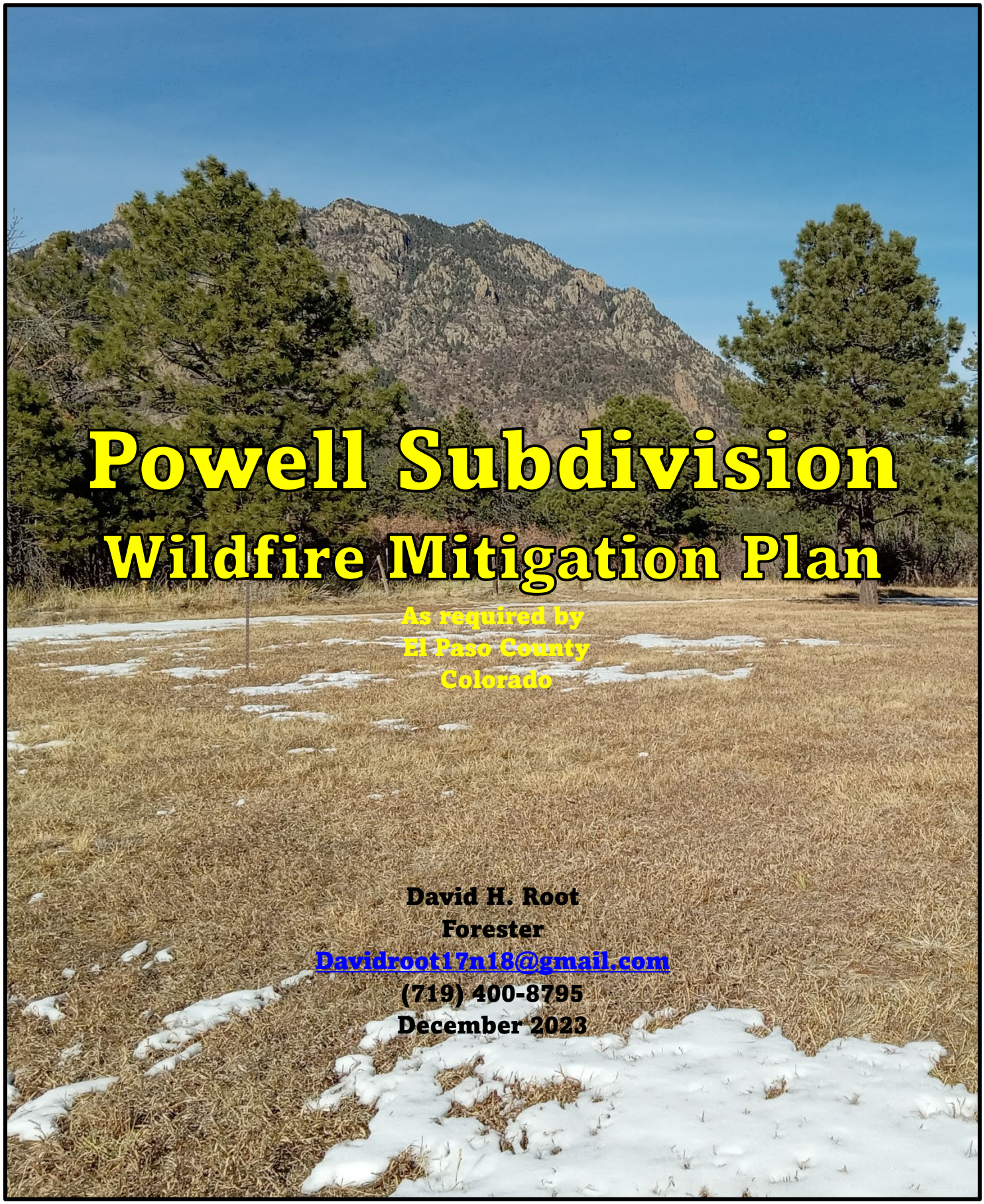

Powell Subdivision

Wildfire Mitigation Plan

As required by
El Paso County
Colorado

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December 2023

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PREFACE

On the afternoon of June 13th, 2003, driven by fierce winds and 100-degree heat, the Black Forest Fire burned through Cathedral Pines. Every home but one survived.

Post fire evaluation by wildfire experts of the Pikes Peak Wildfire Prevention Partners found that the common thread in the areas that suffered minimal damage was fuel reduction.[1]

"Community wide mitigation was found to be most effective in managing wildfire; even during extreme burning conditions. . .

In areas where ladder fuels were pruned and tree stands thinned, tree losses were minimized. Tree losses were heaviest in areas abutting unthinned forests. Firefighters were able to safely defend structures as the fire swept through the community."

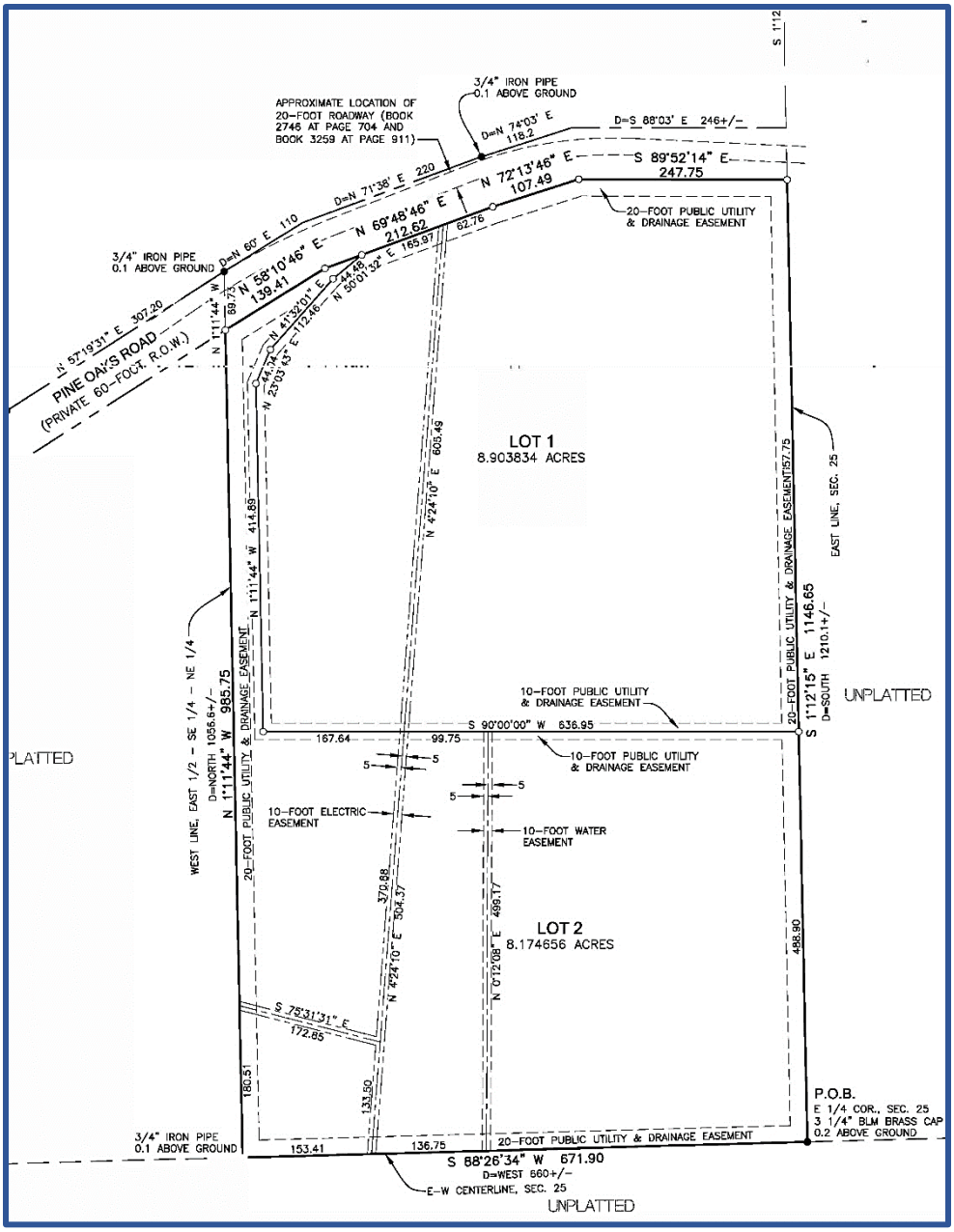
With all due respect to Smokey, wildfires are inevitable.

