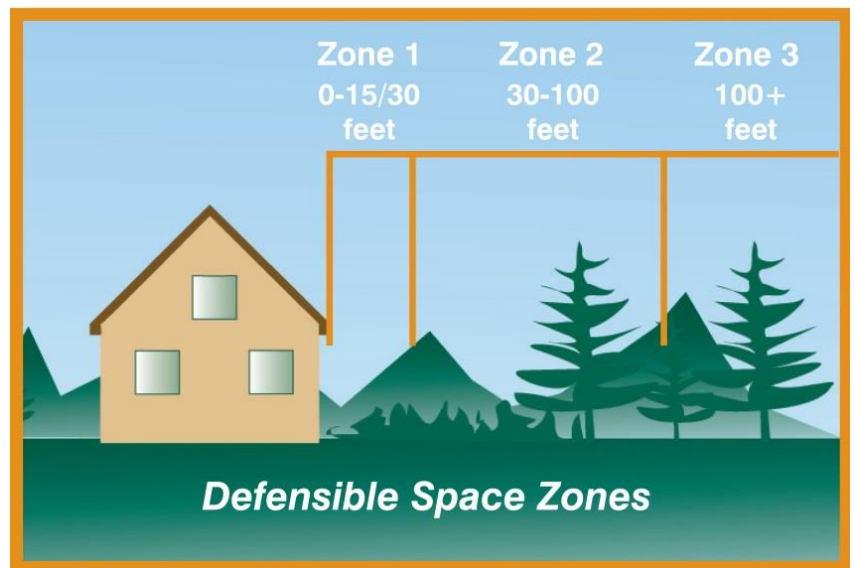
V PRESCRIPTIONS FOR WILDFIRE HAZARD REDUCTION

DEFENSIBLE SPACE VS. 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 fuel break thinning away from structures to reduce severe fire behavior, 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 of the forest conditions existing on the area in question.

DEFENSIBLE SPACE

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 and increase the spacing between trees. Fuels are reduced according to prescriptions for each zone.



ZONE ONE: This is the closest zone to a structure and extends 30 feet from the outermost edge of a structure including any decks or outbuildings. The management goal is to reduce or eliminate most large trees or shrubs within this zone so that the convective heat will not ignite the structure. Within 15 feet of the structure, remove most conifers. A few tall trees may be left close to the home if the lowest branches are pruned so that they are well above a class A roof. It is best to limit this to one or two trees near a structure. Treat such trees as part of the structure and, create 15-30 feet of defensible space beyond the tree.

While it is crucial 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.

Landscaping and Defensible Space: Most homeowners in Higby Estates have some degree of landscaping surrounding their home. Well-designed landscaping can increase the effectiveness of defensible space, but poorly designed landscaping will undo all the good of defensible space.

Landscaping should follow the same logic as defensible space. The amount and continuity of fuel in landscaping should be minimized to the greatest extent possible. Landscaping with deciduous trees, due to their lower flammability, is superior to landscaping with conifers. The blue spruce found in many Higby Estates landscapes can increase the fire hazard because of the lower limbs touching the ground. The lower limbs of spruces should be trimmed as for other conifers. Fact Sheets about *Firewise Landscaping* and *Firewise Plant Materials* are found in Appendices D and E respectively.

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 out 70 feet from zone one (100 feet total distance around the house). As slopes increase, increase the width of zone two on the downhill side of the house, and increase the spacing between tree crowns.

Firewise Landscaping

- **Never plant junipers or other flammable species in defensible spaces.**
- **Maintain five feet of bare earth or rock mulch around foundations, and decks.**
- **Never plant tall, shrubs with woody stems or branches around foundations or near decks.**
- **Never plant within five feet of windows or foundation vents.**
- **Increase spacing between plants in zone one.**
- **Use low growing succulent plants in zone one.**
- **Plant in small irregular clusters or islands**
- **Stone or gravel paths break up fuel continuity and enhance defensible space.**
- **Keep plants and grass well irrigated.**
- **Plant shrubs in wide separated patches and in openings, not beneath trees.**
- **Plant recognized firewise plants from the list in Appendix D and E.**

The fuel reduction guideline for zone two is to thin the trees to an average spacing of 10-foot crown separation. 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 greater than 25 feet tall should be pruned to a height of 8 feet above ground, but smaller trees should have at least two-thirds of the green branches remaining.

Firefighters must be able to escape quickly if conditions suddenly deteriorate. Zone two should extend along both sides of driveways for a width of 50 feet from each edge of the drive. To provide adequate clearance for large structural fire trucks, 12 feet of horizontal clearance and 13 feet of vertical clearance should be maintained. At the end of driveways, there should be adequate room for fire engines to turn around.

ZONE THREE: Zone three extends from the outer edge of zone two to the property line. The guideline for zone three is to thin the forest primarily to improve forest health. Spacing is less critical in this area, but openings should be made in the canopy. A useful rule of thumb is that a tree should receive sunlight from all four sides.

FOREST HEALTH AND WILDFIRE MITIGATION

Fuel reduction is not simply a matter of removing a certain volume of wood from the forest. It requires that fuel be removed in a way that also enhances the health of the forest and achieves the objectives of the property owner. As noted in the introduction, before European settlement, frequent, low intensity fires maintained open forest stands.

Reconstruction of fire history and forest dynamics in the neighboring upper South Platte landscape, located 30 miles 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 The Hayman Fire in 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. In 2002 the study area burned in the Hayman Fire.

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

The information that follows is intended to be a general and highly simplified summary of some basic concepts of forest management. It is only intended to give the reader an idea of how foresters approach the process of prescribing treatments for fire mitigation and other objectives. The recommendations here apply only to ponderosa pine forests and are not necessarily appropriate in other forest types. When planning any sort of forest management, 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. A site visit can be scheduled with private consulting foresters, or with the CSFS Woodland Park Field Office at (719) 687-2921.

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.

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 sunlight for germination and those that require shade.

PONDEROSA PINE

The Forest in Higby Estates is ponderosa pine with a few Douglas-fir. 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.

Ponderosa is considered a shade intolerant tree, meaning that young seedlings require full sunlight to grow. They do not grow in the shade of a dense forest canopy, but seeds sprout after some disturbance kills the existing trees.

It follows that if the trees in a particular area grow in 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. Small trees are not necessarily young, but merely suppressed. In ponderosa stands, young trees are usually found in openings.



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)

Any mention of ponderosa pine in Higby Estates must note that many of the trees are infested with dwarf mistletoe. The dwarf mistletoe can add extra complication to fuel reduction projects, but is a manageable condition. More information about this parasite and its management options is included in Appendix A.

DOUGLAS-FIR: Unlike ponderosa, Douglas-fir are shade tolerant. 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 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 cut, especially the ladder fuels. There is an important exception to this general rule where the ponderosa 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.

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 position in the canopy.

Ponderosa pine stands can be divided in four levels in the forest canopy, and the largest trees at the highest level of the canopy are called dominants. These are usually the



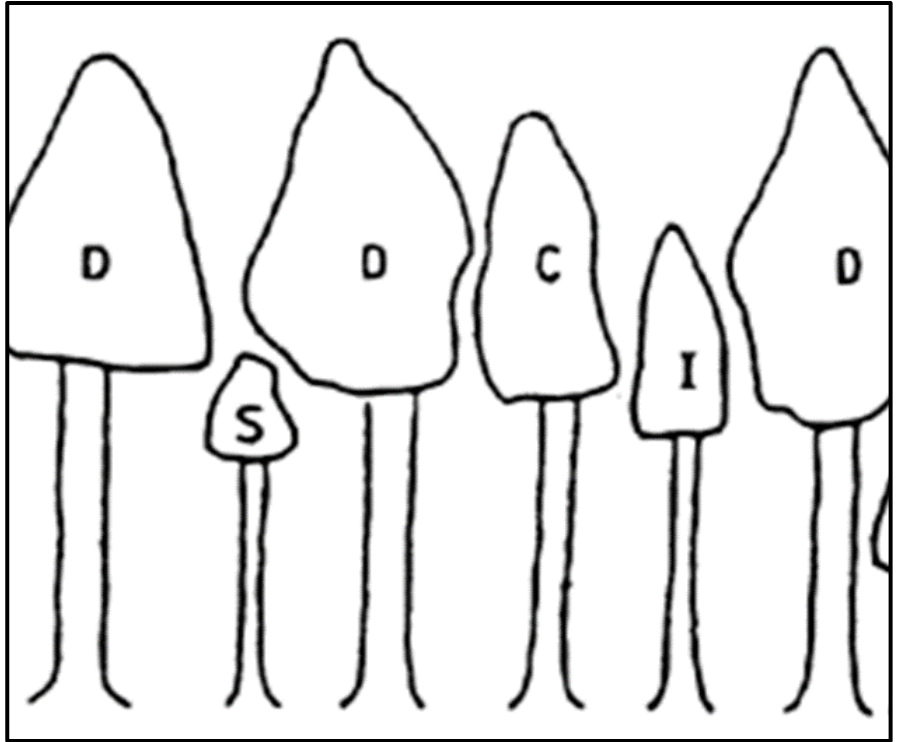
Fuel reduction changed the fire intensity of the Black Forest Fire. The trees south of Shoup Road (left) were thinned about 1980, and again in 2012. As firebrands carried the fire across Shoup Road, the fire changed from a crown fire to a ground fire. The photo was taken on August 2, 2013. The thinned forest is rapidly recovering.

most vigorous since they have the largest root systems, most leaf area and receive the most sunlight.

Next are the co-dominant trees. These trees occupy the upper-middle level of the canopy, but tend to be crowded by, and of smaller diameter than the dominants. They are less vigorous with smaller root systems and fewer needles as the result of crowding by the dominant trees.

At the lower middle of the canopy, are the intermediate trees. These are usually deformed and weak trees, unable to compete with the taller trees for adequate water or sunlight. A common characteristic of intermediate trees is a flattened top, the result of being overtopped by the larger trees.

At the lowest level of the forest are the overtopped (suppressed) trees. These are completely shaded by the dominant and co-dominant trees.



Trees are classified depending of their position in the forest canopy. The dominant trees (D) are the most vigorous, receiving the most sunlight and water. Codominants (C) are slightly crowded by their larger siblings but still receive adequate sun and water. The intermediate (I) and overtopped (suppressed) (S) trees receive little sunlight or water.

Vigorous trees should have generally straight trunks, a large number of green branches and long dense needles. Avoid leaving trees with large wounds on the trunk, or V shaped forked tops. As the tree grows in diameter, a narrow fork will eventually break, leaving a large open wound in the tree.

In shade intolerant ponderosa 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 age diversity. Thickets of young trees should be thinned to give adequate growing space.

Thinning from below removes all of the overtopped, intermediate and many 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 trees, and 3) eliminates ladder fuels by removing the overtopped trees, shrubs, and pruning lower limbs of remaining trees.

