

RED HILL FOREST WILDFIRE PROTECTION PLAN



JUNE 2009

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INTRODUCTION

Red Hill Forest Subdivision is situated in the center of Park County, Colorado, and encompasses approximately 13,600 acres. The Subdivision is divided between the North-West Fire Protection District and the Hartsel Fire Protection District. There are 580 lots in the subdivision, 108 of which are improved. The subdivisions population continues to expand at an ever-increasing rate. As our population expands, so does the potential of wildfire to destroy homes and our community. Therefore, it is imperative that all private landowners work cooperatively to decrease this risk.

Background

The twentieth century brought an era of conservation regarding the nation's forests. Fires were actively suppressed to protect the young trees. The present forests are quite different from those existing before settlement, when the role of fire in maintaining healthy forests was not recognized.

As fires have been suppressed, fuel levels have increased so that fires more easily ignite and burn with greater intensity. Additionally, climatic variations and drought cycles have worsened the fuel situation. The prolonged drought has made the forests drier, and the trees more susceptible to death from insects and disease. Finally, the rapid expansion of residential housing and other development in the wildlands has greatly increased the difficulty of managing wildfires.

Fire managers can no longer just focus on perimeter control and putting the fire out. They must deal with evacuation and safety of residents, protection of homes, greater fire intensities, heavy media interest and other issues. There must be high levels of cooperation and coordination across jurisdictional and agency boundaries. Wildfire poses an enormous risk to Red Hill Forest and its increasing number of residents. It is clear that the homeowners must have a strategy for improving awareness, coordinating suppression response, and acting efficiently in fuel mitigation projects.

Healthy Forest Restoration Act

In 2000, more that 7 million acres burned across the United States, marking one of the worst wildfire seasons in American history. The fire season of 2002 was another reminder to citizens and governments about the severity of wildfire in America. Since then, the acreage burned each year has increased.

The fire seasons of 2000 and 2002 led to comprehensive forest planning and the enactment of the Healthy Forest Restoration Act (HFRA) in 2003. In HFRA, Congress directed vulnerable communities to prepare Community Wildfire Protection Plans.

HFRA requirements for Community Wildfire Protection Plans

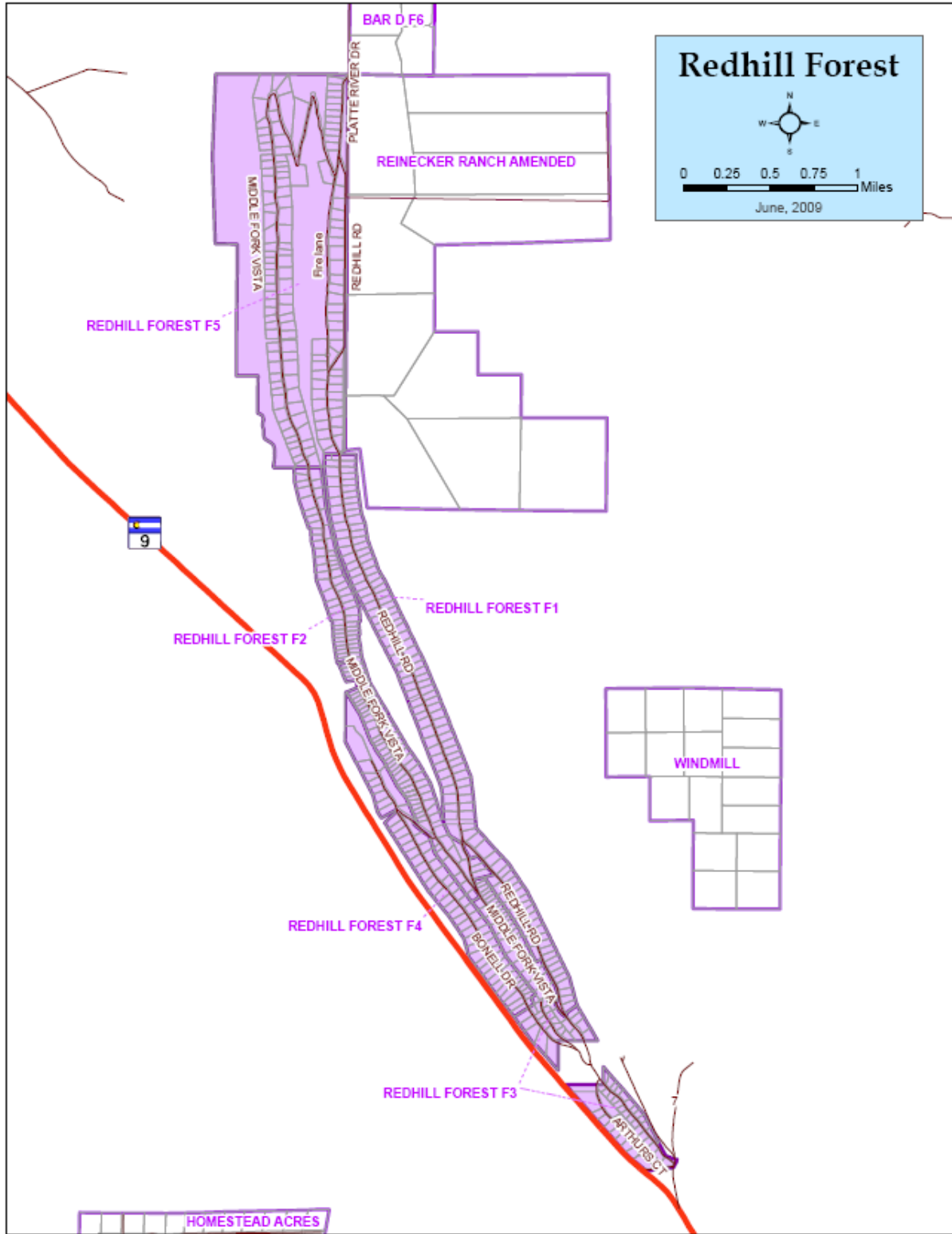
The Healthy Restoration Act requires the following items of a CWPP:

- a. Collaboration between private landowners, emergency services personnel and federal and state land managers.
- b. Identification and prioritization of fuel reduction strategies and treatments, with recommendations for the future.
- c. Recommendation of measures that homeowners and communities can take to reduce ignitability of structures.

Wildland Urban Interface (WUI) Description

The wildland-urban interface (WUI) is commonly described as the zone where structures and other human development meet and intermingle with undeveloped wildland or vegetative fuels.

Most of the factors and treatments that determine the survivability of a structure lie within one to two hundred yards of the structure, and usually are located on private lands. However, many other items beyond that distance are critical to a community. These include, among others, community water supplies, effects on property and real estate values, community infrastructure, economic impacts to residents and businesses, aesthetic values, and a sense of community or why “we live here.”



Map 1: Red Hill Forest Base Map. This map provides general information about Red Hill Forest Subdivision.

GOALS AND OBJECTIVES

This subdivision plan is intended as a first step in the wildfire mitigation planning process. The following are the broad goals and specific objectives of the Red Hill Forest Wildfire Protection Plan.

Goal One:

Promote and develop materials and information regarding prevention and education that improve community wildfire awareness and safety. The wildfire plan creates awareness within the Red Hill Subdivision about wildfire danger, creates a workable action plan to mitigate hazards on private lands, and improves prevention and preparedness.