The purpose of this document is to give The Powell subdivision a good chance to survive the next wildfire.

[1] Pikes Peak Wildfire Prevention Partners. 2014. *Black Forest Fire Assessment Team Report to the Governor of Colorado*. WWW.ppwpp.org

I Introduction

Before any subdivision is approved, El Paso County requires that a wildfire mitigation plan be developed. This Wildfire Mitigation Plan is for 17 acres of land located at 305 Pine Oaks Road in El Paso County Colorado. The property is in the wildland urban interface with a significant risk of wildfire. Wildland Urban Interface, or WUI, is a term for any area where structures are built among wildland fuels. The property is owned by Mr. Brett Powel, and the owners wish to subdivide it into two residential lots as shown in the plat below.



The current property is to be subdivided into two parcels. The northern parcel will consist of 8.9 acres and the southern parcel will be 8.17 acres. The northern parcel contains the current home, a wood frame building built in 1935 and added onto over the years. The home site also contains several outbuildings. The plan is to build a metal building on the southern parcel containing a shop building and living quarters For Mr. Powell on the upper floor.

The location of the new building is shown by the T posts marking the building corners.

The parcel is within the Southwestern Highway 115 Fire Protection District and is included in both the Southwestern 115 Community Wildfire Protection Plan of 2007 and El Paso County Wildfire Protection Plan (CWPP) of 2010

These are large-scale plans covering large expanses of land, and do not give any Wildfire risk information or recommendations for this parcel. The SW 115 CWPP is expected to be updated in 2024.

Therefore, a wildfire mitigation plan specific to the property is necessary, and the observations and recommendations that follow are based on actual observations of the property and are not taken from the SW 115 or El Paso County CWPPs.

The property was mitigated about 15 years ago. Gambel oak was masticated in the understory to create discrete patches of oak in openings well separated from other oak clumps. The ponderosa pine forest was thinned to create openings in the canopy. Unlike many fuel mitigation projects, the initial work has been well maintained. The Powell family holds a yearly "mowing party" to cut the oak sprouts, and the property is still well mitigated.

The fuel reduction on the Powell property clearly shows in this aerial photo. The open forest canopy absence of ladder fuels and discrete clumps of oak contrast with untreated fuels on adjacent parcels. The proposed shop and living quarters are in the grassy meadow at the center of the photo.

Utilities are above ground electricity and natural gas is supplied from an underground propane tank. There is one fire hydrant on

the property. Access and egress from the property is via Pine Oaks Road east to Colorado Highway 115. Pine Oaks Road traverses a drainage and dead ends to the west of the property. Pine Oaks Road is a two lane, paved road along the dry creek towards the highway. The road traverses dense fuels that make escape or access for firefighters hazardous. Although it is beyond the scope of this subdivision plan, a concerted effort among all the neighbors is needed to improve the safety of Pine Oaks Road as an evacuation route. The work done by the Powell family serves as a fine example of proactive mitigation.

Access to the subdivision from Pine Oaks Road is via a driveway and unsurfaced roads around the property. The driveway is the most hazardous portion of the property as it traverses the slope towards Pine Oaks Road along the dry stream bed. Additional thinning along the edges of the driveway would make access for firefighters safer. We will address this further in the prescriptions section.

The proposed community is in a wildfire prone environment and adjacent to wildland fuels. For millennia, these lands have burned, and most of the fires were prescribed burning by Native American tribes. Native Americans used the most convenient technology available, fire, to maintain open savannahs where game was abundant, travel through the forest was easier and enemies could be seen for longer distances. Over millennia of burning, animals, and the vegetation itself adapted to frequent low intensity wildfires. Removal of the Native Americans in the 1870's and attempts to extinguish all wildfires created the overly dense forest as it is today. The idea of a "natural forest" --one not influenced by human activity--has never really existed.

The fuel reduction and continual maintenance have created a wildfire adapted community on the property. The phrase simply means that when there is a fire, the fuels are modified to allow only low intensity fires that produce smaller amounts of radiant heat and embers. Structures are planned and built to resist ignition from radiant heat and embers. Because wildfires are of lower intensity, firefighters can safely defend them. If no firefighters are available, structures have a good chance of surviving without intervention.

As all wildfires were suppressed, fuels increased to such a degree that fires are larger, hotter, and more destructive. The objective of this plan is to maintain the forest in its fire adapted condition. Rather than fire, machines and equipment will do the work. The intention is not to create a wildfire proof forest since that is simply wishful thinking. This ecosystem requires periodic disturbance for forest health and renewal.

The terrain is a gradual slope rising from the east to the west. Slopes rarely exceed 10%, and then only for short distances. As noted, there is one steep slope on the far northern portion of the property where the driveway leaves Pine Oaks Road. A small knob also rises near the east boundary at the northeast corner, and there is a steep drainage for a dry stream running east from the property in lot two and slopes near the southern boundary become steeper.

There are no streams on the property, but there is one dry pond.

No currently infested mountain pine beetle trees were observed during a visit to the property on October 16th, 2023. The one potentially threatening disease is a moderate infection of dwarf mistletoe north and west of the existing house. Mistletoe is a parasitic plant that over many years debilitates trees and spreads through forest stands. It does not kill tree quickly and a long-range treatment plan is necessary. More information about dwarf mistletoe is included in Appendix A.

There is no record of any fire on the property. During the walk around on the property, no fire scars or indications of historical or recent fire were noted. There have been large fires in the area, though. Around 1854 a large fire ignited on the slopes of Cheyenne Mountain and burned at least as far as Wilkerson Pass in South Park. Significant fires also occurred on Cheyenne Mountain in 1890 and again in 1950. The latter had nine fatalities including one 14-year-old firefighter. South of the property, the TA-24 fire of 2008 burned 9,800 acres east of Highway 115 from approximately Barrett Road to Red Rock Valley. A pilot working the fire was killed when his plane went down in the high winds[2].

Adjacent properties are all privately owned residential parcels. Cheyene Mountain State Park is a few hundred yards north across Pine Oaks Road. The park has a long history of fuel reduction projects.

The aerial photo at the right is taken from the Natural Resources Conservation Service's *Soil Survey of El Paso County, Colorado.* According to the survey there are no restrictions on the use of forest harvesting machinery, and the soils show only a low potential for damage by fire.

Map Unit Symbol	Map Unit Name	Acres in AOI
13	Bresser sandy loam, cool, 5 to 9 percent slopes	7.9
17	Chaseville gravelly sandy loam, 8 to 40 percent slopes	0.1
38	Jarre-Tecolote complex, 8 to 65 percent slopes	11.0
Totals for Area of Interest		**19.0**

Soil Map of the Powell Property

[2] Russel, Kathy. (2010). *Community Wildfire Protection Plan for Unincorporated El Paso County.*

II The Home Ignition Zone

Before going further, we must explain some basic concepts of wildland fire behavior. A basic understanding of how wildfires burn helps the reader understand how and why the prescriptions are developed.

Fire behavior, the intensity, rate of spread and direction of spread, are determined by three factors: fuel, topography, and weather.

FUEL: Anyone who has ever built a campfire understands that more fuel equals a hotter fire. We have noted previously that, after a century of wildfire suppression, the forests are unnaturally dense, with high fuel loads. Removing fuel from the forest reduces the amount of heat generated by a fire, but the arrangement of the fuel also influences fire behavior. Effective fuel reduction must address the amount and the arrangement of fuels.

The most hazardous arrangement of fuel is a dense forest understory and a closed forest canopy. Understory shrubs, trees or low branches, called ladder fuels, allow a low intensity ground fire climb into the canopy. A closed forest canopy with connected tree crowns allows the fire to spread through the treetops, as a crown fire, that produces massive amounts of radiant heat and windborne embers.

The amount of heat generated by a flame is directly proportional to its length. Flames longer than four feet produce lethal amounts of heat, and firefighters with hand tools cannot directly attack them. A crown fire produces flame lengths of 60 to 100 feet. Firefighters must fall back to safer areas hoping to halt the fire when it reaches them.