SLASH TREATMENTS

Fuel reduction always creates slash, the tree limbs that are unusable as firewood or another product. Slash treatments will always be needed to clean up the residue from forest management treatments, or 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 treatments are the most labor intensive, and, thus expensive, part of any fuel reduction project. There are many ways to properly treat logging slash, but only two will likely be used in Higby Estates.



Ponderosa pine thinned from below is an effective wildfire mitigation strategy. A month after the Black Forest Fire burned through, the only evidence is some scorched needles.

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 and scattered widely over the ground. In Higby Estates where aesthetics is an important concern, lopping and scattering is appropriate only when a few limbs have been pruned or the volume of slash is small.

The treated slash is left to decompose, and until it breaks down it may be unsightly. Over the course of several winters, snow pack pushes the slash down and it decomposes. Smaller pieces of slash decompose faster, and decomposition usually requires three to five years or longer if larger material was present. Lop and scatter should not be used adjacent to high values, such as homes, or in areas prone to regular fire occurrence.

Improperly lopped and scattered slash can also lead to problems with ips or turpentine beetles. These beetles may lay eggs in green slash and the brood will emerge to attack living trees. This problem can be alleviated by doing any forest management treatments

requiring lop and scatter method in the late fall and winter when the beetles are dormant and by cutting slash into small pieces that dry out quickly.

CHIPPING: Chipping is grinding 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.

It requires mechanized equipment to perform the chipping. The slash must be dragged to the chipper, and it can quickly become a very laborious or expensive operation.

Chipping is the most common method of slash disposal in the defensible zones. Chips do not significantly contribute to fire hazard 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. Spread chips over the ground to a depth of less than four inches, or they can pull nitrogen out of the soil, reducing the productivity of the ground for several years.

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 chipped within six weeks of cutting will not harbor infestations of ips, turpentine, or other bark beetles.

COMMUNITY CHIPPING PROJECTS: Higby Estates HOA has long sponsored community chipping days. Landowners are quite willing to expend the effort to reduce fuel if there is a simple low-cost way to remove the slash. Community chipping usually consists of one of two approaches.

First is the community slash site where landowners may drop off the slash at a designated area. The slash is then ground and given away as mulch or used in some sort of reclamation activity. Most sites are open on designated days and manned by volunteers from the sponsoring community. The Black Forest Slash and Mulch Program is an example and is available to all Higby Estates residents. The slash site operates during the summer months, and is open only on weekends and some evenings. The current operating schedule can be found at: www.bfslash.org Rather than hauling slash to collection sites, other communities such as Woodmoor have paid for roll-off dumpsters to be placed at certain locations in their communities for collection of slash.

The second method is the drive by chipping program. The community contracts with a tree service or mitigation contractor to bring a chipper to the community on a certain day. Residents with slash to dispose of may drag it to the curb where the contractor will chip it on site. The chips are normally blown back onto the property. Usually an official from the homeowner's association or mitigation committee coordinates the program, and records the location of slash piles for the contractor.

WILDLIFE HABITAT

Improvement of wildlife habitat is an important value for Higby Estates homeowners. Many species use the forests and grasslands of Higby Estates, and each has a unique set of habitat requirements. It is beyond the scope of a CWPP to list the needs of each. As a general

rule, the greatest number and diversity of wildlife species is found where there are a variety of habitats, for example where there are openings mixed with trees. Fuel reduction that creates openings in the forest is entirely compatible with good wildlife management. Landowners who wish to manage for a particular species of wildlife can find more information from the Colorado Division of Parks and Wildlife.

Some clumps in zone three should have the low branches retained for thermal and hiding cover for wildlife. This ladder fuel may compromise fuel reduction objectives slightly, but the increased hazard can be mitigated by separating cover clumps by more widely spaced trees with ladder fuels removed. Such clumps should be as far from structures as possible, and land-owners should consider the proximity of clumps to neighboring homes as well as their own.

Landowners are often uncertain about the threat posed by standing dead trees and down wood in all defensible space zones. Standing dead “wildlife” trees are valuable habitat, and some should remain in zone three, but not zones one and two. Good rules of thumb for retaining dead trees for wildlife are: first, the tree should be larger than ten inches in diameter measured at 4.5 feet above the ground; second, no more than five widely spaced trees per acre should be retained; third, no wildlife tree should pose a threat of falling on anyone or anything.

There are also rules of thumb for down wood. Large concentrations of wood, such as brush piles or jackstrawed wood pose a threat, and should be removed or broken up. Isolated down logs, in various stages of decay, are beneficial wildlife habitat, and do not pose a significant wildfire threat when they remain in zones two or three. The effort of removing isolated decaying logs from the forest floor is largely wasted, and would be more effective applied to removing ladder fuels and opening the forest canopy.

EDUCATION

Before homeowners will take any action, they must be convinced that there is a real and serious threat. A primary objective of this CWPP is to document the wildfire threat to Higby Estates and the surrounding area in a realistic and convincing manner. Second, homeowners must understand why the proposed solutions are realistic and effective. Property owners



Scattered standing dead trees and down logs provide good wildlife habitat, and should remain.

cannot be forced to reduce fuels on their properties, so they must be convinced.

Neither the forest nor the community is static. A program of education is required as new residents will move into the community and new concerns come up over time. Outreach should always emphasize forest stewardship as the objective, and fuel reduction as one essential part of that stewardship.

The education program should address the community's needs over time. Based on the work already done in Higby Estates, most of the community understands the need for fuel reduction, and property owners are taking steps to mitigate the problem. Residents have done a good job reducing ladder fuels, but many have not adequately thinned the upper forest canopy well enough to reduce the crown fire hazard. Future education should emphasize the need to create canopy openings and the great harm caused by crown fires, and the best practices to address the threat.

One topic to address is the concern among many homeowners that thinning trees will leave them with no trees should a mountain pine beetle epidemic occur. The best prevention for bark beetles and other pests is to thin the forest. Massive bark beetle mortality occurs in dense forest stands where the trees suffer from lack of adequate water, nutrients, and sunlight.

Bark beetles are able to locate, probably by the scent of the sap, weak trees, and avoid vigorous trees. When a female beetle successfully penetrates the bark, she releases a chemical scent, or pheromone, that attracts other beetles. Research studies show that the greater air circulation in open stands disperses the pheromone before it is sensed by other beetles.

Managing for diverse ages of trees also protects against severe losses to insect and disease. Where there are truly young trees, it is desirable to diversify the forest by retaining the younger trees.

Community education should emphasize the dangers posed by firebrands, and how to prevent home ignitions by fire hardening homes and outbuildings. This second part of the fire equation is often underemphasized. Higby Estates has done a good job of emphasizing both elements of community protection in their Firewise program.

Another issue to address is the dwarf mistletoe that is prevalent in areas of Higby Estates. Like wildfire, the mistletoe is not a single landowner's issue as the infected trees are on many adjoining properties. Mistletoe management should be a community effort. Residents should also be aware of other forest health concerns. The community currently has a proactive program in place for ips and mountain pine beetle, but as more landowners begin forest management and fuel reduction, other bark beetles can become an issue. Ips and turpentine beetles can become problems if homeowners do not understand the proper timing and methods of slash removal, and an education program can help prevent such problems.

Thinning of dwarf mistletoe infected stands also has positive benefits beyond fuel reduction. Thinning in mistletoe infected stands increase the vigor of the remaining trees allowing

them to tolerate the mistletoe for a longer time. Thus, the homeowner has an opportunity to underplant with non-susceptible species, and the seedlings have room to grow.

Education programs, irrespective of the specific topic, should encourage property owners to monitor the forest, wildlife and other resources in Higby Estates. When residents have a greater understanding of their forest as a living, constantly changing entity, they are more likely to be responsive to the subtle changes in the forests that may indicate a serious problem ahead. All the current threats to our forests began as small problems that went unnoticed.

Anytime homeowners are encouraged to use chainsaws or other equipment, their safety should be paramount, but most have little experience operating chainsaws or falling trees. Safety training for chainsaws and tree falling should be part of the community curriculum. Higby may want to consider offering volunteer help with mitigation efforts to those who are not capable to do this kind of work.

ADJOINING COMMUNITIES:

Higby Estates is surrounded by other communities that share a serious wildfire hazard but have not been as proactive. If adjoining communities will join the effort, wildfire hazard in the area will be greatly reduced.

By far, successful wildfire hazard reduction within Higby Estates is the best influence on its neighbors. Fortunately there are other Firewise sites in the area who can be allies of Higby Estates to persuade others to join in a regional effort. Promontory Pointe, Woodmoor and Arrowwood III are neighboring Firewise sites who share a common interest with Higby Estates in regional fuel reduction.

Red Rock Ranch, a Firewise site south of Palmer Lake, was recently selected as one of six communities nationwide to participate in Firewise USA's *Sites of Excellence* pilot project. The intent of the project is to "work closely with the community to motivate residents to increase mitigation at the parcel level and acknowledge their achievements". Firewise USA will provide extensive support and periodically provide updates via their *Firebreak* newsletter, social media and on www.firewise.org. Higby Estates can apply the lessons learned from the project. Also, Higby should contact and work with the developers of new nearby communities to encourage the developers to use community-wide Firewise practices.

MAINTENANCE:

Defensible 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 snows or wind. Prune any broken branches if they are not too high in the tree to prune safely, and trees bent by heavy winter snows 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 are dormant at this time, and there is adequate time to cut and treat the tree before the adult beetles fly the next July.

Ips (engraver) beetles are active between April and October, and can produce four generations during that period. In other words, ips can attack a tree anytime during the warm months, so homeowners must be constantly alert for them. Ips lay eggs in recently cut green slash, and the eggs will develop into adults within eight weeks. Therefore it is necessary to treat any slash by chipping, lop and scatter or removal to the Black Forest Slash and Mulch Site within six weeks after it was cut. Slash generated during the winter months when ips are dormant, is not a hazard. More information about ips and mountain pine beetles is in Appendix A.

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.