Specific objectives

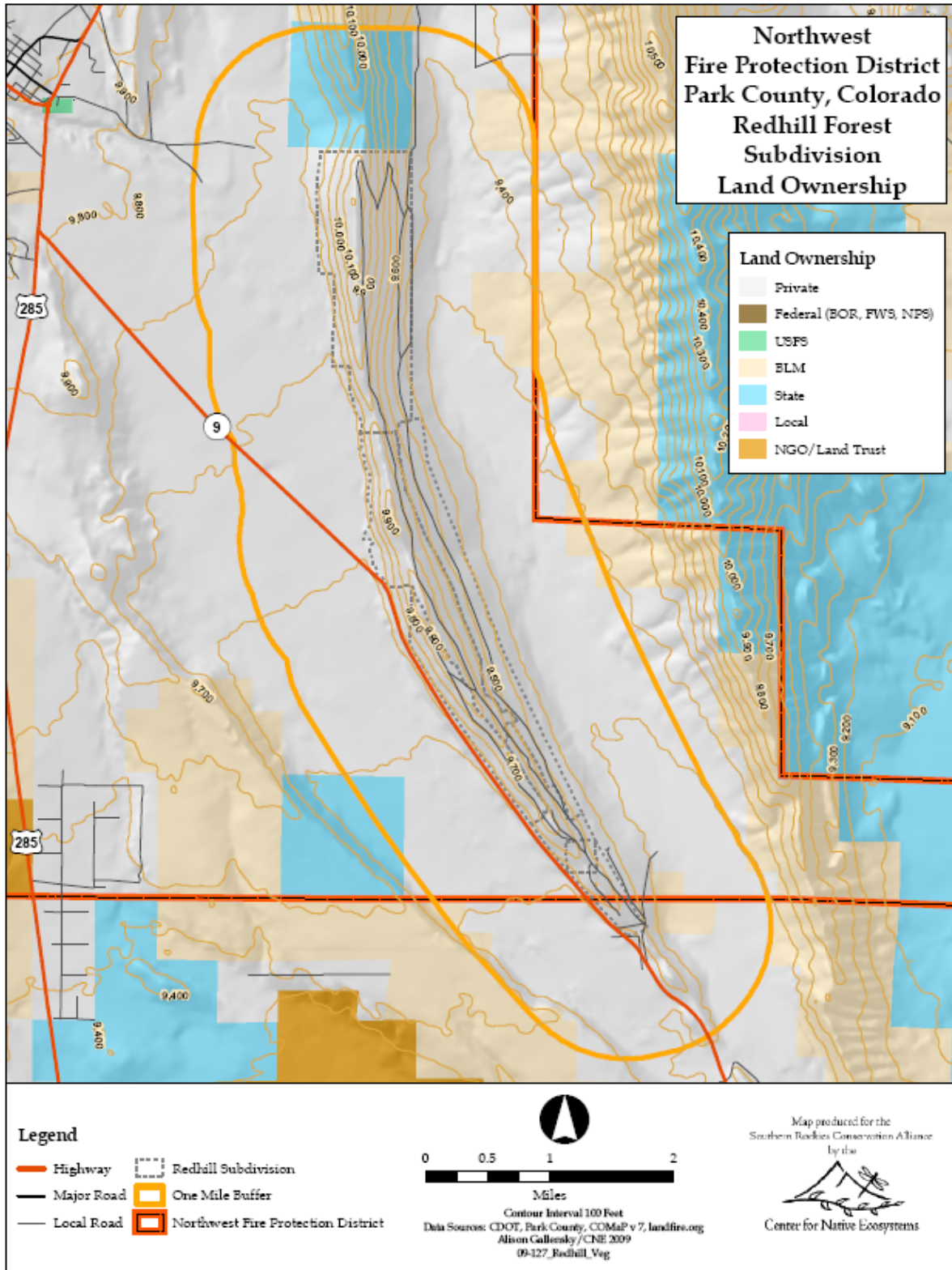
- 1. Develop an updated assessment of subdivision risk to catastrophic wildfire and preparedness for wildfire. Present the assessment to the residents of Red Hill Forest through this wildfire plan.***
- 2. Continue to provide information to individuals and homeowners for creating defensible space and reducing the susceptibility of structures to wildfire by identifying websites and other sources in this document.***
- 3. Provide information to the residents about the growing beetle infestation problem and how it will affect Red Hill Forest in the coming years.***

Goal Two:

Review appropriate hazardous fuel reduction treatments for the Red Hill Forest Subdivision and implement the most appropriate actions. Red Hill Forest has diverse needs regarding wildfire mitigation. It is important for the private property owners to develop mitigation plans for their properties and for the subdivision to work toward creating manageable mitigation solutions.

Specific objectives

- 1. Develop an initial assessment of wildfire hazard on private lands. This would be an individual property analysis to help owners to know the most effective actions they can take. Information would be maintained by the fire department and only made available to the individual owners.***
- 2. Provide support, through the Red Hill Board, to create cooperative efforts across ownership boundaries on an ongoing basis as requested.***
 - a. Develop community project days to assist one another and handle created biomass.***
 - b. Seek grant funding (through NWFPD CWPP) to enable project accomplishment on multiple areas (consider identifying specific portions of the area as first need-jfc).***
- 3. Work with local fire protection districts, the county, and other entities to improve wildfire mitigation opportunities for private landowners.***



Map 2: Red Hill Forest Land Ownership Map

CURRENT RISK SITUATION

Drought

Colorado has a long history of periods of low precipitation and drought, including our most recent years. The period from the beginning of the 1980's to approximately the late 1990's was actually one of the wettest periods in Colorado history, and hence, is a deceptive indicator of long-term moisture regimes. Throughout history, drought is more the norm in the arid Inter-mountain West.

One of the short-term effects of drought and water shortage is an increased risk for wildfires. Prolonged weather patterns, such as drought, correlate strongly to major fire years in Park County. For example, the Hayman fire occurred during the spring of 2002, which was the driest on record for Colorado at the time. There were 15,770 fires in the Rocky Mountain Region that year. The next year saw higher precipitation and a lower incidence of wildfires; 3,957 total.