TOPOGRAPHY: The shape of land influences wildfire intensity, direction of spread, and rate of spread. Heat rises so that the radiant heat warms and dries fuels on slopes above the fire. Warm air rises and creates upslope winds that push fires uphill, and fires may move uphill four times faster than on level terrain. Topographic features such as drainages also influence fire behavior. Winds follow drainages, so wildfires burn up a drainage. Steep and narrow drainages increase fire intensity dramatically, but even small a topographic feature will influence fire behavior.

WEATHER: Weather influences wildfire behavior as a current and long-term phenomenon. Long term drought increases the odds that any spark will ignite the dry fuel. Once the fuel ignites, current weather influences the intensity, rate of spread and direction of spread. The Black Forest Fire is an example. The weather on the day it ignited was hot, dry, and windy.

Once the first spark ignited the fuel, strong winds and ladder fuels quickly pushed the fire into the tree crowns and it quickly exceeded the ability of the first responders to halt it. Weather is the wild card of fire behavior. One cannot know in advance what the weather will be when a spark meets the fuel.

Neither topography nor weather can be altered to influence fire behavior. Only the amount and arrangement of fuels can be changed in advance of a wildfire to protect life and property.

THE HOME IGNITION ZONE: The home ignition zone includes the vegetation—both wildland and landscaping--within 100 feet of a structure, *and the structure itself*. Successful wildfire mitigation addresses both the surrounding fuel and the vulnerability of any structures to ignition.

Homes have the best chance for survival if the amount and arrangement of fuel near the home is altered to reduce wildfire intensity. Typically, the defensible zone is one hundred feet surrounding a structure, but each defensible zone should be enlarged downhill on steep slopes.

Defensible space does not require a clearcut surrounding homes. In the simplest terms mature trees should be separated so that fire cannot burn through the upper forest canopy. Ladder fuels should be eliminated so that low intensity fire on the ground cannot reach the forest canopy.

A wildfire can ignite a structure through any one of three ways--radiation, convection, and firebrands. Effective reduction of wildfire hazard addresses all three and protects both homes and the natural environment.

RADIATION: Wildfires can spread to a home by radiating heat in the same way a fire in a woodstove heats a room. On level terrain intense radiated heat can ignite combustible materials from a distance of one hundred feet. To compensate for the effect of slope, defensible space should be extended further than 100 feet on slopes below structures. The steeper the slope, the further defensible space should extend.

CONVECTION: Direct contact with flames, or the wildfire's convective heat column—the hot air and gas rising from the flames--may also ignite a home. This will most likely occur when trees, debris or brush near a structure ignite, and the flames touch a flammable part of the structure. Well executed fuel reduction reduces the chances that flames will directly contact a home or other structure.

FIREBRANDS: Firebrands are embers carried on winds from strong convection drafts in the burning zone. In most cases, the flame front passes quickly, but a shower of firebrands falls on the structure before and after the flame front passes. During server wildfires, embers can ignite spot fires, new fires far ahead of the main fire, as far as five miles from the flaming front. Autopsies of homes burned in wildfires show that 60 to 90% of ignitions are from firebrands, not direct flame contact or radiant heat.

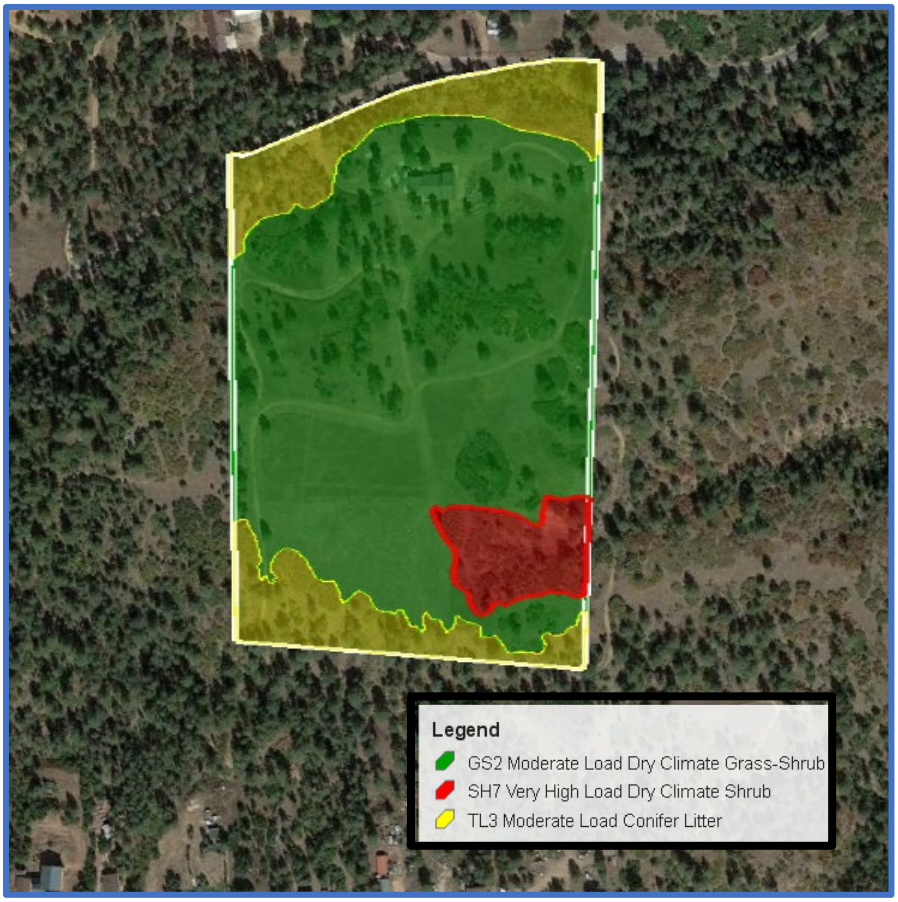
The unburned trees in the background indicate that windblown firebrands, not direct flames contact, ignited this home in the Black Forest Fire. Where wind deposits leaves and needles, wind will also deposit firebrands.

Due to the effective mitigation already in place, the greatest threat to current and future structures is from the possibility of embers ignitions. Chapter V contains information to build ember ignition resistant structures and ways to increase ember resistance of existing structures.

III. Fuel Conditions:

Fire reports show wildfires occur in every month of the year, and residents must be on guard all year around. The threat of a severe wildfire is always greatest during periods of hot, dry, and windy weather and during periods of extended drought. The most damaging wildfires, the Marshall Fire, Waldo Cañon and Black Forest all burned after dry winters and during periods of hot temperatures, high winds, and low relative humidity.

Of the three influences on fire behavior, fuels and topography are easily discernable. Weather must be assumed. To reach a conclusion about the fire threat weather is assumed to be Hot, dry, and windy, the sort that will produce the most intense fire behavior.



Fuel Models (Scott and Burgan) on the Powel Property

Fuels can be analyzed based on standard fuel models. Fuels of similar types, such as grass or ponderosa pine, can be expected to burn with predictable intensities under similar topography and weather conditions. Fuel models were determined by ground observation and then drawn onto the aerial photograph to produce the map above.

The model outputs used here, rate of spread and flame length, serve to illustrate the potential severity of a wildfire. Flame length was explained earlier. Rate of spread is straightforward. It is how fast the fire will move across the landscape when the mid-flame wind speed is 10 miles per hour.

The fuel models used here are those developed by Scott and Burgan.[3] There are three on the property.

[3] 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.

GS2: Moderate Load Dry Climate Grass-Shrub: The model predictions that follow are for unmitigated fuels, especially tall grass. As long as the grass is mowed regularly and the discrete oak clumps are maintained, fire behavior will be moderated.

The fire burns through a continuous fuel bed of grass and shrubs. It may spread rapidly depending on wind speed. The model predicts that very dry grass fuel with midflame wind speeds of 10 MPH, the fire would spread at 0.75 miles per hour with flames lengths approximately ten feet.

Fuel model GS2 on the property. Within this fuel model there are small clumps of Gambel oak and ponderosa pine, but they are not large enough to alter wildfire behavior.