VI. Implementation Action Plan

Action	Description	Est Timeline
1-CWPP	<ul style="list-style-type: none"> -Publish & distribute to all homeowners. -Revise/ update Implementation Action Plan. -Review/ update CWPP [every 5 yrs]. 	2019 Annual 2024, 2029
2-Provide Educational Information and Demonstrations	Programs to increase awareness about forest health and wildfire risk reduction include - <ul style="list-style-type: none"> -<i>'Higby Firewise Notes'</i> periodic email newsletter. -Newcomer packets to all new residents. -HHOA website – Forest Health & Firewise information. -Consultations by Forestry Committee members. -Firewise demonstrations by CSFS & other experts. -Direct contacts with homeowners to provide information and to increase participation. -Improve messaging and delivery of educational information to create more interest in forest health and mitigation. -Topics for focus include – <ul style="list-style-type: none"> -Fuel reduction is an essential part of forest stewardship. -Need for thinning to open the forest canopy, esp. Zones 2 & 3. -Hardening homes against firebrand attack. -Dwarf mistletoe management. -Beetle issues and slash cutting timing. -Safety training for using chainsaws and felling trees. -Forest management maintenance schedule for homeowners. 	Annual

3-Provide Resources to encourage and help homeowners to act	Programs to help owners improve forest health, reduce wildfire risk, and improve wildfire preparedness include – -Annual forest inspection by CSFS. -Annual chipping day. -Fire department 'windshield tour' of Higby. -Volunteer network of helpers.	Annual
4-Develop a community-wide fuels reduction & wildfire preparedness strategy	Programs include- -Mitigate easements and drainage ditches along streets. -Complete mitigation of Common Lot A. -Mitigate vacant lots. -Driveway mitigation for safe ingress & egress for firefighters. -Reflective address signs at end of driveways to help firefighters.	2019-20
5-Ensure safe evacuation for residents in a wildfire emergency	Programs include - -Develop and communicate an Emergency Preparation & Evacuation Plan specific to Higby. -Establish and communicate emergency notification systems, including reverse 911. -Update the Higby Directory for a chain-call notification system. -CERT training for Higby personnel.	2019
6-Outreach with nearby communities	-Improve awareness, communication and networking with nearby communities to help reduce regional wildfire risk. Eg - Bent Tree, Happy Landings, Woodmoor, Arrowwood III. -Work with developers to encourage incorporation of Firewise mitigation practices to help reduce regional wildfire risk. Eg – Sanctuary Pt, Home Place Ranch, Grandwood Ranch.	2019-20
7-Retain Firewise Community status	Become a Fire Adapted Community	Annual

APPENDIX A

INSECT AND DISEASE CONDITIONS

Literally thousands of insect and diseases are present in the forests surrounding the community--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. 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.

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/comm-on-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.



Well managed forests have a multitude of benefits. They are resistant to catastrophic fires, insect and disease, sustain wildlife populations and are pleasant places to be. Colorado State Forest Service Photo by Dave Root

DWARF MISTLETOE

The primary forest disease in Higby Estates is 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.

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 and lodgepole dwarf mistletoe are visible on the branch as thick finger-like growths extending out of the branch or trunk. The shoots of ponderosa and lodgepole dwarf mistletoe are long and obvious to casual observation, but Douglas-fir dwarf mistletoe shoots are shorter than the needles and are not easy to see.



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

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.



The shoots of ponderosa DMT growing from a branch. The shoots are reddish in the photo can be green or yellow as well. Mistletoe goes to seed in August.

MOUNTAIN PINE BEETLE

Due to the massive mountain pine beetle (MPB) epidemic in the western United States and Canada, MPB is the most feared insect in the forest. Unlike the Western Slope, mountain pine beetle is at normal levels in the area. The beetles have crossed the Continental Divide in northern Park County and northern Larimer County, and activity currently is confined mostly to higher altitude lodgepole pine. It presently is not known if or when the beetles will reach into the lower-elevation ponderosa forests, but where they have reached ponderosa, heavy mortality has occurred.



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.

Adult beetles fly from midsummer through the first frost, although the vast majority fly between mid-July through the middle of September. 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.

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 en masse. 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 attacked a tree.

Woodpeckers feed on the larvae through the fall and winter. The holes made by the 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.



Mountain pine beetle galleries under the bark. The maternal beetle burrowed straight up the tree, creating the darker central gallery. Larval beetles feed horizontally, creating the smaller galleries. A larva is in the upper right and pupae in the lower left. Note the bluestain in the wood. Colorado State Forest Service photo by David Leatherman.

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.

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.

Following are treatment options for beetle-infested trees:

- Cut the tree and move all wood greater than four inches in diameter to a designated mountain pine beetle-safe site – usually an area at least one mile away from the nearest pine tree.
- 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 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 lethal temperatures 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.

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 permethrin 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.

When there is no epidemic of mountain pine beetle, use of permethrin as a precautionary measure is not recommended. Mites are small insects that feed on the sap of pine trees, and typically do no damage. Permethrin kills insects that prey on mites, and with continued use over several years, the population of mites will increase to the level that they can damage the tree.

Thinning forests for increased health and vigor by far is the best preventive measure for mountain pine beetle. 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 as its larger cousin. Ips will attack larger trees if they are severely weakened by disease (most often dwarf mistletoe), or are damaged by



Solar treatment of beetle infested trees is effective only if the logs are placed in a sunny area, and the 6 mil clear plastic is sealed with dirt at the edges to create a greenhouse. CSFS photo.

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, often following mountain pine beetles into larger trees.

The differences between mountain pine beetle and ips are significant to anyone implementing a forest management program. In contrast to MPB, which produce one generation per year, ips may produce up to four. Ips become active in spring when the weather exceeds 50 degrees F, developing from egg to adult within eight weeks. They continue to attack trees until the first fall frosts. For this reason, preventive spraying should be done with permethrin 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.



The reddish-brown sawdust on this freshly cut 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. Colorado State Forest Service photo by Dave Root.

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. Slash cut late in fall that is subsequently infested can be treated or piled and burned over the winter, but 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.

References

Cranshaw, Whitney, David Leatherman, Boris Kondratieff, Paul Opler, and Casey Sclar. Nd. *Insects and Diseases of Woody Plants of the Central Rockies*. Bulletin 506A, Colorado State University Cooperative Extension.

Furniss, R.L., and Carolin, V.M. (1977). *Western Forest Insects*. Miscellaneous Publication No. 1339 USDS Forest Service.

Johnson, Warren T., and Lyon, Howard H. 1991. *Insects that Feed on Trees and Shrubs*. Comstock Publishing Associates, Cornell University Press.

Appendix B

Resources and Links

Websites:

Pikes Peak Wildfire Prevention Partners Black Forest Fire Video: <https://vimeo.com/84393594>

Tri-Lakes Monument Fire Protection District: <http://www.tlmfire.org/>

Cost Share Assistance Database: <http://nrdb.csfs.colostate.edu/>

Colorado State Forest Service: <http://www.csfs.colostate.edu/>

CSFS, Woodland Park Field Office: <https://csfs.colostate.edu/woodland-park/>

Coalition for the Upper South Platte: <http://cusp.ws/>

Firewise Communities: <http://www.firewise.org/>

Ready Set Go: <http://www.wildlandfirersg.org/>

El Paso County Sheriff's Office: <https://www.epcsheriffsoffice.com/>

El Paso County: <https://www.elpasoco.com/>

Colorado State University Extension: <http://elpaso.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/>

Nature Conservancy, Colorado:

<http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/colorado/index.htm?intc=nature.tnav.where.list&src=sea.AWP.PR0.CP94.AD151.KW5796.MT1.BU901&nst=0&adpos=1t1&creative=81534669878&device=c&matchtype=b&network=g&gclid=CL6Ao8vVsMcCFQczaQodK8IA3A>

Fire Adapted Communities: <http://www.fireadapted.org/>

Colorado Tree Farmers: <http://www.treefarmer.com/>

Colorado Department of Natural Resources: <https://cdnr.us/#/start>

Fire Learning Networks:

<https://www.conservationgateway.org/ConservationPractices/FireLandscapes/FireLearningNetwork/Pages/fire-learning-network.aspx>

Black Forest Together: <http://www.blackforesttogether.org/>

Publications:

Community Wildfire Protection Planning

All Colorado CWPPs: <http://csfs.colostate.edu/wildfire-mitigation/colorado-community-wildfire-protection-plans/>

Wildfire Mitigation

CO Dept. of Revenue Tax Subtraction: <https://www.colorado.gov/pacific/sites/default/files/Income65.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://static.colostate.edu/client-files/csfs/pdfs/FIRE2012_1_DspaceQuickGuide.pdf

Firewise Landscaping: <https://static.colostate.edu/client-files/csfs/pdfs/06303.pdf>

Firewise Plant Materials: <https://static.colostate.edu/client-files/csfs/pdfs/06305.pdf>

Forest Home Fire Safety: <https://static.colostate.edu/client-files/csfs/pdfs/06304.pdf>

Grass Seed Mixtures to Reduce Wildfire Hazard: <https://static.colostate.edu/client-files/csfs/pdfs/06306.pdf>

Living With Fire: A Guide to the Homeowner: <https://static.colostate.edu/client-files/csfs/pdfs/LWF51303.pdf>

Firewise Construction: Site Design and Building Materials:
<https://static.colostate.edu/client-files/csfs/pdfs/firewise-construction2012.pdf>

Decks: <https://static.colostate.edu/client-files/csfs/pdfs/decks.pdf>

Roofing Materials: <http://static.colostate.edu/client-files/csfs/pdfs/roofing.pdf>

Siding: <http://static.colostate.edu/client-files/csfs/pdfs/siding.pdf>

Windows and Glass: http://static.colostate.edu/client-files/csfs/pdfs/windows_and_glass.pdf

Wildfire and Insurance: https://csfs.colostate.edu/media/sites/22/2014/02/co_wildfire_guide.pdf

Forest Health and Management

Gambel Oak Management: <https://static.colostate.edu/client-files/csfs/pdfs/06311.pdf>

Landowner's Guide to Thinning: http://static.colostate.edu/client-files/csfs/pdfs/landowner_g4thin_scr.pdf

Landowner's Guide to Living With Bark Beetles:
http://static.colostate.edu/client-files/csfs/pdfs/MPB_Newspaper_Insert_Final.pdf

Landowner Assistance Programs in Colorado:
<https://static.colostate.edu/client-files/csfs/pdfs/Landowner-Assistance-Programs-rev112610.pdf>

Forest Insect and Disease Information

Dwarf Mistletoe Management: <http://static.colostate.edu/client-files/csfs/pdfs/DMT.pdf>

Mountain Pine Beetle: <http://static.colostate.edu/client-files/csfs/pdfs/MPB.pdf>

Solar Treatment for Mountain Pine Beetle:
http://static.colostate.edu/client-files/csfs/documents/Solar_Treatment_for_Mountain_Pine_Beetle_April_2009.pdf

Products used to Prevent Mountain Pine Beetle:

https://static.colostate.edu/client-files/csfs/pdfs/Web_Revision_June6_MPB_Prev_Products_QG.pdf

Ips Beetles: <http://static.colostate.edu/client-files/csfs/pdfs/Ips.pdf>

Western Spruce Budworm: https://csfs.colostate.edu/media/sites/22/2014/02/Western_Spruce_Budworm_QG_10May2016.pdf

Firewood and House Log Insects: http://static.colostate.edu/client-files/csfs/documents/firewood_insects.pdf

Protecting Trees During Construction: <http://static.colostate.edu/client-files/csfs/pdfs/construction.pdf>

Douglas-fir Tussock Moths: <https://csfs.colostate.edu/media/sites/22/2014/02/Douglas-Fir-Tussock-Moth-QG-2015-FINAL.pdf>

Post Wildfire Recovery:

Insects and Disease Associated with Forest Fires: <http://static.colostate.edu/client-files/csfs/pdfs/06309.pdf>

Vegetative Recovery after Wildfire: <http://static.colostate.edu/client-files/csfs/pdfs/06307.pdf>

Soil Erosion Control After Wildfire: <https://csfs.colostate.edu/media/sites/22/2018/07/06308.pdf>

Replanting in Burned Areas: Tips for Safety & Success:

<https://static.colostate.edu/client-files/csfs/pdfs/FINAL-Post-FireReplanting-andSafetyTips-2013Feb11.pdf>

Aspen Survival After Wildfire: <https://static.colostate.edu/client-files/csfs/documents/How-to-Aspen.pdf>

Douglas-fir Survival After Wildfire: <http://static.colostate.edu/client-files/csfs/documents/How-to-Dougfir.pdf>

Gambel Oak and Serviceberry Survival After Wildfire:

<http://static.colostate.edu/client-files/csfs/documents/How-to-gambel-oak-and-serviceberry.pdf>

Piñon Pine and Juniper Survival After Wildfire: <http://static.colostate.edu/client-files/csfs/documents/How-to-PJ.pdf>

Ponderosa Pine & Lodgepole Survival After Wildfire:

<http://static.colostate.edu/client-files/csfs/documents/How-to-Ponderosa-and-lodgepole.pdf>

Appendix C

Glossary

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 the 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 more or less 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 outer most leaves on a tree defines 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 eave 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 of 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 reduction 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 sets 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. 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 measure 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. 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 on 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.