Changing Fuel Conditions

Fuel types in Park County range from open grasslands in South Park to lodgepole pine in the higher elevations, and ponderosa pine/Douglas-fir in lower portions of the County. Within all of these fuel types are patches of aspen and grass openings. Natural fire regimes differ in all these fuel types, and, therefore, so do the strategies to mitigate wildfire hazard.

In the Redhill Forest Subdivision, there is a mix of approximately 85% Douglas Fir trees with a small portion of Aspen trees intermixed throughout the area. Over the years, the forest has become overpopulated with trees, making them more susceptible to insect and disease mortality, and has accumulated greater levels of surface fuels. Before fire suppression, this forest type was characterized by frequent, low intensity fires. Most stands burned every five to thirty years. Frequent burning had a thinning and cleansing function in this forest type. Stands maintained in this way were open, with herbaceous groundcover.

The result of years of fire suppression is a change in the species composition. For example, the proportion of Douglas fir has increased significantly due to the denser, more closed forests. Douglas fir does not regenerate well in the open canopy. We are seeing Douglas Fir rejuvenate in open areas. These types of forest need intensive management with the absence of fire. Regeneration of Douglas fir further increases forest density and creates abundant ladder fuels to move fires into the tree crowns.

Many of these once open forests have become overgrown and unhealthy. Areas that once may have only supported 30 to 50 trees per acre, now often contain hundreds in the same space. Previous meadows have become forested and all of these trees now compete for limited water and nutrients. This results in trees smaller in diameter and more susceptible to drought, disease and insects.

Weakened vegetation will often fuel large, catastrophic fires that threaten lives, property and the environment. The aftermath of such incidents leaves the forest void of nutrients, a clean water supply, and a home for displaced wildlife. In forests that are not overgrown, wildfire burns more slowly and often stays closer to the ground, clearing away excess fuel such as needles, litter and small seedlings and revitalizing the forest, without destroying the healthy trees. Increased mortality and lack of low intensity fires, combined with very low decomposition rates in an arid climate, adds more dead wood to the surface of the forest.