Fire behavior in grass fuel is greatly influenced 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 significant amount of dry fuel.

TL3 Moderate Load Conifer Litter: This model encompasses the areas of ponderosa pine with Gambel oak in the understory. A fire burns through a moderate load of litter and fallen needles. There is only a light load of larger diameter woody fuels on the forest floor.

TL3 is the narrow bands of untreated forest on the northern and southern edges of the property.

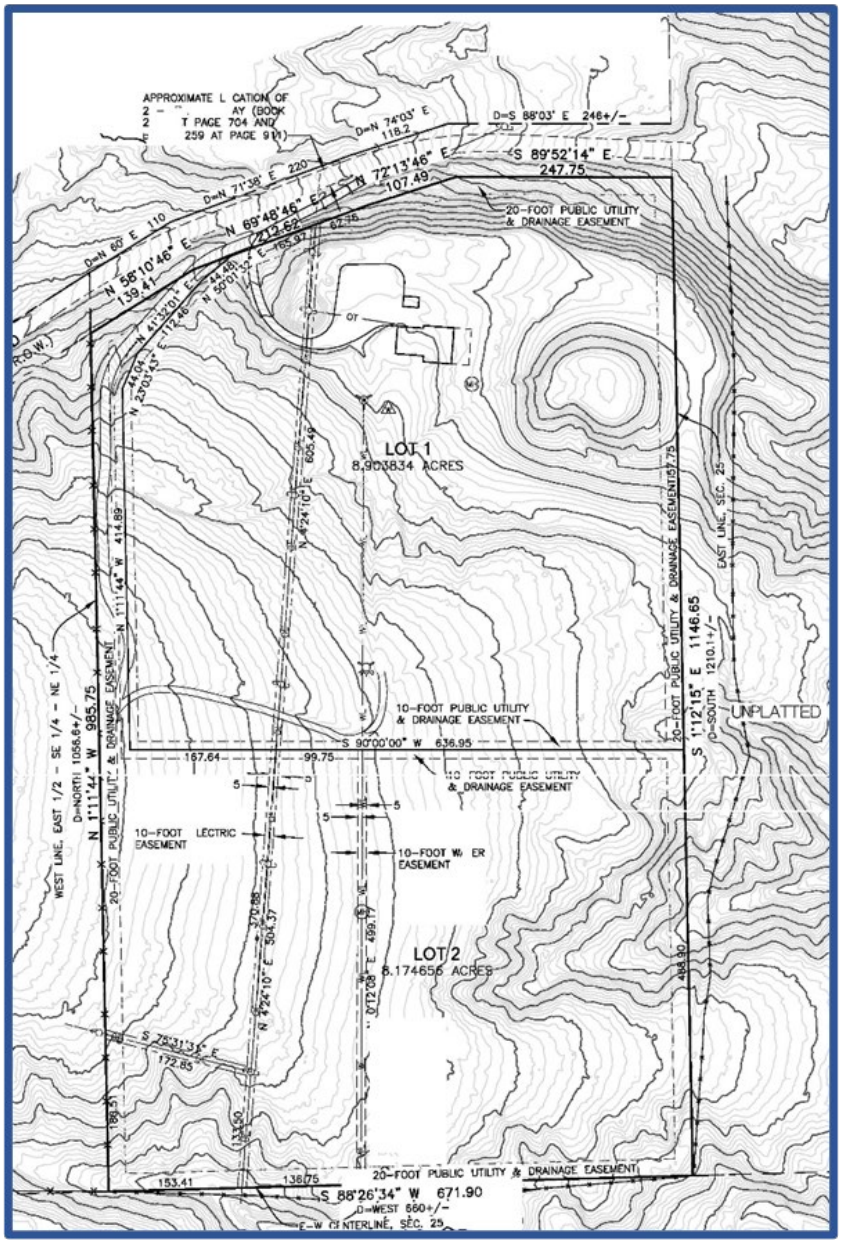
With midflame wind speeds of 10 MPH, the model predicts low rates of spread at approximately 300 feet per hour, and low flame lengths of two feet. The most hazardous area of this fuel type is on the steep slopes south of Pine Oaks Road where the forest has not been mitigated. The driveway traverses this area, and there is a danger that firefighters may not be able to defend the property for fear that escape down the driveway may be cutoff.

Fuel Model SH7 is in the drainage on the southeastern edge of the property. Fires form adjacent propertied could travel up this drainage. The fire would drop to the ground when it reaches treated fuels in the grass fuel model.

SH7: Very High Load Dry Climate Shrub: A fire in this fuel type is carried primarily by shrubs and shrub litter. In very dry fuels and with a midflame windspeed of 10 miles per hour, the model predicts flame length of approximately 20 feet. Rate of spread for very dry fuels and a 10 mph midflame wind is predicted to be approximately one mile per hour.

This fuel model is in the drainage that flows east near the southeast corner of the subdivision. Although the draw is short, it has steep slopes and can draw a fire on adjacent properties to the Powel Subdivision. Should a fire burn up the drainage, it would strike the well mitigated areas of the property and intensity should drop.

Topography: The final consideration when determining the overall fire hazard in the subdivision is the topography as shown in the map on the right. The significant topographical features are the steep slope at the northern end of the property, and the steep drainage near the southeast corner.



The Powell Subdivision topography

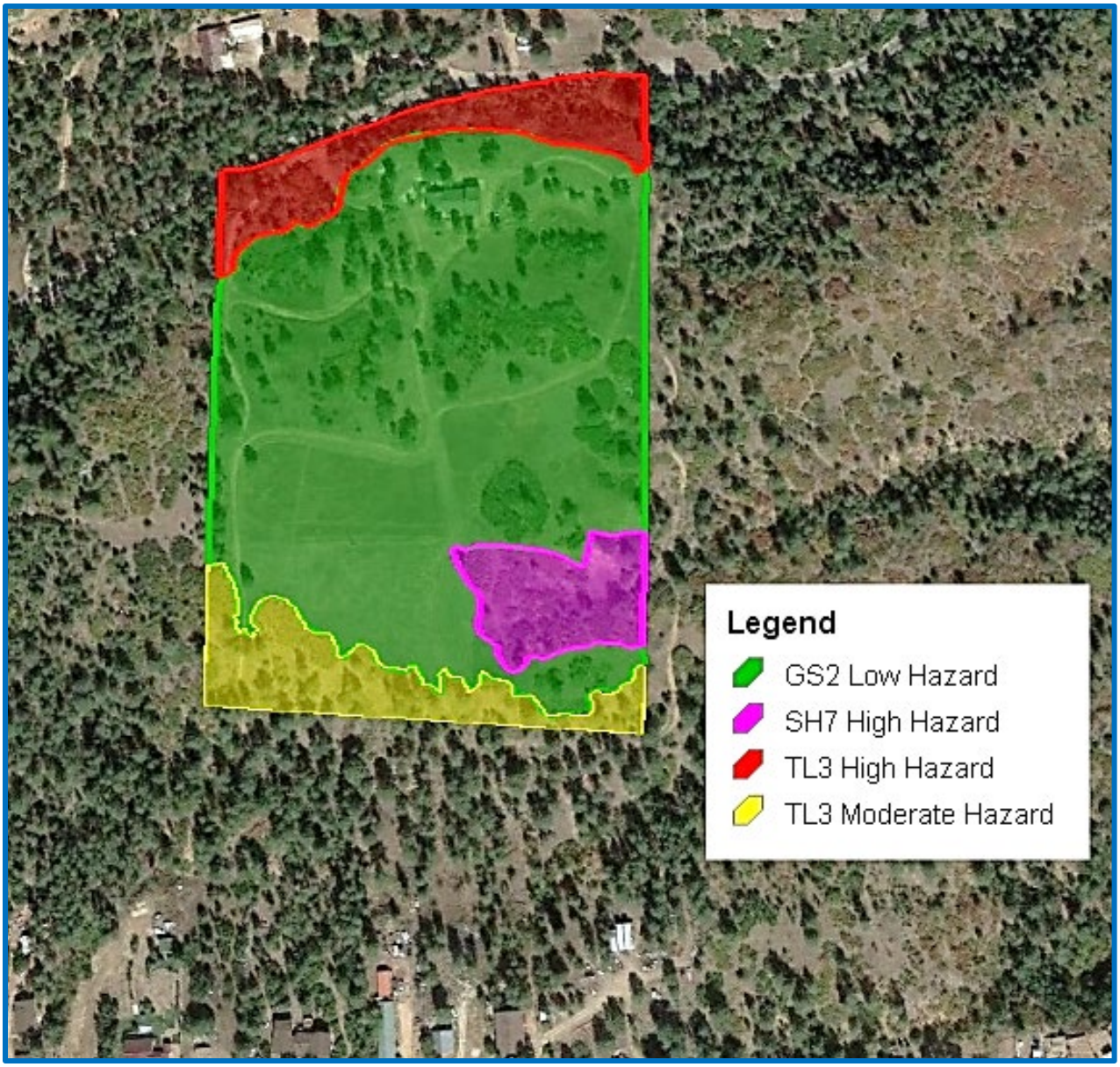
Hazard Ratings: The final hazard ratings are drawn on the map on the next page.