Quick Facts...

More people are moving into Colorado's rural areas, increasing the chances of wildfire.

"Defensible space" is the primary determinant of a structure's ability to survive wildfire.

Native species are generally the best plant materials for landscaping in defensible space, but others can be grown successfully in Colorado.

To be a FireWise homeowner, plan well, plant well and maintain well.



Putting Knowledge to Work

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Appendix D

FORESTRY

Fire-Resistant Landscaping

by F.C. Dennis¹

no. 6.303

Colorado's population is growing, its urban areas are rapidly expanding, and people are building more homes in what was once natural forest and brushlands. Newcomers to rural areas need to know how to correctly landscape their property to reduce wildfire hazards.

Improper landscaping worries land managers and fire officials because it can greatly increase the risk of structure and property damage from wildfire. It is a question of *when*, not *if*, a wildfire will strike any particular area.

Vegetative clearance around the house (defensible space) is a primary determinant of a home's ability to survive wildfire. Defensible space is, simply, room for firefighters to do their job. If grasses, brush, trees and other common forest fuels are removed, reduced, or modified to lessen a fire's intensity and keep it away from the home, chances increase that the structure will survive. It is a little-known fact that in the absence of a defensible space, firefighters will often bypass a house, choosing to make their stand at a home where their safety is more assured and the chance to successfully protect the structure is greater.

Landscaping Defensible Space

People often resist creating defensible space because they believe that it will be unattractive, unnatural and sterile-looking. It doesn't have to be! Wise landowners carefully plan landscaping within the defensible space. This effort yields a many-fold return of beauty, enjoyment and added property value. Development of defensible space is outlined in fact sheet 6.302, *Creating Wildfire-Defensible Zones*.

Colorado has great diversity in climate, geology and vegetation. Home and cabin sites can be found from the foothills through 10,000-foot elevations. Such extremes present a challenge in recommending plants. While native plant materials generally are best, a wide range of species can be grown successfully in Colorado.

Many plant species are suitable for landscaping in defensible space. Use restraint and common sense, and pay attention to plant arrangement and maintenance. It has often been said that *how* and *where* you plant are more important than *what* you plant. While this is indeed true, given a choice among plants, choose those that are more resistant to wildfire.

Consider the following factors when planning, designing and planting the FireWise landscape within your home's defensible space:

- Landscape according to the recommended defensible-space zones. That is, the plants near your home should be more widely spaced and lower growing than those farther away.
- Do not plant in large masses. Instead, plant in small, irregular clusters or islands.

The best tree species to plant generally are those naturally occurring on or near the site.

Mow grass short around shrubs.

Plant low-growing, nonresinous shrubs near structures.

Keep grass mown around structures to a maximum of 8 inches.

Plant wildflowers near structures only if they are well-irrigated and cut back during the dormant season.

Gravel area or mow grass short next to the structure.

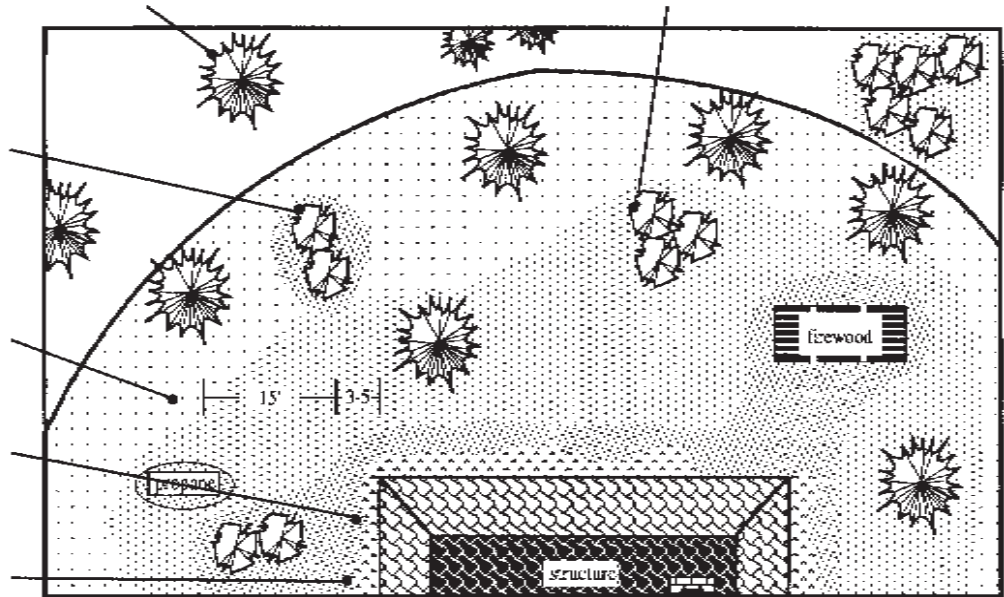


Figure 1: Forested property surrounding a homesite; shows optimum placement of vegetation near the structure.

- Use decorative rock, gravel and stepping stone pathways to break up the continuity of the vegetation and fuels. This can modify fire behavior and slow the spread of fire across your property.
- Incorporate a diversity of plant types and species in your landscape. Not only will this be visually satisfying, but it should help keep pests and diseases from causing problems within the whole landscape.
- In the event of drought and water rationing, prioritize plants to be saved. Provide available supplemental water to plants closest to your house.
- Use mulches to conserve moisture and reduce weed growth. Mulch can be organic or inorganic. Do not use pine bark, thick layers of pine needles or other mulches that readily carry fire.
- Be creative! Further vary your landscape by including bulbs, garden art and containers for added color.

References

- 6.302, Creating Wild-Fire Defensible Zones
- 6.304, Forest Home Fire Safety
- 6.305, FireWise Plant Materials
- 6.306, Grass Seed Mixes to Reduce Wildfire Hazard
- 7.205, Pruning Evergreens
- 7.206, Pruning Shrubs
- 7.207, Pruning Deciduous Trees
- 7.233, Wildflowers for Colorado
- 7.406, Flowers for Mountain Communities
- 7.423, Trees and Shrubs for Mountain Areas
- 7.413, Ground Covers for Mountain Communities

Grasses

During much of the year, grasses ignite easily and burn rapidly. Tall grass will quickly carry fire to your house. Mow grasses low in the inner zones of the defensible space. Keep them short closest to the house and gradually increase height outward from the house, to a maximum of 8 inches. This is particularly important during fall, winter and before green-up in early spring, when grasses are dry, dormant and in a “cured” fuel condition. Given Colorado’s extremely variable weather, wildfires can occur any time of the year. Maintenance of the grassy areas around your home is critical.

Mow grasses low around the garage, outbuildings, decks, firewood piles, propane tanks, shrubs, and specimen trees with low-growing branches.

Ground Cover Plants

Replace bare, weedy or unsightly patches near your home with ground covers, rock gardens, vegetable gardens and mulches. Ground cover plants are a good alternative to grass for parts of your defensible space. They break up the monotony of grass and enhance the beauty of your landscape. They provide a



Figure 2: Ladder fuels enable fire to travel from the ground surface into shrubs and then into the tree canopy.

variety of textures and color and help reduce soil erosion. Consider ground cover plants for areas where access for mowing or other maintenance is difficult, on steep slopes and on hot, dry exposures.

Ground cover plants are usually low growing. They are succulent or have other FireWise characteristics that make them useful, functional and attractive. When planted in beds surrounded by

walkways and paths, in raised beds or as part of a rock garden, they become an effective barrier to fire spread. The ideal groundcover plant is one which will spread, forming a dense mat of roots and foliage that reduces soil erosion and excludes weeds.

Mulch helps control erosion, conserve moisture and reduce weed growth. It can be organic (compost, leaf mold, bark chips, shredded leaves) or it can be inorganic (gravel, rock, decomposing granite).

When using organic mulches, use just enough to reduce weed and grass growth. Avoid thick layers. When exposed to fire, they tend to smolder and are difficult to extinguish. Likewise, while your property might yield an abundance of needles from your native pines or other conifers, don't use them as mulch because they can readily catch and spread wildfire. Rake, gather and dispose of them often within your defensible space.

Wildflowers

Wildflowers bring variety to a landscape and provide color from May until frost. Wildflower beds give a softer, more natural appearance to the otherwise manicured look often resulting from defensible space development.

A concern with wildflowers is the tall, dense areas of available fuel they can form, especially in dormancy. To reduce fire hazard, plant wildflowers in widely separated beds within the defensible space. Do not plant them next to structures unless the beds are frequently watered and weeded and vegetation is promptly removed after the first hard frost. Use gravel walkways, rock retaining walls or irrigated grass areas mowed to a low height to isolate wildflower beds from each other and from other fuels.

Shrubs

Shrubs lend color and variety to the landscape and provide cover and food for wildlife. However, shrubs concern fire professionals because, as the next level in the "fuel continuum," they can add significantly to total fuel loading. Because of the woody material in their stems and branches, they are a potential source of fire brands. When carried in the smoke column ahead of the main fire, fire brands can rapidly spread the fire in a phenomenon known as "spotting."

But the primary concern with shrubs is that they are a "ladder fuel" – they can carry a relatively easy-to-control surface grass fire into tree crowns. Crown fires are difficult, sometimes impossible, to control (see Figure 2).

To reduce the fire-spreading potential of shrubs, plant only widely separated, low-growing, nonresinous varieties close to structures. Do not plant them directly beneath windows or vents or where they might spread under wooden decks. Do not plant shrubs under tree crowns or use them to screen propane tanks, firewood piles or other flammable materials. Plant shrubs individually, as specimens, or in small clumps apart from each other and away from any trees within the defensible space.