REDHILL FOREST VEGETATION TYPES

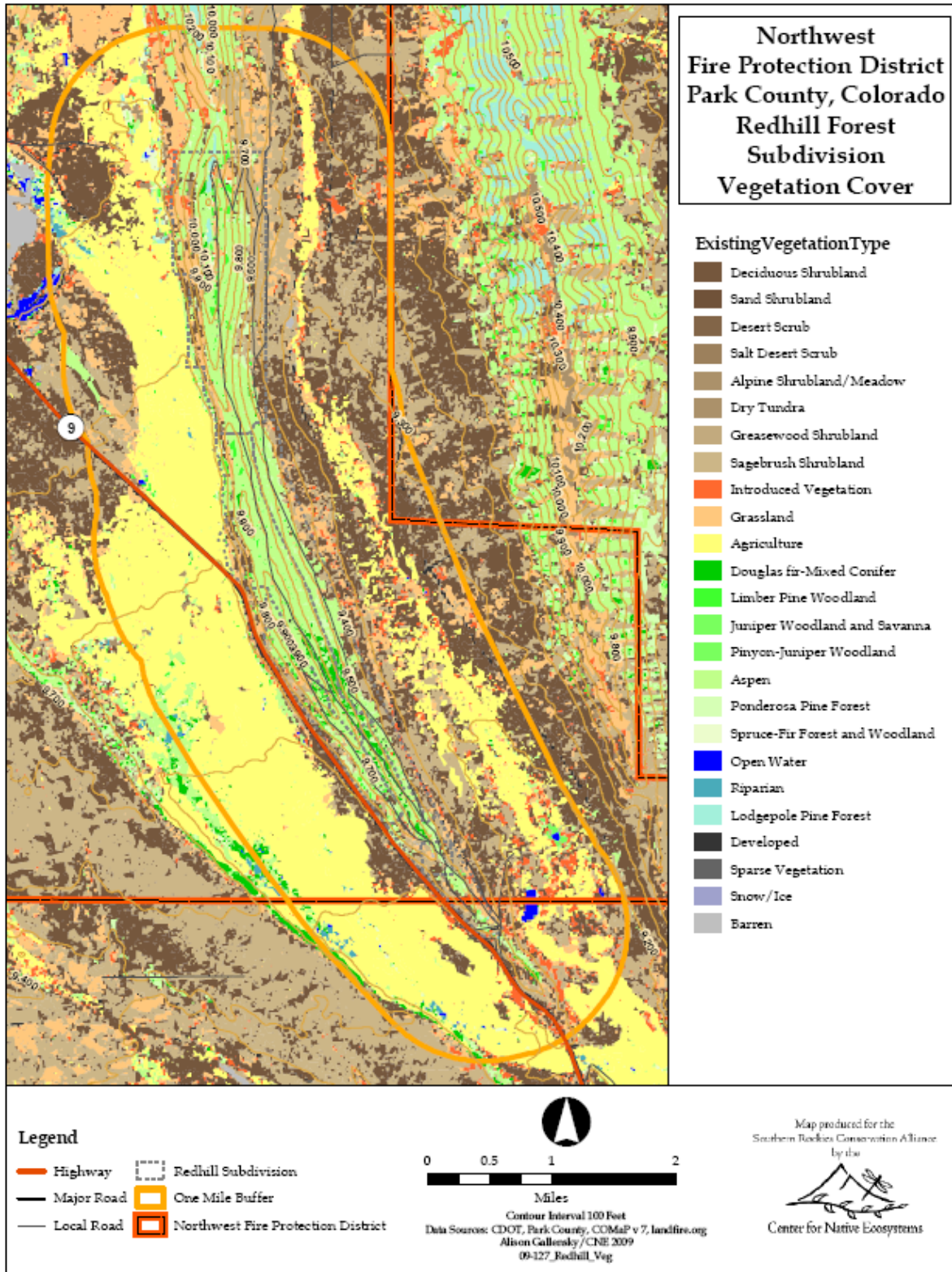
Vegetation Cover Type	Map Legend	Acres	Percent
Agriculture-Cultivated Crops and Irrigated Agriculture	Agriculture	4,400	32%
Rocky Mountain Lower Montane-Foothill Shrubland	Deciduous Shrubland	2,000	15%
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	Aspen	1,200	9%
Quercus gambelii Shrubland Alliance	Deciduous Shrubland	1,200	9%
Inter-Mountain Basins Big Sagebrush Shrubland	Sagebrush Shrubland	1,100	8%
Southern Rocky Mountain Montane-Subalpine Grassland	Grassland	1,100	8%
Artemisia tridentata ssp. vaseyana Shrubland Alliance	Sagebrush Shrubland	900	7%
Introduced Upland Vegetation-Perennial Grassland and Forbland	Introduced Vegetation	500	4%
Rocky Mountain Aspen Forest and Woodland	Aspen	300	2%
Developed-Open Space	Developed	200	1%
Agriculture-Pasture/Hay	Agriculture	100	1%
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	Spruce-Fir Forest and Woodland	100	1%
Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	Limber Pine Woodland	100	1%
Rocky Mountain Subalpine-Montane Mesic Meadow	Alpine Shrubland/Meadow	100	1%
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	Douglas fir-Mixed Conifer	100	1%
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	Douglas fir-Mixed Conifer	100	1%
Southern Rocky Mountain Ponderosa Pine Woodland	Ponderosa Pine Forest	100	1%
		13,600	

Vegetation in and within 1 mile of the Redhill Forest Subdivision Park County, Colorado

Data Source: landfire.gov Data Retrieved: 6/10/2009

Acres rounded to the nearest hundred. Cover types with less than 100 acres removed from table

Analysis performed by Alison Gallensky, Center for Native Ecosystems, 6/11/2009



Map 3: Red Hill Forest Vegetation Map.

Detailed Insect and Disease Conditions

Insect and disease outbreaks have several impacts on potential wildfires. First, standing dead evergreens, with their dead needles still intact, add considerably to the potential for crown fires, as well as significantly increasing the spread rates of crown fires.

Standing dead trees, known as snags, have several impacts on fires. The small dead needles act much like kindling, spreading fire to the larger diameter wood. Without the needles the fire will not often spread through the crowns. Once the needles have fallen, dead trees may actually reduce the potential for crown fires or reduce fire spread. Regardless, as snags catch fire and fall, dead trees increase hazard to firefighters. As fire burns up the trunk of dead trees, embers are carried into the air increasing the danger of new fires igniting downwind.

In the absence of fire, the snags begin to blow down. The downfall greatly increases the surface fuel load, and the likelihood of mortality or crown fire in the remaining forest. The fire's heat from large accumulations of fuel on the forest floor adds significantly to soil damage as heavy fuels burn for long periods of time. This unraveling of the forest as mortality occurs and trees start to fall is what makes many high elevation forest types flammable.

Mountain Pine Beetle

Over the last several years, communities in Colorado—most notably Summit, Jackson, Grand and Routt Counties—have been experiencing an unprecedented epidemic of mountain pine beetles. Large, mature lodgepole and ponderosa pines are the preferred hosts, and many areas are experiencing 70 percent or greater mortality. Limber and bristle cone pines are less often attacked by beetles, but are more susceptible to white pine blister rust. Mountain pine beetle, in ponderosa pine, has also reached epidemic levels in the Arkansas Valley, where over fifty percent of the ponderosa pine have died in infected areas.