Fuel Model GR2, Low Hazard**:** Thanks to the initial fuel mitigation and the Powell family's continued maintenance the hazard here is low.

Fuel Model SH7, High Hazard: Due to the steep slopes, this area was not mitigated in the original fuel reduction. The drainage has a high hazard, but mitigation would require specialized machines or hand work that is prohibitively expensive. Fortunately, these fuels are surrounded by well mitigated areas and the overall risk to the property does not make it a priority for treatment.

Fuel Model TL3, Moderate Hazard: The slightly steeper terrain and untreated fuels along the southern boundary combine for a moderate hazard. Like the shrub fuels above the cost of treating this difficult terrain would not be cost effective as the area is surrounded by well mitigated fuels.

Fuel Model TL3, High Hazard**:** The steep slopes, up to 25% for short distances, increases the wildfire hazard to high. Although the canopy is open, the dense understory of Gambel oak creates a high hazard. Like the other areas, it abuts effective mitigation, but the concern is the driveway that traverses the high hazard. In the event of a wildfire, access for firefighters might be blocked, or firefighters already on the property might be trapped. Therefore, the driveway is the highest priority for mitigation. Ponderosa pine in this area also has a moderate infection of dwarf mistletoe that can be addressed during any mitigation activities. Appendix A has information for control of dwarf mistletoe.



IV FIRE MITIGATION AND FOREST HEALTH PRESCRIPTIONS.

During severe fire weather the entire community is at risk, and reduction of the risk involves fuel mitigation around homes prior to construction and homeowner maintenance.

The Black Forest Fire serves as an example of the worst-case scenario, and how severe weather greatly increases fire intensity. Winds were gusting to 40 miles per hour, temperatures were above 100 degrees and humidity was below 10%. The fire spread over eight miles in one afternoon and killed nearly every tree and burned every unmitigated home in its path.

Access and evacuation:

In the event of an evacuation, the County Sherriff will determine the safest evacuation route based on the current conditions and expected fire behavior. Residents should follow the Sheriff's instructions without hesitation. If a fire is threatening the area, it is advisable to evacuate early and not wait for an evacuation order from the Sheriff.

Information will be relayed to residents by local media and through reverse 911 calls to local phones. Reverse 911 calls are not automatically relayed to wireless phones, so to receive reverse 911 notices, cell phones

Evacuation Tips:

In Advance of an Evacuation:

- **Know at least two ways out of your Neighborhood.**
- **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, 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 "to go kit" ready for pets. Visit https://www.nfpa.org/-/media/Files/Public-Education/Campaigns/TakeAction/TakeActionPetsChecklist.pdf for more information**

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 "to go kits' 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 protect your face.**

need to be registered with the El Paso-Teller E911 Authority. The address of the registration webpage is:

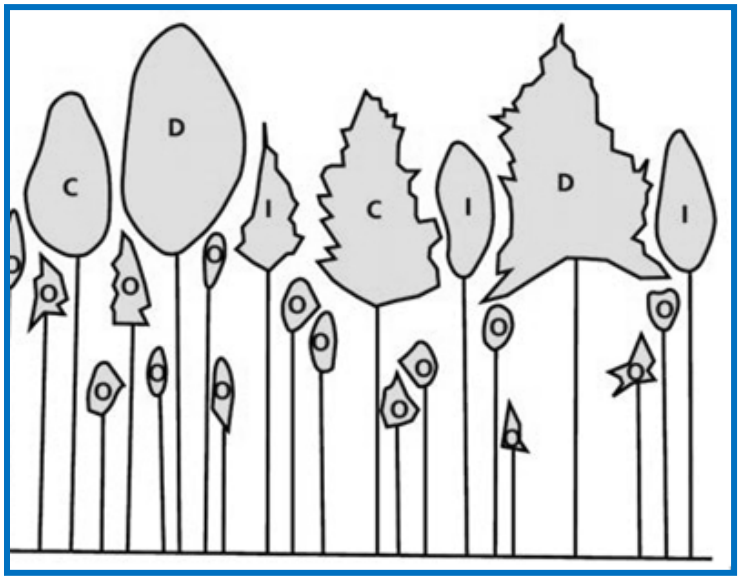
Http://www.elpasoteller911.org

When the fire weather is severe, homeowners should remember not to leave flammable items outside. This includes rattan doormats, flammable patio furniture, firewood stacked next to the house, or other flammables.

TREE SELECTION:

Fuel reduction removes trees of poor form and low vigor while trees of good form and high vigor remain. A quick primer on tree selection will help landowners understand forest thinning. Homeowners may wish to have their trees marked for thinning by a qualified forester. Ponderosa pine are shade intolerant trees. They germinate and grow in sunny openings after a disturbance has removed the existing forest and exposed bare soil. The most vigorous trees outgrow and over top their weaker siblings.

The significance for those thinning trees is, absent insect infestation severe damage or disease, the largest trees in a clump are likely to be the most vigorous. Large diameter and height are signs of vigor. Other indicators of vigor are long thick needles, the number of



On the right is a schematic diagram of forest stands based on crown position in even aged stands. "D" indicates dominant trees (the tallest and largest diameter trees); "C" indicates co-dominant trees (those slightly less tall and thinner trunk diameter); "I" indicates intermediate trees (shorter and crowded by the larger trees; "O" indicates overtopped trees (those in the understory below all the others.

On the right is a photograph of one of the clumps on the Powell property. Dominant, co-dominant and intermediate trees are clearly seen. Because ponderosa pine is shade intolerant this clump has few overtopped trees.

green branches on a tree or crown ratio. Trees with more green branches covering at least 50% of the trunk are vigorous. A conical or Christmas tree shape in the tree also indicates vigor. A rounded top indicates less vigor but is not a fatal flaw if there are no better trees to leave.

Forest thinning should remove all overtopped trees, nearly all intermediate trees. Co-dominants should be removed when they are poorly formed or if necessary to make spaces between dominants. A few clumps that are not within 200 feet of structures (including those on neighboring properties) can have only overtopped and a few intermediate trees removed. Stands with closed canopies and intertwined branches are cover and shelter for wildlife. If the clump is away from a structure, less than 100 feet in diameter and separated from other clumps by approximately 30 feet, no great hazard will result.

Forests are natural things with tremendous amounts of variability. There are no absolute rules when marking stands. If approximately 90% of the remaining trees are of good vigor the tree marking is good. A few trees can be character trees, those with interesting shapes or unique attributes that add to the aesthetic value of property and create a sense of nature. Standing dead trees are essential wildlife habitat, and some down wood is also important habitat. Be sure that down wood and wildlife trees are separated by wide distances, and not in defensible zones.

Before leaving this topic, it is important to make one final observation. Even though wildfire mitigation seems to emphasize tree spacing, thinning to a pre-determined spacing is poor forestry. Leaving healthy vigorous trees is the objective and spacing is secondary.

FUEL MODEL GS2 PRESCRIPTION:

This model represents the mitigated areas of the property and includes the current and proposed structures. The prescription here is simple: Keep doing what you are doing. The continued maintenance keeps the hazard low.

Grass should not go into the winter taller than six inches. Grass fires may burn any month of the year, and tall cured grass should not be present during the winter months.

The mowed grass on the left effectively halted the spread of the Black Forest Fire.