Mow grasses low around shrubs. Prune dead stems from shrubs annually. Remove the lower branches and suckers from species such as Gambel oak to raise the canopy away from possible surface fires.

Structural Elements of a FireWise Landscape

When building a deck or patio, use concrete, flagstone or rock instead of wood. These materials do not burn and do not collect flammable debris like the space between planks in wooden decking.

Where appropriate on steeper ground, use retaining walls to reduce the steepness of the slope. This, in turn, reduces the rate of fire spread. Retaining walls also act as physical barriers to fire spread and help deflect heat from the fire upwards and away from structures.

Rock or masonry walls are best, but even wooden tie walls constructed of heavy timbers will work. Put out any fires burning on tie walls after the main fire front passes.

On steep slopes, consider building steps and walkways around structures. This makes access easier for home maintenance and enjoyment. It also serves as a physical barrier to fire spread and increases firefighters' speed and safety as they work to defend your home.



FIREWISE is a multi-agency program that encourages the development of defensible space and the prevention of catastrophic wildfire.



This fact sheet was produced in cooperation with the Colorado State Forest Service.

¹Wildfire Hazard Mitigation Coordinator, Colorado State Forest Service.

Trees

Trees provide a large amount of available fuel for a fire and can be a significant source of fire brands if they do burn. Radiant heat from burning trees can ignite nearby shrubs, trees and structures.

Colorado's elevation and temperature extremes limit tree selection. The best species to plant generally are those already growing on or near the site. Others may be planted with careful selection and common sense.

If your site receives enough moisture to grow them, plant deciduous trees such as aspen or narrow-leaf cottonwood. These species, even when planted in dense clumps, generally do not burn well, if at all. The greatest problem with these trees is the accumulation of dead leaves in the fall. Remove accumulations close to structures as soon as possible after leaf drop.

When site or available moisture limits recommended species to evergreens, carefully plan their placement. Do not plant trees near structures. Leave plenty of room between trees to allow for their growth. Spacing within the defensible space should be at least 10 feet between the edges of tree crowns. On steep ground, allow even more space between crowns. Plant smaller trees initially on a 20- to 25-foot spacing to allow for tree growth. At some point, you will have to thin your trees to retain proper spacing.

As the trees grow, prune branches to a height of 10 feet above the ground. Do not overprune the crowns. A good rule of thumb is to remove no more than one-third of the live crown of the tree when pruning. Prune existing trees as well as ones you planted.

Some trees (for example, Colorado blue spruce) tend to keep a full crown. Other trees grown in the open may also exhibit a full growth habit. Limit the number of trees of this type within the defensible space. Prune others as described above and mow grasses around such specimen trees.

Maintenance

A landscape is a dynamic system that constantly grows and changes. Plants considered fire resistant and that have low fuel volumes can lose these characteristics over time. Your landscape, and the plants in it, must be maintained to retain their FireWise properties.

- ☐ Always keep a watchful eye towards reducing the fuel volumes available to fire. Be aware of the growth habits of the plants within your landscape and of the changes that occur throughout the seasons.
- ☐ Remove annuals and perennials after they have gone to seed or when the stems become overly dry.
- ☐ Rake up leaves and other litter as it builds up through the season.
- ☐ Mow or trim grasses to a low height within your defensible space. This is particularly important as grasses cure.
- ☐ Remove plant parts damaged by snow, wind, frost or other agents.
- ☐ Timely pruning is critical. Pruning not only reduces fuel volumes but also maintains healthier plants by producing more vigorous, succulent growth.
- ☐ Landscape maintenance is a critical part of your home's defense system. Even the best defensible space can be compromised through lack of maintenance. The old adage "An ounce of prevention is worth a pound of cure" applies here.

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FORESTRY

FireWise Plant Materials

by F.C. Dennis¹

no. 6.305

Quick Facts...

FireWise landscaping can be aesthetically pleasing while reducing potential wildfire fuel.

Plant choice, spacing and maintenance are critical.

Your landscape, and the plants in it, must be maintained to retain their FireWise properties.

Creating a “defensible space” around your home is one of the most important and effective steps you can take to protect you, your family and your home from catastrophic wildfire. Defensible space is the area between a structure and an oncoming wildfire where nearby vegetation has been modified to reduce a wildfire’s intensity. (See fact sheet 6.302, *Creating Wildfire-Defensible Zones*.)

Many people resist creating defensible space around their homes because they believe these areas will be unattractive and unnatural. This is far from true. With careful planning, FireWise landscaping can be aesthetically pleasing while reducing potential wildfire fuel. It can actually enhance beauty and property values, as well as personal safety.

Many native plants are highly flammable during different seasons of the year. At such times, left unmanaged, they can accelerate the spread of a wildfire through your neighborhood, threatening homes, property and lives.

All vegetation, naturally occurring and otherwise, is potential fuel for fire. Its type, amount and arrangement has a dramatic effect on fire behavior. There are no truly “fireproof” plant species, so plant choice, spacing and maintenance are critical to defensible space landscaping. In fact, **where** and **how** you plant may be more important than **what** you plant. However, given alternatives, choose plant species that tend to be more resistant to wildfire.

General concepts to keep in mind when choosing and planting FireWise species are:

- A plant’s moisture content is the single most important factor governing its volatility. (However, *resin* content and other factors in some species render them flammable even when the plant is well-watered.) Conifers tend to be flammable due to their oil and pitch content, regardless of their water content.
- Deciduous plants tend to be more fire resistant because their leaves have higher moisture content and their basic chemistry is less flammable. Also, when deciduous trees are dormant, there is less fuel to carry fire through their canopies.

In some cases, there is a strong correlation between drought tolerance and fire resistance. For example, a plant may shed its leaves or needles during extreme drought. Other drought-tolerant species may have smaller leaves or thick, succulent leaves. These plants offer less fuel or have a higher moisture content, both of which help reduce fire hazard.

There also appears to be a correlation between a plant’s salt tolerance and natural fire resistance. Plants adapted to salty conditions, and actually growing in salty situations, may better resist burning.

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FireWise Plant List

The following list was prepared by Phil Hoefer, Colorado State Forest Service. It was reviewed by Jim Knopf, a landscape architect in Boulder, and two landscape architects on Colorado's Western Slope. Bloom time is approximate (observed in Boulder at 5,600 feet).

Key: Water needs: VL = very low L = low M = medium H = high
 Sun/Shade: S = sun PS = part sun Sh = shade
 Elevation: Y = Yes N = No ? = Questionable or unknown

Scientific Name	Common Name	Approx.	Sun/Shade Preference	Approx.	Elevation					Approx.
		Water Needs		Mature Height	(1,000 ft.)	5	6	7	8	
Flowers and Ground Covers										
<i>Achillea lanulosa</i> ^a	Native yarrow	L-H	S/PS	1.5 - 2'	Y	Y	Y	Y	Y	Jul
<i>Achillea tomentosa</i> ^b	Woolly yarrow	M-H	S/PS	.5'	Y	Y	N	N	N	Jul
<i>Aconitum</i> spp. ^c	Monkshood	M-H	S	2'	Y	Y	Y	Y	Y	Jun-Jul
<i>Aconitum columbianum</i> ^{ac}	Columbian monkshood	M-H	S	2'	Y	Y	Y	Y	Y	Jun-Jul
<i>Ajuga reptans</i> ^b	Bugleweed	H	Sh	< .5'	Y	Y	Y	Y	Y	Jun-Jul
<i>Alchemilla</i> sp.	Lady's mantle	M-H	PS/Sh	1'	Y	Y	Y	Y	?	Jun-Jul
<i>Allium cernuum</i> ^{ac}	Nodding onion	L-H	S/PS	1'	Y	Y	Y	Y	Y	Jun
<i>Allium geyeri</i> ^{ac}	Geyer onion	L-H	S/PS	1'	Y	Y	Y	Y	?	Jun
<i>Anaphalis margaritacea</i> ^a	Pearly everlasting	L-H	S	1.5 - 2.5'	Y	Y	Y	Y	?	Aug
<i>Anemone blanda</i>	Windflower	M-H	S/PS	1'	Y	Y	Y	Y	?	Apr-May
<i>Antennaria parvifolia</i> ^{ab}	Small-leaf pussytoes	M	S/PS	<.5'	Y	Y	Y	Y	Y	Jun
<i>Antennaria rosea</i> ^{ab}	Rosy pussytoes	M	S/PS	<.5'	Y	Y	Y	Y	Y	Jun
<i>Aquilegia</i> spp.	Columbine	M-H	S/PS	1 - 2'	Y	Y	Y	Y	Y	Jun-Jul
<i>Aquilegia coerulea</i> ^a	Colorado blue columbine	M-H	S/PS	1 - 2'	Y	Y	Y	Y	Y	Jun-Jul
<i>Aquilegia chrysantha</i> ^a	Yellow columbine	M-H	S/PS	1 - 2'	Y	Y	Y	Y	Y	Jun-Aug
<i>Arabis</i> sp. ^b	Rockcress	L-H	S	< 1'	Y	Y	Y	Y	Y	May-Jun
<i>Armeria maritima</i>	Sea thrift	L-H	S/PS	.5'	Y	Y	Y	Y	Y	Apr-Jun
<i>Artemisia caucasica</i>	Caucasian sage	L-M	S/PS	1 - 2'	Y	Y	Y	?	?	n/a
<i>Artemisia frigida</i> ^{ac}	Fringed sage	L-M	S	1 - 1.5'	Y	Y	Y	Y	Y	n/a
<i>Artemisia ludoviciana</i> ^a	Prairie sage	L-M	S	1 - 1.5'	Y	Y	Y	?	?	n/a
<i>Aster laevis</i> ^a	Smooth aster	L-H	S/PS	1 - 3'	Y	Y	Y	Y	?	Aug-Sep
<i>Aster porteri</i> ^a	Porter aster	L-M	S	1'	Y	Y	Y	?	?	Aug-Sep
<i>Aubrieta</i> sp. ^b	False rockcress	M	S	1'	Y	Y	Y	Y	Y	Apr-May
<i>Aurinia</i> sp. ^b	Basket of gold	M	S/PS	1'	Y	Y	Y	Y	Y	Apr-May
<i>Calochortus gunnisonii</i> ^a	Mariposa lily	M-H	S	.5 - 2'	Y	Y	Y	Y	?	Jul-Aug
<i>Campanula rotundifolia</i> ^a	Common harebell	M-H	S	.5 - 1'	Y	Y	Y	Y	Y	May-Oct
<i>Centranthus ruber</i>	Jupiter's beard	L-H	S/Sh	2 - 2.5'	Y	Y	Y	Y	?	May-Oct
<i>Cerastium strictum</i> ^{ab}	Mouse ear chickweed	M	S/PS	1'	Y	Y	Y	Y	?	May-Jun
<i>Cerastium tomentosum</i> ^b	Snow-in-summer	L-M	S/PS	1'	Y	Y	Y	Y	Y	May-Jun
<i>Claytonia lanceolata</i> ^a	Spring beauty	M	Sh	.5 - 1.5'	Y	Y	Y	?	?	Mar-Apr
<i>Convallaria majalis</i> ^{bc}	Lily-of-the-valley	H	Sh	< 1'	Y	Y	Y	Y	?	May-Jun
<i>Delosperma nubigenum</i> ^b	Hardy yellow iceplant	M-H	S	.5'	Y	Y	Y	?	?	Jun
<i>Delphinium</i> spp. ^c	Delphinium	M-H	S/PS	.5 - 3'+	Y	Y	Y	Y	Y	Jun-Jul
<i>Dianthus</i> spp.	Pinks	L-H	S	<.5' - 2'	Y	Y	Y	Y	Y	May-Aug
<i>Doronicum</i> sp.	Leopard's bane	H	S/PS	2 - 3'	Y	Y	Y	Y	?	Jul-Aug
<i>Echinacea purpurea</i> ^a	Purple coneflower	M	S	2 - 3'	Y	Y	Y	Y	Y	Jul-Aug
<i>Epilobium angustifolium</i>	Fireweed	H	S/PS	3'	N	Y	Y	Y	Y	Jul-Aug
<i>Erigeron flagellaris</i> ^a	Whiplash daisy, trailing fleabane	L-M	S	< 1'	Y	Y	?	?	?	Jun-Jul
<i>Eriogonum umbellatum</i> ^a	Sulphur flower	M	S/PS	<.5'	Y	Y	Y	Y	Y	Jun-Jul
<i>Erysimum asperum</i> ^a	Western wallflower	M	S/PS	1'+	Y	Y	Y	Y	?	Jun-Jul
<i>Gaillardia aristata</i> ^a	Blanket flower	L-M	S	1 - 1.5'	Y	Y	Y	Y	Y	Jul-Sep
<i>Galium boreale</i> ^{ab}	Northern bedstraw	M-H	Sh	<1'	Y	Y	Y	Y	Y	May-Jun
<i>Geranium</i> spp.	Hardy geraniums	M	Sh/PS	2'	Y	Y	Y	Y	Y	May-Oct
<i>Geranium caespitosum</i> ^a	Wild geranium	M	Sh/PS	2'	Y	Y	Y	Y	Y	May-Oct
<i>Geum triflorum</i>	Prairie smoke	M-H	S/PS	1.5'	Y	Y	Y	?	?	Jun
<i>Helianthella quinquenervis</i> ^a	Aspen sunflower	M	S	1'	?	?	?	Y	Y	?
<i>Helianthemum nummularium</i>	Rockrose	M-H	S	< 1'	Y	Y	Y	?	?	May-Jun
<i>Helianthus pumilus</i> ^a	Small sunflower	M	S	1 - 2'	Y	Y	Y	?	?	Jun-Jul
<i>Heuchera</i> spp.	Coral bells	M-H	PS/Sh	1 - 2'	Y	Y	Y	Y	Y	Jun-Aug
<i>Ipomopsis aggregata</i> ^a	Scarlet gilia	M	S/PS	1 - 2'	Y	Y	Y	Y	Y	Jun-Aug
<i>Iris germanica</i>	Bearded iris	L-M	S	1 - 3'	Y	Y	Y	Y	Y	May-Jun