In Park County, the epidemic has not reached the levels of other counties, but there are several areas of high activity. The worst activity is in the area from Weston Pass south to Trout Creek Pass. Mountain pine beetles in ponderosa pine are active in the southern end of Park County and in the Bailey area.

The beetles are at epidemic levels for the same reasons that the forests are at increased risk of devastating crown fires. A century of fire suppression contributes to unnaturally dense, unhealthy, and declining forests. As with the potential for catastrophic fire, five years of drought have intensified the problem. The devastation wrought by the beetles in neighboring counties is no different than that caused by the Hayman and other fires except that it occurs over a much longer span of time.

Ips or Engraver Beetles

These relatives of the mountain pine beetle usually attack injured or recently felled trees. They commonly attack all pines, and have been particularly devastating to pinion pines in southwest Colorado. They also commonly infest improperly treated logging slash, from which new broods emerge to attack living trees. Ips have usually been considered a killer of smaller diameter trees

less than four inches in diameter, but in the aftermath of the drought they have successfully attacked larger trees in increasing numbers. Larger trees infected with dwarf mistletoe have been particularly susceptible to ips beetle. Trees in horse corrals and animal pens where soil is compacted and nutrient loads from manure stress trees are commonly attacked by ips beetles.

A particularly important difference between ips and mountain pine beetles is that ips may produce up to four generations per year as opposed to the mountain pine beetles one. Ips often infects the top of a tree first and subsequent generations continually move down the tree until the entire tree is killed.

Both beetles transmit a fungus called bluestain that is primarily responsible for the death of infested trees. Feeding activity of the larval beetles spreads the fungus throughout the tree. The fungus plugs the conductive vessels of the tree that transport water and nutrients from the roots to the needles, and the trees simply die from lack of water. Ips beetles are at normal levels in Park County, but are increasing in many locations.

Dwarf Mistletoes

Dwarf mistletoe is a serious problem in conifer forests throughout Colorado, and Park County is no exception. In fact there are likely more trees in the County infected with this parasite than there are trees infested with bark beetles. Because dwarf mistletoes kill trees slowly—it may take 60 years to kill the tree—mistletoe is often unnoticed. Most often, mistletoes weaken trees to the point that bark beetles attack them, and it is the beetle that shoulders the blame for death of the tree.

Dwarf mistletoe is a parasitic plant that grows on the branches or trunks of their host conifers. Aspen are not susceptible to mistletoe. The parasites invade the conductive tissues of the tree, and draw water and nutrients from the host. The visible shoots of the mistletoe are reproductive structures only, and produce no food for the parasite. Over time, infected branches become twisted and contorted into bizarre shapes called witch's brooms. Less visible damage caused by dwarf mistletoes includes growth reduction, loss of wood quality, poor tree form, and reduction in seed crops.

There are three species of dwarf mistletoe in the County, and they are named by their principle host. These are ponderosa pine, lodgepole pine, and Douglas fir. The Douglas-fir species occurs exclusively on Douglas fir. Both the ponderosa and lodgepole may occur on either pine species. In addition, ponderosa pine and lodgepole pine mistletoes may infect other species of pines including ornamentals.

Fire is the natural control for dwarf mistletoe. As trees in mistletoe pockets succumbed to the parasite, fuels levels increase and intense fires burn the infected trees. Young trees will be quickly infected if the large trees above them are infected. Control strategies for these or any other forest insects or diseases are complex and site specific, and beyond the scope of this document.

Forestry advice on forest health, insects and disease is available to landowners through the Colorado State Forest Service, consulting foresters, and the Colorado State University Cooperative Extension Service. Information on forest insects and disease and fire mitigation can be obtained from the Colorado State Forest Service Website at:

www.colostate.edu/Depts/CSFS

To view aerial maps of insect activity in Park County, go to:

<http://www.fs.fed.us/r2/resources/fhm/aerialsurvey/>.

WILDLAND FIRE BEHAVIOR

Fire behavior

The fire behavior triangle shows the primary factors that influence how a forest fire will burn and spread. They are fuels, topography and weather. When specific characteristics of each of these factors are known, the behavior of a fire can generally be predicted, and the way it will burn on the landscape can be modeled.