Mow the grass within 30 feet of structures in late fall if necessary to reduce the fuel during the cold months.

Mowing grass when the weather is hot, dry and windy can also be dangerous. The April 2002 Pine Glen Fire in Black Forest was started when a homeowner tried to mow grass, ironically to reduce the fire hazard, on just such a day. The fire burned about 70 acres on the Pineries Ranch (now the Pineries Open Space) over the next two days. Grass should be mowed when the humidity is high, and the wind is light.

The area is not without risks though. The greatest hazard here is that embers from a fire off the property might ignite low intensity wildfires that could contact, and ignite, a structure. The information in Chapter V should be followed for construction of the new buildings and the current structures should be inspected to keep them resistant to ember ignitions and isolated from low intensity fires. Below are prescriptions for the three defensible space zones. The current structures on the property have good defensible space and the material is included here mostly as a guide for future maintenance.

Zone one (0 to 5 feet): This is the closest zone to a structure and extends 5 feet from the foundation and edge of any deck. The goal is to eliminate most large trees or shrubs so that the convective heat will not ignite the structure.

All coniferous trees should be removed. A high value tree may be left within this zone if the lowest branches are pruned so that they are well above a fire-resistant roof. Only one or two trees near the structure should remain. Treat such trees as part of the building and create at least 15 feet of space on the side of the tree away from the structure.

Be sure not to accumulate any combustible materials in zone one. Firewood should be at least 30 feet away from the structure and uphill. Beware of any landscaping as shrubs or tall plants will become dangerous fuels adjacent to a structure. Firewise landscaping is described in Chapter V.

Zone two (5 to 30 feet): Trees should have an average spacing of ten feet between the branches. Remember the earlier admonition about spacing, any forest management project, should always leave vigorous trees, and shuch trees do not always occur on a convenient spacing. Clumps of two or three trees can remain in this zone. If two desirable trees are left on a closer spacing, increase the space around the clump.

Ladder fuels should be removed from all three zones of defensible spaces. Remove shrubs or low branches that will permit a ground fire to reach the upper crown of the tree. Trees greater than 30 feet tall should be pruned eight feet from the ground. Smaller trees should always have at least two-thirds of the green needles 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 30 feet from each

edge of the drive. This is important to allow safe access and egress for emergency vehicles. Adequate clearance should be maintained to allow access to large structural fire trucks. Twelve feet of horizontal clearance and 13 feet of vertical clearance are required. At the end of driveways, adequate room for a large fire engine to turn around should be maintained.

Zone three (30 to 100 feet): The main fuel reduction guideline for zone three is to thin the trees to an average spacing of 10-feet crown separation. Clumps of two to five 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 as described for zone two.

The family mows the property yearly to keep oak sprouts down and there are clumps of older oak well isolated from mature clumps. Yearly mowing creates excellent mitigation and can continue unaltered if the family wishes. However, the Powells may consider letting some small areas of oak sprouts grow in zone three while removing some older clumps. The purpose would be to break the oak into younger and older clumps simply to increase vegetative diversity on the property. Age diversity of oak also improves the overall forest health and wildlife habitat on the property. The degree to which this suggestion is followed depends entirely on the family's objectives for their property. So long as clumps are small and isolated, the mitigation will remain effective.

FUEL MODEL TL3, HIGH HAZARD PRESCRIPTION:

The primary hazard in this fuel type is the driveway through this fuel model. To defend property, firefighters must have a safe and rapid escape route should the fire explode unexpectedly. Despite the excellent defensible space, heavy fuel along the driveway is a hazard that may prevent firefighters from defending the property.

The forest canopy is generally open, but the Gambel oak in the understory can burn intensely and cut off escape. The prescription is to mitigate fuel within 30 feet of each edge of the driveway. When the mitigation is complete, the forest structure should resemble zone two of defensible space. Remove most of the oak within thirty feet of the driveway.

Treat the ladder fuels by removing them from within ten feet of the driplines of the remaining conifers and break the oak into discrete clumps. The maximum diameter of a clump should not exceed 2 times the height of the oak. Clumps should be in openings and separated from other oak clumps by 3 times the height of the oak. For example, if the oak is 5 feet tall, then 15 feet of space should separate the clump from other woody vegetation.

The forest canopy does not require heavy thinning, but trees that are ladder fuels should be removed. Trees remaining should be dominant and co-dominants. Also, as the trees grow taller than eight feet, they will need to be pruned by the homeowners, remembering to always leave two thirds of the green branches.

The ponderosa pine in this area has a light infection of dwarf mistletoe. Some of the trees with heavy infections of mistletoe could be removed during the fire mitigation if the Powell family chooses. Appendix A has more information about treating the disease.

FUEL MODEL TL3, MODERATE HAZARD: The forest structure here is like the northern area of the property, but the terrain is less steep and there is no important access route through the model. Therefore, there is no pressing need to mitigate this area. The prescription is to do nothing.

FUEL MODEL SH7, HIGH HAZARD, PRESCRIPTION: Although this unit is a high hazard, it is a low priority. The mitigation surrounding the drainage makes the effort and expense of working in this topography pointless. Time and money spent trying to mitigate this area can be used more effectively mitigating the driveway. The greatest concern here is that firebrands may spread from the draw onto structures or into fuel mode GS2 starting spot fires. Adequate mitigation of the GS2 fuel type and hardening structures are the most effective mitigation for this area.

SLASH DISPOSAL:

Defensible space and forest thinning produce large amounts of unusable limbs and waste wood called slash. Slash must be properly treated dried branches left on the ground become a hazardous fuel bed.

The most common and aesthetically pleasing slash treatment is chipping. The slash if chipped and left on the ground to decay. Chipping does not remove the fuel but puts it close to the ground where it would smolder and not produce open flames. Branches must usually be hand carried and fed through the chipper, so it is labor intensive and expensive.

The cheapest, but visually unpleasant, slash disposal is to lop and scatter the slash. The slash is cut into pieces that are less than 24 inches long and less the 12 inches high. Over the course of several winters, snow pushes the slash onto the ground where it decays. If winter snow is minimal, as frequently happens in this region, the breakdown may be slow. Until the slash decays, it may burn and produce enough heat to kill nearby trees. Lop and scatter is best used where terrain does not permit access to chippers and then only in small areas where the concentration of slash is small.

The most common method of thinning trees for wildfire mitigation is with masticating machines. A masticating machine (or Fecon head) is simply a drum with large teeth mounted on a tractor or skid steer. The tractor drives through the woods grinding trees marked for removal grinding them into shreds. Tree removal and chipping are combined into one step.

CONTRACTING:

There are many contractors in the area who do mitigation work for landowners either by machine or by hand. Most contractors are honest businesspeople who do quality work, but there are dishonest individuals in any business, so landowners should be cautious when

hiring a contractor. Obtain at least three bids for any project and obtain at least three references from past jobs.

FINANCIAL ASSISTANCE:

Finally, there are state and federal cost share programs available to landowners to help defray the cost of mitigation and forest management. The percentage of cost paid, and the timing of the programs vary. Most programs are administered through the Colorado State Forest Service, and information can be found on their website at: http://csfs.colostate.edu/

Another opportunity for cost sharing may be through the Natural Resources Conservation Service's (NRCS) EQIP Program. Information can be found on the NRCS website at: https://www.nrcs.usda.gov/programs-initiatives/eqip-environmental-quality-incentives

WILDFIRE MITIGATION TAX SUBTRACTION:

It is also important to note that a portion of expenses related to wildfire mitigation is deductible from Colorado taxes. More information on the Colorado Wildfire Mitigation Tax Subtraction is available on the Department of Revenue website at:

https://tax.colorado.gov/sites/tax/files/Income65.pdf#:~:text=Individuals%2C%20estates%20and%20trusts%20may%20claim%20a%20subtraction,claim%20per%20tax%20year%20is%20limited%20to%20%242%2C500.

V PREVENTING HOME IGNITION

New residents in rural subdivisions are typically refugees from urban life. They seek the slower pace and privacy of life on five acres of rural land. What often surprises them is that emergency services cannot respond with eight minutes of a 911 call. The expectation is that when a wildfire breaks out, a fire engine will be parked in every driveway spraying unlimited amounts of water to halt the fire in its tracks.