Scientific Name	Common Name	Approx. Water Needs	Sun/Shade Preference	Approx. Mature Height	Elevation (1,000 ft.)					Approx. Bloom Month
					5	6	7	8	9	
<i>Iris missouriensis</i> ^{ac}	Missouri iris	M-H	S	1 - 2'	Y	Y	Y	Y	Y	May
<i>Lamium</i> sp. ^b	Dead nettle	M-H	Sh	< 1'	Y	Y	Y	Y	?	May-Jun
<i>Lavandula</i> spp.	Lavender	L-M	S	1 - 2'	Y	Y	Y	?	?	Jun-Nov
<i>Leucocrinum montanum</i> ^a	Sand lily	L-M	S	< 1'	Y	Y	Y	?	?	May
<i>Liatris punctata</i> ^a	Dotted gayfeather	VL-L	S	1 - 2'	Y	Y	Y	Y	Y	Aug-Oct
<i>Linum lewisii</i> ^{ac}	Wild blue flax	L-H	S/PS	1 - 2'	Y	Y	Y	Y	Y	May-Sep
<i>Lupinus argenteus</i> ^{ac}	Silver lupine	M	Sh/PS	1 - 3'	Y	Y	Y	Y	Y	Jun-Jul
<i>Mertensia lanceolata</i> ^a	Narrow-leaved chiming bells	M-H	Sh/PS	1 - 2'	Y	Y	Y	Y	Y	May-Jun
<i>Mimulus guttatus</i> ^a	Yellow monkey-flower	H	Sh	1'	?	Y	Y	Y	Y	?
<i>Monarda fistulosa</i> ^a	Native beebalm	M-H	S/PS	1 - 2'	Y	Y	Y	Y	Y	Jul-Oct
<i>Oenothera caespitosa</i> ^a	White stemless evening primrose	L-M	S	1 - 2'	Y	Y	Y	Y	Y	Jun-Aug
<i>Papaver orientale</i>	Oriental poppy	H	S/Sh	2 - 3'	Y	Y	Y	Y	Y	May-Jun
<i>Penstemon caespitosus</i> ^{ab}	Mat penstemon	L-M	S	< .5'	Y	Y	Y	Y	Y	Jun
<i>Penstemon secundiflorus</i>	Sidebells	L-M	S	1 - 2'	Y	Y	Y	Y	?	May-Jun
<i>Penstemon teucrioides</i> ^a	Germander penstemon	L-M	S	.5'	Y	Y	Y	?	?	Jun-Jul
<i>Penstemon virens</i> ^{ac}	Blue mist penstemon	M	S/PS	.5'	Y	Y	Y	Y	Y	May-Jun
<i>Phlox subulata</i>	Moss phlox	M	S	< .5'	Y	Y	Y	Y	Y	May
<i>Polemonium</i> sp.	Jacob's ladder	H	S/PS	1 - 2'	Y	Y	Y	Y	Y	May-Aug
<i>Potentilla fissa</i> ^a	Leafy potentilla	M-H	PS	1'	Y	Y	Y	Y	?	?
<i>Potentilla verna</i> ^b	Spring potentilla	M-H	PS	< .5'	Y	Y	Y	Y	Y	Mar-May
<i>Pulsatilla patens</i> ^a	Pasque flower	M	S/PS	1'	Y	Y	Y	Y	Y	Mar-May
<i>Ratibida columnifera</i> ^a	Prairie coneflower	L-M	S	2'	Y	Y	Y	Y	Y	Jul-Sep
<i>Rudbeckia hirta</i> ^a	Black-eyed Susan	M-H	S	2 - 3'	Y	Y	Y	Y	Y	Jul-Sep
<i>Salvia officinalis</i>	Cooking sage	L-M	S/PS	2'	Y	Y	Y	Y	?	Jun
<i>Saxifraga hirsuta</i>	Saxifrage	H	S/PS	.5'+	Y	Y	Y	Y	Y	May-Jun
<i>Scutellaria brittonii</i> ^a	Skullcap	M	S/PS	.5 - 1'	Y	Y	Y	Y	?	Aug-Sep
<i>Sedum</i> spp. ^b	Stonecrop	M	S/PS	1 - 1.5'	Y	Y	Y	Y	Y	Jul-Aug
<i>Sedum lanceolatum</i> ^a	Yellow stonecrop	M	S/PS	.5'	Y	Y	Y	Y	Y	Jul-Aug
<i>Sempervivum</i> sp.	Hens and chicks	L-M	S/PS	.5'	Y	Y	Y	Y	Y	n/a
<i>Senecio spartioides</i> ^{ac}	Broom groundsel	VL-L	S	2 - 3'	Y	Y	?	?	?	Sep-Oct
<i>Solidago missouriensis</i> ^a	Smooth goldenrod	L-M	S	1 - 2'	Y	Y	Y	Y	?	Jul-Aug
<i>Thalictrum fendleri</i> ^a	Fendler meadowrue	H	S/PS	2 - 3'	?	?	Y	Y	Y	Jul-Aug
<i>Thermopsis divaricarpa</i> ^a	Spreading golden banner	M-H	S/PS	2'	Y	Y	Y	Y	?	May
<i>Tradescantia occidentalis</i> ^a	Western spiderwort	M	S/PS	1.5'	Y	Y	Y	Y	?	Jun-Aug
<i>Thymus</i> spp. ^b	Thyme	L-M	S	< .5'	Y	Y	Y	Y	Y	Jun-Jul
<i>Veronica pectinata</i>	Speedwell	L-M	S	< .5'	Y	Y	Y	Y	Y	Apr-Jul
<i>Vinca minor</i> ^b	Periwinkle, myrtle	H	Sh	< 1'	Y	Y	Y	Y	?	Apr-Jun
<i>Waldsteinia</i> sp. ^b	Barren strawberry	M-H	Sh/PS	< 1'	Y	Y	Y	Y	?	May-Jun

Shrubs

<i>Arctostaphylos nevadensis</i> ^{ab}	Pinemat manzanita	M	S/PS	1 - 2'	Y	Y	Y	N	N	n/a
<i>Arctostaphylos patula</i> ^a	Greenleaf manzanita	M	S/PS	3 - 4'	Y	Y	Y	N	N	n/a
<i>Arctostaphylos uva-ursi</i> ^{ab}	Kinnikinnick, bearberry	M	S/Sh	1'	Y	Y	Y	Y	Y	n/a
<i>Betula glandulosa</i> ^a	Bog birch	H	S/PS	6 - 8'	Y	Y	Y	Y	Y	n/a
<i>Calluna</i> sp.	Heather	H	S/PS	2'	Y	Y	Y	?	?	Jul-Aug
<i>Ceanothus fendleri</i> ^a	Buckbrush, mountain lilac	M	S	2'	Y	Y	Y	?	?	Jul
<i>Cercocarpus intricatus</i> ^a	Little-leaf mountain mahogany	VL-L	S	4 - 6'	Y	Y	Y	Y	?	n/a
<i>Cercocarpus montanus</i> ^{ac}	True mountain mahogany	L-M	S	4 - 6'	Y	Y	Y	Y	?	n/a
<i>Chrysothamnus</i> spp. ^a	Rabbitbrush	VL-L	S	2 - 6'	Y	Y	Y	Y	Y	Jul-Aug
<i>Cornus stolonifera</i> ^a	Redtwig dogwood	H	S/Sh	4 - 6'	Y	Y	Y	Y	Y	n/a
<i>Cotoneaster horizontalis</i>	Spreading cotoneaster	M	S/PS	2 - 3'	Y	Y	Y	Y	?	May-Jun
<i>Daphne burkwoodii</i>	Burkwood daphne	M	S/PS	2 - 3'	Y	Y	Y	?	?	Apr-Jun
<i>Erica</i> sp.	Heath	H	S/PS	1'	Y	Y	Y	?	?	Jan-Mar
<i>Euonymus alatus</i>	Burning bush euonymus	M	S/Sh	1 - 6'	Y	Y	Y	?	?	n/a
<i>Fallugia paradoxa</i> ^a	Apache plume	VL-L	S	2 - 4'	Y	Y	Y	Y	Y	Jun-Oct
<i>Holodiscus dumosus</i> ^a	Ocean spray, cliff/rock spirea	L-M	S/PS	4'	Y	Y	Y	Y	Y	Jun
<i>Jamesia americana</i> ^a	Wax flower	M-H	S/Sh	2 - 6'	Y	Y	Y	Y	Y	Jun
<i>Lonicera tatarica</i>	Tatarian honeysuckle	M	S/PS	4 - 6'	Y	Y	Y	Y	Y	May-Jun
<i>Mahonia aquifolium</i>	Oregon grape holly	M-H	S/Sh	4 - 6'	Y	Y	Y	?	?	May-Jun