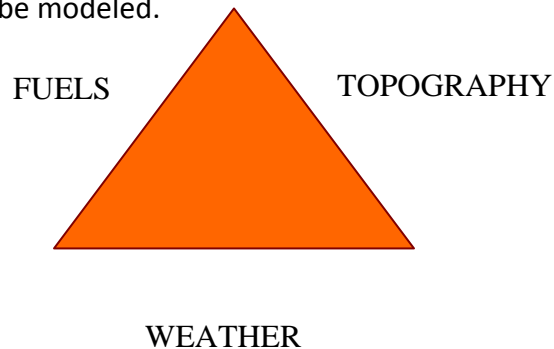


Figure 2: Fire Behavior Triangle

Primary forest fuels consist of grass, herbs, and other non-woody vegetation, downed woody material, shrubs and brush, conifer trees, duff (decaying material) and litter on the forest floor. Heavy surface fuels, such as shrubs and small trees or dense accumulations of down wood, or conifer trees with low branches, can create fuel “ladders” to carry fire from the surface to the crowns of conifer trees.

Torching is when individual trees, or small groups of trees, have burning crowns. If the trees are dense enough, and winds are high enough or the slope steep enough, flames at the top of the larger trees will spread to other trees. This is called a “crown fire,” and it can spread rapidly, given the right conditions.

Fires also commonly “spot.” Embers carried by air currents ahead of, or adjacent to, the fire cause spotting. The embers may ignite new fires and rapidly increase the rate of spread and difficulty of control. Spotting can range from small embers landing close to the existing fire, to larger burning material, such as branches, being lofted high in the air and landing up to a mile or more ahead of the fire.

Aspen must also be mentioned in any discussion of fuels. Any mitigation activities that enlarge or regenerate aspen patches will have multiple benefits. Aspen are often the first species to regenerate after a fire, and provide important food for deer and elk. Deciduous trees, such as aspen, do not support crown fires and act as a natural fuel break. One of the most significant effects of fire suppression has been diminished numbers of aspen.

Topography is the “lay of the land”. Critical factors that influence fire behavior are slope steepness and direction, also known as aspect. Fire will spread at a much higher rate uphill

because the convective heat rising from the fire is preheating and drying the fuels up slope of the fire.

Weather is the leg of the fire behavior triangle that will always remain uncontrollable and sometimes, unpredictable. Unlike fuels, which can be managed, and topography, which remains fixed, weather is a dynamic force that can quickly change a small ground fire into a roaring crown fire. Another factor in fire behavior is air and fuel temperature. High air temperatures reduce the amount of pre-heating necessary to bring fuels to the temperature of ignition. Bright sunshine can raise the surface temperature of ground fuels to 150°F, much higher than the temperature of surrounding air.

When air temperature rises, relative humidity falls. Humidity quickly affects the lighter fuels that are critical for carrying fires. Smaller fuels dry or absorb moisture more quickly than large diameter fuels. When humidity decreases, smaller fuels will dry quickly, and ignite more easily.

Weather patterns change rapidly, often making wildfires difficult to control. Fire behavior can be relatively accurately predicted when one has knowledge of the fuels, fuel moistures, predicted weather, and the terrain on which the fire is burning in. However, interaction of the various fire triangle elements, spotting, and high intensity fires can result in behavior that can catch both firefighters and residents unaware, if they don't plan for all contingencies.

Fire Seasons

Although fires can occur year round here, there are three typical periods when high fire danger can occur. The first is spring after snowmelt, when the grass has not greened up, shrubs have not leafed out, and fuel moistures in the conifers are low. Strong winds are common. The next and typically highest period of fire danger is late May through early July before the onset of the monsoon season, when fuel moistures are still low, lightning has started, air temperatures are high, humidity is low, high winds are common, and burning periods (daylight) are at their longest. During this fire danger period the Hayman, Buffalo Creek, Hi Meadow and Schoonover fires were ignited. The monsoon season is the period of the greatest number of fires, because of the extensive thunderstorms and lightning. However, because of the rain, there is usually less potential for large fires and most fire spread is extremely slow, if at all. Finally, in the fall after the monsoon season, there can be periods of higher fire danger with the return of drier conditions, dormancy of vegetation, and winds. Even though there is potential, no large fires have occurred in Park County during this time period over the last several decades.

Fire Occurrence

Park County has an average of 25 wildfires each year. While lightning is responsible for the majority of the fire starts, the largest and most damaging fires are human caused. Education is critical to prevent the most dangerous types of wildfires.