Reality is not like that. When a wildfire is reported, the first dispatch is to the local fire district. Volunteer firefighters must arrive at the station, put on their gear, and leave the station. Even before the first firefighters leave the station, 911 will dispatch firefighters from adjacent fire districts as automatic mutual aid. Homes in rural areas are typically far from the station and roads are not as easily negotiated as urban streets. If the weather is hot, dry, and windy and the fuel is untreated, a fire can reach the tree crowns within minutes and become unstoppable. This is the scenario of the Black Forest Fire.

Homeowners should begin mitigation with the assumption that the home may have to survive without intervention from firefighters. Removal and alteration of wildland fuels does not eliminate wildfire from defensible spaces, but it reduces the amount of radiant heat and embers from the fire.

As noted in chapter one, there are several existing structures including a home and several sheds. The existing fuel treatments will effectively reduce the amount of radiant heat impinging on structures during a wildfire. The greatest threat to existing and any existing structures would be firebrands or a low intensity fire igniting a building.

Recall from Chapter One that 60% to 90% of homes destroyed in wildfires are ignited by firebrands, when the flames may be miles away. Existing structures should be hardened against firebrands as much as their basic construction will allow. New structures should be designed for maximum resistance to ember ignition.

The most vulnerable part of a structure most vulnerable to firebrands is the roof. Any class A roofing material will resist ember ignitions, and class A roofs are required by building codes. 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.

Combustible debris, dried needles, or leaves, on a roof are extremely dangerous and should be removed as often as it accumulates. Debris tends to accumulate where one roof shape meets another, gables, or dormer windows for example. Eddies in the wind tend to deposit debris in these places. Winds associated with wildfires will deposit firebrands in the same places. Chimneys should have well maintained spark arrestors.

The eves (the extension of the roof over the outside wall) are also vulnerable areas. Open eves, with the roof joists exposed, are particularly vulnerable because the irregular surfaces can trap hot gasses and firebrands. Enclosure of exposed eves (called a soffit) helps prevent

this. If possible,t 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.

Gutters should be kept free of debris for the same reasons. Should firebrands ignite debris in gutters, the fire will spread to the wooden eves and the home will be lost. Plastic gutters are combustible and may burn, igniting the structure. Gutters and downspouts should be metal.

Vents, in roofs and foundations, are also areas of vulnerability, but are necessary to ventilate attics and crawl spaces. During a wildfire, heated gasses and firebrands can enter attics or crawl spaces through vents. All vents should be screened with metal screening with openings of 1/8 inch or less. Soffit vents should be located as close to the edge of the eve as possible. Vegetation around foundation vents can create unintended vulnerability, particularly on the downhill side. Landscaping with stone or rock around crawlspace vents is recommended.

Walls of existing structures cannot be easily altered, and wood siding is reasonable safe when defensible space is adequate to keep intense radiant heat 100 feet away.

Metal, stucco or stone is obviously more resistant to ignition than wood siding. El Paso County building codes require stucco or stone exteriors on homes built in the wildland urban interface.

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 last longer than single pane when exposed to the heat of a fire.

The vinyl window frame on this home melted and warped in the Black Forest Fire, but not enough to allow firebrands inside the home. Metal framed windows resist warping.

Window frames are also important. Metal frames offer the best protection. Vinyl frames usually do not burn but can melt when exposed to intense 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 from firebrands, assuming the homeowner can close them before evacuating.

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

Decks are second to roofs as vulnerable features on homes. Part of the charm of living in a rural environment is enjoying the view from the deck, and a few simple actions can greatly reduce the vulnerability of decks.

If a deck burns, the home will burn with it. Keep the underside of decks clear of any combustible material.

The worst thing any homeowner can do is to store firewood, scrap lumber, even gasoline on or beneath a deck. Nothing combustible should be beneath a deck. Only bare soil, stone, or brick is safe.

Beware of debris that collects in the cracks of the decking above the joists. Even if the decking is ignition resistant cement fiberboard, trapped debris can ignite from firebrands and spread the fire to the wood joists below. Use a stiff broom or pressure nozzle to remove debris anytime it accumulates. New standards for deck construction issued by the National Fire Protection Association recommend that decking boards be placed a minimum of ¼ inch apart to help reduce the volume of debris trapped between joists.

Chair cushions, umbrellas, propane bottles, even door mats can ignite from embers. It is not our intent to suggest homeowners forgo soft cushions, but simple precautions will reduce any hazards. On days when there is high fire danger, store cushions or other flammable items inside when leaving for the day. Check propane tanks and hoses frequently to be sure they are not cracked or in poor condition. Propane bottles should be painted a light color. Dark colored propane tanks absorb radiant heat while silver or white tanks reflect heat.

Aside from the hazard posed by firebrands, the other hazard is that a low intensity fire would contact a structure on the Powell property. Homeowners in rural areas have varying appetites for landscaping. Not all dangerous fuels are native plants. Some of the worst come from garden centers, and poor landscaping choices can undo all the good of defensible space.

Regardless of the homeowner's desire for landscaping, the one essential landscape feature is to maintain a five-foot non-combustible barrier around the foundation and deck. Defensible space does not prevent fires. It reduces them to low intensity, but the barrier prevents any fire from touching a structure. The barrier can be bare dirt or more elaborate depending

on the homeowner's taste. Under no circumstances use wood, rubber, or other combustible mulch next to a foundation.

If the homeowner prefers, some plants are permissible in the barrier. Plant only a few herbaceous flowers and never plant woody shrubs, junipers, or tall ornamental grasses. Any plant that creates woody or dry vegetation near the walls should be avoided. The El Paso County Master Gardeners publish a useful list of Firewise landscape plants that may be downloaded at:

https://elpaso.extension.colostate.edu/wp-content/uploads/sites/44/2022/09/Low-Water-Fire-Resistant-Plant-Materials-0712-2022-1.pdf

Other landscaping suggestions are:

- Plant in small clumps with space between clumps.
- Stone, gravel, or dirt paths help break up fuel continuity and improve defensible spaces.
- Landscape with Firewise plants.
- It is pointless to rake up needles or leaves beyond the five-foot buffer. It has negligible effects on fire behavior and removes natural mulch that holds soil moisture. All the effort required to rake up needles is better used thinning forest trees and making the structure ember resistant.

It is tempting to store firewood near the home for easy gathering on cold days. This habit should be avoided. Firewood should be stored at least 30 feet away and uphill from any structure.

Many homeowners desire wooden privacy or wood rail fences. In a wildfire, wood fences become wicks that bring flames in direct contact to a structure. Fortunately, it is not necessary to forgo wood fences. Separating the fence from a structure with a four-foot metal gate will adequately mitigate the hazard. It is also necessary to keep tall grass and other flammable vegetation at least five feet away from wooden fences.

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

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

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

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

WEBSITES:

Firewise USA: http://firewise.org/

Protecting Your Home with Defensible Space:
http://static.colostate.edu/client-files/csfs/pdfs/FIRE2012_1_DspaceQuickGuide.pdf

Firewise Construction:
http://static.colostate.edu/client-files/csfs/pdfs/firewise-construction2012.pdf

Firewise Landscaping: http://static.colostate.edu/client-files/csfs/pdfs/06303.pdf

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

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

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

Colorado State Forest Service: http://csfs.colostate.edu/

Natural Resources Conservation Service EQIP Program: https://www.nrcs.usda.gov/programs-initiatives/eqip-environmental-quality-incentives

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

Ready, Set, Go: http://www.wildlandfirersg.org/

Evacuation preparedness for pets: https://www.nfpa.org/-/media/Files/Public-Education/Campaigns/TakeAction/TakeActionPetsChecklist.pdf

APPENDIX A: INSECT AND DISEASE CONDITIONS

Literally thousands of insects 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 on the property 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/common-insects.html.

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

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

Well maintained forest have a multidude 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 is common in Black Forest, Mountain pine beetle is increasing in stands with severe dwarf mistletoe or that were underburned, but not killed in the Black Forest Fire.

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 dwarf mistletoe are visible on the branch as thick fingerlike growths extending out of the branch or trunk.

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. Colorado State Forest Service photo by Dave Root.