Scientific Name	Common Name	Approx. Water Needs	Sun/Shade Preference	Approx. Mature Height	Elevation (1,000 ft.)					Approx. Bloom Month
					5	6	7	8	9	
<i>Mahonia repens</i> ^{ab}	Creeping grape holly	L-H	S/Sh	1 - 2'	Y	Y	Y	Y	Y	Mar-May
<i>Philadelphus microphyllus</i> ^a	Little-leaf mockorange	M	S	2 - 3'	Y	Y	Y	Y	?	Jun
<i>Physocarpus monogynus</i> ^a	Mountain ninebark	M	S/Sh	2 - 4'	Y	Y	Y	Y	Y	Jun
<i>Potentilla fruticosa</i> ^a	Shrubby cinquefoil	M	S/PS	2 - 3'	Y	Y	Y	Y	Y	May-Sep
<i>Prunus besseyi</i> ^a	Western sand cherry	L-M	S	1 - 3'	Y	Y	Y	Y	?	May
<i>Purshia tridentata</i> ^a	Antelope bitterbrush	L-M	S	1 - 2'	Y	Y	Y	?	?	Jun-Aug
<i>Ribes aureum</i> ^a	Golden currant	M	S/PS	2 - 3'	Y	Y	Y	Y	Y	Apr-May
<i>Rosa woodsii</i> ^a	Woods' or native wild rose	M	S/PS	2 - 3'	Y	Y	Y	Y	Y	Jun-Jul
<i>Shepherdia canadensis</i> ^d	Russet buffaloberry	M-H	S	5 - 6'	Y	Y	Y	Y	Y	n/a
<i>Symphoricarpos</i> spp. ^d	Snowberry, coralberry	M	S/PS	2 - 3'	Y	Y	Y	Y	Y	n/a
<i>Viburnum edule</i> ^a	Highbush cranberry	H	S	6 - 8'	Y	Y	Y	Y	Y	May-Jun
<i>Yucca baccata</i> ^a	Banana or broad-leaf yucca	VL-L	S/PS	2 - 3'	Y	Y	Y	N	N	Jun
<i>Yucca filamentosa</i>	Adam's needle	M	S/PS	2 - 3'	Y	Y	Y	N	N	Jun
<i>Yucca glauca</i> ^a	Spanish bayonet, small soapweed, Great Plains yucca	VL-L	S/PS	2 - 3'	Y	Y	Y	Y	?	Jun

Large Shrubs and Trees

<i>Acer ginnala</i>	Ginnala maple	M-H	S	6 - 10'	Y	Y	Y	Y	Y	n/a
<i>Acer glabrum</i> ^a	Rocky Mountain maple	M-H	S/Sh	6 - 10'	Y	Y	Y	Y	Y	n/a
<i>Acer grandidentatum</i> ^a	Wasatch maple	M	S/PS	10 - 20'	Y	Y	Y	Y	?	n/a
<i>Alnus tenuifolia</i> ^a	Thinleaf alder	H	S/PS	6 - 8'	Y	Y	Y	Y	Y	Apr
<i>Amelanchier alnifolia</i> ^{ac}	Saskatoon alder-leaf serviceberry	M	S/PS	6 - 8'	Y	Y	Y	Y	Y	Apr-May
<i>Amelanchier utahensis</i> ^a	Utah serviceberry	VL-M	S	4 - 6'	Y	Y	N	N	N	May
<i>Betula fontinalis</i> ^a	River birch	H	S/PS	6 - 8'	Y	Y	Y	Y	?	n/a
<i>Cercocarpus ledifolius</i> ^a	Mountain mahogany	VL-L	S	6 - 15'	Y	Y	?	N	N	n/a
<i>Corylus cornuta</i> ^a	Filbert, beaked hazelnut	H	S/Sh	5 - 6'	Y	Y	Y	?	?	n/a
<i>Crataegus</i> spp. ^a	Hawthorn (several native)	M	S	6 - 8'	Y	Y	Y	Y	?	May
<i>Fraxinus pennsylvanica</i>	Green ash	M-H	S	20 - 25'	Y	Y	Y	Y	?	n/a
<i>Gleditsia triacanthos</i>	Honeylocust	M-H	S	60 - 70'	Y	Y	N	N	N	May
<i>Malus</i> sp.	Crabapple	M	S	10 - 15'	Y	Y	Y	Y	N	Apr-May
<i>Physocarpus opulifolius</i> ^a	Tall ninebark	M	S/PS	4 - 6'	Y	Y	Y	?	N	May
<i>Populus tremuloides</i> ^a	Aspen	M	S	8 - 25'	Y	Y	Y	Y	Y	n/a
<i>Prunus americana</i> ^a	American wild plum	M	S/PS	4 - 6'	Y	Y	Y	Y	N	Apr
<i>Prunus cerasifera</i> ^c	Flowering plum	M	S/PS	8 - 10'	Y	Y	Y	?	N	Apr
<i>Prunus pensylvanica</i> ^{ac}	Pin/fire/wild/red cherry	M	S/PS	6 - 8'	Y	Y	Y	?	N	May
<i>Prunus virginiana melanocarpa</i> ^{ac}	Western chokecherry	M-H	S/PS	6 - 8'	Y	Y	Y	Y	Y	Apr-May
<i>Rubus deliciosus</i> ^a	Boulder raspberry, thimbleberry	M	S/Sh	4 - 6'	Y	Y	Y	Y	Y	Apr-May
<i>Salix amygdaloides</i> ^a	Peachleaf willow	H	S/PS	20 - 30'	Y	Y	Y	Y	?	n/a
<i>Shepherdia argentea</i> ^a	Silver buffaloberry	M	S/PS	4 - 6'	Y	Y	Y	Y	?	Apr
<i>Sorbus scopulina</i> ^a	Western mountain ash	M-H	S/Sh	6 - 8'	Y	Y	Y	Y	?	May
<i>Syringa vulgaris</i>	Common lilac	M	S	6 - 8'	Y	Y	Y	Y	Y	May

^a Native species.

^b Ground cover plant.

^c This species, or some species in this genus, may be poisonous to livestock, pets, wildlife and/or people under some conditions. Before planting, check with Colorado State University Cooperative Extension, Colorado State Forest Service, or other knowledgeable personnel.

^d Several species of *symphoricarpos* are native.

Plants for a FireWise Landscape

Plants that are more resistant to wildfire have one or more of the following characteristics:

- They grow without accumulating large amounts of combustible dead branches, needles or leaves (example: aspen).
- They have open, loose branches with a low volume of total vegetation (examples: currant and mountain mahogany).
- They have low sap or resin content (examples: many deciduous species).
- They have high moisture content (examples: succulents and some herbaceous species).
- They grow slowly and need little maintenance (do not need frequent pruning).
- They are short and grow close to the ground (examples: wildflowers and groundcovers).
- They can resprout following fire, thus reducing relandscaping costs (example: aspen).



Conifers

In Colorado, conifers make up much of our natural forest. Because of their high resin content, they are more susceptible to fire.

Even though conifers are flammable, you do not need to remove all of them from around your home. Wildfire hazards usually can be effectively reduced through proper thinning and pruning of existing trees and shrubs.

When choosing conifers for your defensible space, consider those with characteristics that make them better able to survive fire:

- thick bark,
- long needles, or
- self-pruning. (Self-pruning trees lose lower branches naturally, leaving a greater distance between ground and canopy.)

Additional FireWise Guidelines

Some additional tips to follow when planning a FireWise landscape include:

- Landscape according to the recommended defensible-space zones. The plants nearest your home should be more widely spaced and smaller than those farther away.
- Plant in small, irregular clusters and islands, not in large masses.
- Break up the continuity of the vegetation (fuel) with decorative rock, gravel and stepping stone pathways. This will help modify fire behavior and slow its spread across your property.
- Plant a variety of types and species. Besides being aesthetically pleasing, this will help ensure a healthier forest by reducing insects and diseases. Healthy, vigorous, thinned forests can better resist catastrophic fires than unhealthy ones with insect and disease problems.
- In the event of drought and water rationing, prioritize the plants you wish to save. Provide supplemental water to those nearest your home, perhaps using “gray water.”
- Mulch to conserve moisture and reduce weed growth. Mulch can be organic (wood chips or small bark pieces) or inorganic (gravel or rock). Avoid pine bark, thick layers of pine needles or other materials that can easily carry fire.



Don't Forget Maintenance

A landscape is a dynamic, constantly changing system. Plants considered “fire resistant” and that have low fuel volumes can lose these characteristics over time. Your landscape, and the plants in it, must be maintained to retain their FireWise properties.



FIREWISE is a multi-agency program that encourages the development of defensible space and the prevention of catastrophic wildfire.

Be aware of the growth habits of the plants on your land and of the changes that occur seasonally. Keep a watchful eye for the need to reduce fuel volumes and fuel continuity.

- Remove annual, herbaceous plants after they have gone to seed or when the stems become overly dry.
- Rake up and dispose of litter as it builds up over the season.
- Mow or trim grasses to a low height within your defensible space. This is especially important as they begin to cure and dry.
- Remove plant parts damaged by snow, wind, frost or other agents.
- Timely pruning is critical. It not only reduces fuel volume but also maintains healthier plants with more succulent, vigorous growth.

Additional FireWise Publications

Cooperative Extension

The following publications are available from The Other Bookstore, Colorado State University Cooperative Extension, 115 General Services Bldg., Fort Collins, CO 80523-4061; (970) 491-6198; resourcecenter@ucm.colostate.edu. Printed copies cost \$1; they are available free on our Web site at www.cerc.colostate.edu:

- 6.302, *Creating Wildfire-Defensible Zones*
- 6.303, *Fire-Resistant Landscaping*
- 6.304, *Fire Safety, Evacuation and Home Defense*
- 6.306, *Grass Seed Mixes for the Reduction of Wildfire Hazard*
- 7.205, *Pruning Evergreens*
- 7.206, *Pruning Shrubs*
- 7.207, *Pruning Deciduous Trees*
- 7.402, *Protecting Trees During Construction*

Colorado State Forest Service

The following publication is available from the Colorado State Forest Service, Colorado State University, Fort Collins, CO 80523-5060; (970) 491-6303:

- *Home Fire Protection in the Wildland Urban Interface*, CSFS #142-399



This fact sheet was produced in cooperation with the Colorado State Forest Service.

¹ Wildfire Hazard Mitigation Coordinator, Colorado State Forest Service.

Colorado State University, U.S. Department of Agriculture and Colorado counties cooperating. Cooperative Extension programs are available to all without discrimination. No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.



Appendix F

Higby Estates

Mitigation Guidelines



Create Defensible Space Management Zones around your home.

Zone 1 = 0-30' from the house footprint [which includes attached decks, fences, etc.]

- Remove most flammable vegetative fuels within 15' of house, to create a buffer from fuels.
- Ok to keep a few large trees and shrubs near house as part of the footprint, but with no fuel sources close enough to carry fire to them. Aspen trees near the house are ok.
- Remove all ladder fuels [18" – 6' tall] that help convert ground fires to crown fires.
- Prune branches up about 10' above ground, but leave about 60% of green on the tree.
- Thin to 10-15' spacing between the tips of the longest branch tips of neighboring trees.
- Trim branches which extend over roof eaves. Remove branches within 15' of chimney.
- Remove combustible landscaping within 3-5' of house--ground cover, mulch, etc.
- Remove all juniper shrubs next to the house – if ignited by embers, it burns like a torch.
- Deciduous shrubs next to the house are ok, but plant away from windows, and keep pruned.
- Remove all flammable debris, leaves, pine needles from within 15' of the house.
- Keep pine needles off of roof, gutters, decks, and 'catch' areas on or next to the house.
- Remove all scrub oak within 30' of house.
- Remove anything combustible stored under decks & porches or against the home.
 - replace combustible fence posts next to the house with metal, if possible.
- Mow dry grass and weeds to height of 6" or less within 30' of house.
- Place woodpiles beyond the 30' zone, with no flammable vegetation within 10'.
- Place spare LPG tanks beyond the 30' zone, with no flammable vegetation within 10'.

-**Driveways** - mitigate for safe fire department access/egress.

- Create clearance of about 12' along each side and at least 13' of vertical clearance.

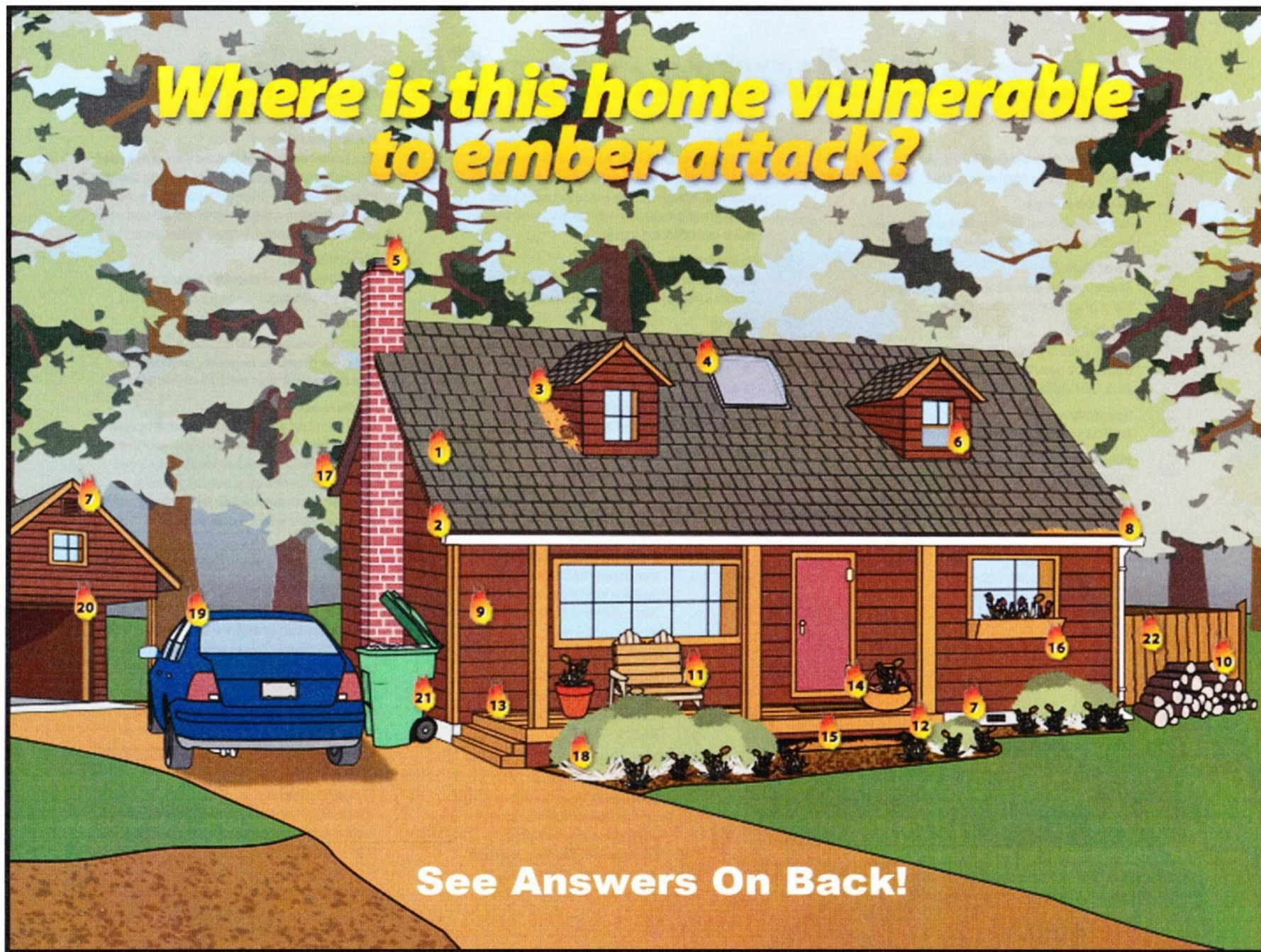
Zone 2 = 30-100' from the house footprint.

- Remove all dead trees and dead branches.
- Remove all ladder fuels.
- Prune branches up about 10' above ground, but leave about 60% of green on the tree.
- Thin out skinny, small, weak, mis-shaped trees to create space for larger, healthy trees.
- Thin to 10-15' spacing between the tips of the longest branch tips of neighboring trees.
- OK to leave trees in clumps – remove least healthy and smaller trees from the clump, and leave 10-15' min between the clump and neighboring trees.
- No need to remove pine needles. They help retain moisture and prevent erosion.

Zone 3 = 100' and beyond from the house footprint.

- Reduce the density of the forest – thin, prune-up, remove ladder fuels.
- Create gaps in the forest canopy by keeping clumps of trees with large open spaces between the clumps. The spacing between clumps does not have to be equal.
- In each clump, keep 5-6 tall, strong, healthy trees—ok to have crowns touching.
- Remove thinner, smaller, weaker, mis-shaped, damaged, mistletoe trees to help improve the health of the larger trees.
- No need to remove pine needles. They help retain moisture and prevent erosion.

Appendix G



Ember Awareness Checklist

- 1 **Wood Roof**
Replace wood shake and shingle roofs with fire-resistant types such as composition, metal and tile.
- 2 **Roof Openings**
Plug openings in roof coverings, such as the open ends of barrel tiles, with non-combustible materials.
- 3 **Roof Debris**
Routinely remove plant debris, such as pine needles, leaves, branches and bark, from the roof.
- 4 **Skylights**
Replace plastic skylights with types constructed of double-pane glass. One of the panes should be tempered glass. Close skylights if wildfire is threatening.
- 5 **Spark Arrester**
Install an approved spark arrester on chimneys.
- 6 **Windows**
Replace single-pane, non-tempered glass windows with multiple-pane, tempered-glass types. Close all windows if wildfire is threatening.

- 7 **Vents**
Cover attic, eave and foundation vents with 1/8-inch wire mesh or install new vent types designed to prevent ember entry. If wildfire is threatening, consider covering vent openings with pre-cut plywood or aluminum foil folded several layers thick and stapled.
- 8 **Rain Gutters**
Keep rain gutters free of plant debris during fire season. Consider using rain gutter covers to reduce maintenance.
- 9 **Siding**
Fill gaps in siding and trim materials with a good quality caulk and replace poor condition building materials.
- 10 **Woodpiles**
Move firewood stacks and scrap lumber piles at least 30 feet from the house or other buildings.
- 11 **Patio Furniture**
Place combustible patio furniture, such as lounges, tables and hammocks, inside the house or garage if wildfire is threatening.

- 15 **Under the Deck**
Remove plant debris, wood piles and other easily ignited materials from under decks. Consider enclosing the open sides of the deck with siding materials that are properly vented or 1/8-inch wire mesh to reduce maintenance and deter ember entry. Do not use wooden lattice to enclose decks.
- 16 **Flowerboxes**
Remove wooden flowerboxes from beneath windows if wildfire is threatening.
- 17 **Eaves**
Cover open eaves with sheathing, such as plywood or fiber-cement board. Use tongue and groove joints or other intricate joint types and don't use butt joints.
- 18 **Flowerbeds**
Replace wood mulches with noncombustible types and remove plant debris, including dried grass and flowers, dead leaves and dead branches from flowerbeds next to the house, other buildings and next to wooden fences. Replace ornamental junipers with low-growing deciduous shrubs or flowers under irrigation.
- 19 **Vehicles**
Close vehicle windows. Back into the garage and close the garage door or park away from the house.
- 20 **Garage Door**
Adjust garage doors to achieve as tight a fit as possible with the door frame. Consider using trim around the garage door opening to reduce the size of gap openings. Close the garage door if wildfire is threatening.
- 21 **Garbage Cans and Recycling Bins**
Use garbage cans covered with tight fitting lids near the house or other buildings. Move newspaper recycling bins indoors.
- 22 **Wooden Fences**
Maintain wooden fences in good condition and create a noncombustible fence section or gate next to the house for at least five feet.



This house was ignited by burning embers landing on vulnerable spots. Notice the adjacent forest is not burning.

- 12 **Deck Boards**
Replace deck boards that are less than one inch thick or that are in poor condition with thicker, good condition boards. Use metal flashing between the deck and the house.
- 13 **Deck Debris**
Remove plant debris from the gaps between deck boards, the gap between the deck and house, and lying on top of the deck.
- 14 **Porch and Deck Accessories**
If wildfire is threatening, remove combustible materials from the porch and deck including newspapers, wicker baskets, door mats, pine cones and dried flower arrangements, and place BBQ propane tanks indoors.

From: University of Nevada, Coop Service FS-09-01

Appendix H

Link to Pikes Peak Wildfire Prevention Partners Video

<https://vimeo.com/84393594>



***Protecting Our Homes,
Our Fire Fighters,
and Our Forests***