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

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

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

The tendency of mistletoe to infect all trees in a stand makes eradication difficult. No effective chemical treatment exists for mistletoe, and the only way to kill the parasite is to kill the host. In stands where only

the susceptible species of tree exists, total eradication of the mistletoe would require a clearcut, which is unacceptable to most landowners.

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

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

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

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

MOUNTAIN PINE BEETLE

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

Adult beetles fly and attack new trees from midsummer through the first frost. Females seek a large, weak tree in which to mate and lay eggs. Vigorous trees generate enough pitch to prevent the female from burrowing through the bark, and this attempt by the tree to prevent entry creates the pitch tubes symptomatic of beetle attack. Pitch tubes are **not** a particularly reliable indicator of a successful attack. If pitch tubes are seen, check for reddish boring dust (fine sawdust) at the base of the tree and in the bark crevices. Boring dust is a more reliable indicator of successful attack.

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

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

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

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.

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, 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:

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

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

While no insecticide effectively treats infested trees, spraying with insecticides such as carbaryl or permethrine prevents attack. Preventive sprays will not kill beetles under the bark. Spray trees between May 1st and July 1st each year for maximum effectiveness. It is not practical to spray every tree on a large tract of land, so choosing which trees to spray depends on the landowner's budget and the value of individual trees to the landowner.

Preventative spraying should be done only if there is a serious threat from infested trees within a mile or less of the property. Preventative sprays kill predators of aphids. Predators keep aphids at low levels and trees can easily tolerate their feeding. Frequent preventative spraying allows aphid populations to increase to concentrations where they may do serious injury or kill a tree outright.

Thinning forests for increased health and vigor by far is the best preventive measure for mountain pine 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 mountain pine beetle. Ips will attack larger trees if they are severely weakened by disease (most often dwarf mistletoe), or are damaged by construction, lightning strikes or in horse corrals where soil compaction injures the roots. Like the mountain pine beetle, ips burrow beneath the bark and inoculate the tree with bluestain fungus, and they often follow mountain pine beetles into larger trees.

The 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.

The differences between mountain pine beetle and ips are significant to anyone implementing a forest management program. In contrast to MPB, which produces 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 permethrine or carbaryl in April and repeated in July. When spraying preventively for ips, it is important to spray the branches, as well as the trunk.

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

Ips will infest green slash and downed logs from forest management projects. If slash is not promptly treated, ips will emerge to attack living trees; treat slash within four to six weeks after cutting. If weather conditions permit, thinning trees in winter when ips are dormant will prevent problems with beetles in slash. However, slash cut after March 1 may still be green enough to attract ips when the weather warms.

Chipping slash will kill ips beetles. Lopping and scattering slash into lengths less than 24 inches promotes rapid drying and prevents infestation. Untreated slash left over the winter will produce live broods the following April. Due to their short lifecycle, solar treatment of ips-infested logs is ineffective. Bucking

larger diameter logs and promptly splitting them into firewood accelerates the drying process and usually is effective in preventing ips infestations.

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

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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.

USDA Forest Service, Forest Health Management Rocky Mountain Region. 2009. *Sudden aspen Decline in Colorado.*

Appendix B: Further Information

Websites:

Cost Share Assistance Database: http://nrdb.csfs.colostate.edu/
Colorado State Forest Service: http://www.csfs.colostate.edu/
CSFS, Woodland Park District: http://csfs.colostate.edu/pages/woodlandparkdist.html
Firewise Communities: http://www.firewise.org/
El Paso County: http://www.elpasoco.com/Pages/default.aspx
Colorado State University Extension: http://www.extension.colostate.edu/chaffee/
Pike National Forest: http://www.fs.usda.gov/psicc
Bureau of Land Management, Royal Gorge Field Office: http://www.blm.gov/co/st/en/fo/rgfo.html
Natural Resources Conservation Service: http://www.co.nrcs.usda.gov/

Publications:

Wildfire Mitigation

***CO Dept. of Revenue Tax Subtraction*:** http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1251915899901&ssbinary=true
Fuel Break Guidelines for Forested Communities: http://csfs.colostate.edu/pdfs/fuelbreak_guidellines.pdf
Protecting Your Home from Wildfire: Creating Wildfire Defensible Zones:
http://csfs.colostate.edu/pdfs/FIRE2012_1_DspaceQuickGuide.pdf
Firewise Landscaping: http://csfs.colostate.edu/pdfs/06303.pdf
Firewise Plant Materials: http://csfs.colostate.edu/pdfs/06305.pdf
Forest Home Fire Safety: http://csfs.colostate.edu/pdfs/06304.pdf
Grass Seed Mixtures to Reduce Wildfire Hazard: http://csfs.colostate.edu/pdfs/06306.pdf
Living With Fire: A guide to the Homeowner: http://csfs.colostate.edu/pdfs/LWF51303.pdf
Firewise Construction: Site Design and Building Materials:
http://csfs.colostate.edu/pdfs/firewise-construction2012.pdf

Forest Health and Management

Gambel Oak Management: http://csfs.colostate.edu/pdfs/06311.pdf
Landowner's Guide to Thinning: http://csfs.colostate.edu/pdfs/landowner_g4thin_scr.pdf
Landowner's Guide to Living With Bark Beetles: http://csfs.colostate.edu/pdfs/MPB_Newspaper_Insert_Final.pdf
Landowner Assistance Programs in Colorado:
http://csfs.colostate.edu/pdfs/Landowner-Assistance-Programs-rev112610.pdf

Forest Insect and Disease Information

Dwarf Mistletoe Management: http://csfs.colostate.edu/pdfs/DMT.pdf
Mountain Pine Beetle: http://csfs.colostate.edu/pdfs/MPB.pdf
Solar Treatment for Mountain Pine Beetle:
http://csfs.colostate.edu/pages/documents/Solar_Treatment_for_Mountain_Pine_Beetle_April_2009.pdf
Products used to Prevent Mountain Pine Beetle: http://csfs.colostate.edu/pdfs/Web__Revision_June6_MPB_Prev_Products_QG.pdf
Ips Beetles: http://csfs.colostate.edu/pdfs/Ips.pdf
Western Spruce Budworm: http://csfs.colostate.edu/pdfs/05543.pdf
Firewood and House Log Insects: http://csfs.colostate.edu/pages/documents/firewood_insects.pdf
Protecting Trees During Construction: http://csfs.colostate.edu/pdfs/construction.pdf

Post Wildfire Recovery:

Insects and Disease Associated with Forest Fires: http://csfs.colostate.edu/pdfs/06309.pdf
Vegetative Recovery after Wildfire: http://csfs.colostate.edu/pdfs/06307.pdf
Soil Erosion Control After Wildfire: http://csfs.colostate.edu/pdfs/06308.pdf
Replanting in Burned Areas: Tips for Safety & Success:
http://csfs.colostate.edu/pdfs/FINAL-Post-FireReplanting-andSafetyTips-2013Feb11.pdf
Aspen Survival After Wildfire: http://csfs.colostate.edu/pages/documents/How-to-Aspen.pdf
Douglas-fir Survival After Wildfire: http://csfs.colostate.edu/pages/documents/How-to-Aspen.pdf
Gambel Oak and Serviceberry Survival After Wildfire:
http://csfs.colostate.edu/pages/documents/How-to-gambel-oak-and-serviceberry.pdf
Piñon Pine and Juniper Survival After Wildfire: http://csfs.colostate.edu/pages/documents/How-to-PJ.pdf
Ponderosa Pine & Lodgepole Survival After Wildfire:
http://csfs.colostate.edu/pages/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 eve or soffit which allows airflow into the attic and/or walls of a structure.

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

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

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

Felling: The cutting down of trees.

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

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

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

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

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

Fire Management: The activities concerned with the protection of people, property, and forest areas from wildfire and the use 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 note regeneration usually maintains the same forest type and is done promptly after the previous stand or forest was removed.

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

Safety zone: An area essentially cleared of flammable materials, used by firefighters to escape unsafe or threatening fire conditions. Safety zones are greatly enlarged areas in which firefighters can distance themselves from threatening fire behavior without having to take extraordinary 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 note in some species cones open and seeds are shed when heat is provided by fires or hot and dry conditions.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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