FUELS MITIGATION

Most of the factors and treatments that determine the survivability of a structure lie within one to two hundred yards of the structure, and usually it is located on private lands. Public land managers do not have any legal authority or responsibility for fire mitigation on those private lands. Likewise, the fire districts do not have mandated responsibility for preparing private property for fire safety. Therefore, the largest opportunity to decrease risk from wildfire lies with the private property owners acting individually or as a community.

The wildfire risk to the community involves many exposures. Among these are water supplies, natural resources, land values, critical infrastructures (such as highways and bridges which can be affected by fire), and even a sense of community. The responsibility for mitigating risk to these critical values crosses all jurisdictional boundaries.

Defensible Space Management Zones

A defensible space perimeter around buildings and structures provide firefighters a working environment that allows them to protect buildings and structures from encroaching wildfires as well as minimizing the chance that a structure fire will escape to the surrounding wildland.

Zone 1 is the area of maximum modification and treatment. It consists of an area of 15 feet around the structure in which all flammable vegetation is removed. This 15 feet is measured from the outside edge of the home's eaves and any attached structures, such as decks.

Zone 2 is an area of fuel reduction. It is a transitional area between Zones 1 and 3. The size of Zone 2 depends on the slope of the ground where the structure is built. Typically, the defensible space should extend at least 75 to 125 feet from the structure. Within this zone, the continuity and arrangement of vegetation is modified. Remove stressed, diseased, dead or dying trees and shrubs. Thin and prune the remaining larger trees and shrubs. Be sure to extend thinning along either side of your driveway all the way to your main access road. These actions help eliminate the continuous fuel surrounding a structure while enhancing homesite safety and the aesthetics of the property.

Zone 3 is an area of traditional forest management and is of no particular size. It extends from the edge of your defensible space to your property boundaries.

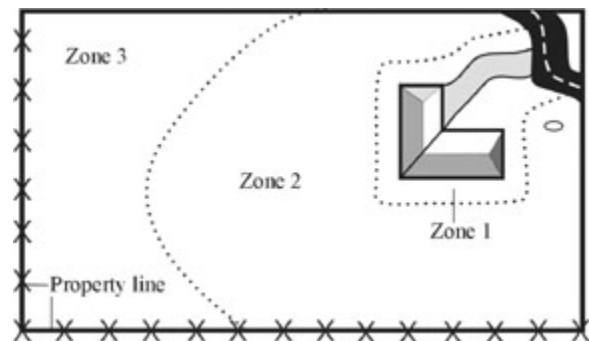


Figure 1: Forested property showing the three fire-defensible zones around a home or other structure.

Information Sources for Reducing Subdivision Risks

There are many sources for finding additional information about methods and resources for community and structure protection. These include the Park County Emergency Service's Office, the Colorado State Forest Service Offices in Woodland Park and Golden, the US Forest Service, and the FireWise program.

Also, the following websites contain a wealth of information on fire protection.

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

<http://www.colostate.edu/Depts/CSFS>

<http://www.healthyforests.gov/community/cwpp.html>

<http://www.fireplan.gov/>

http://www.fs.fed.us/fire/prev_ed/index.html

RECOMMENDATIONS

These recommendations do not preclude individual home and property owners from pursuing other work on their property. Nor do they prevent public land management agencies from pursuing any projects outside those areas identified below.

Treatment efforts should focus on areas adjacent to homes, structures, and other critical infrastructure first. Treatments further away from structures should focus on limiting the potential for large landscape sized high intensity fires that negatively impact watersheds, economic interests, and other community values. It is not necessary, nor desired, to treat all the acres within the subdivision.

Treatment types should be utilized that will change potential fire behavior in the general vicinity of homes, structures, and other infrastructure from a high intensity crown or torching fire to a surface fire. Mechanical treatments should be emphasized. Pile burning and broadcast burning should be employed where it can be done so with acceptable levels of risk.

Treatment Recommendations

- 1. Increase the fire safety, visibility, and overall forest health by removing dead wood and debris from the forest floor to decrease fuel load.**
- 2. Decrease the chance of a structure fire becoming a wildfire by removing low hanging branches and other ladder fuels from around all structures.**
- 3. Increase the fire safety, visibility, and overall forest health by identifying any trees that are diseased or dying and removing them from the property.**
- 4. Encourage and educate property owners of the need to establish defensible spaces around their property and to take actions to reduce structural ignitability.**
- 5. Encourage residents to post clearly visible house address signs (letter height of 4”), practice family fire drills and fire evacuation plans.**
- 6. Coordinate arrangements for fuels mitigation teams or a chipping program within the subdivision to determine needs and assist homeowners in mitigation efforts.**
- 7. Keep a fire danger sign current at the entrance to the subdivision.**
- 8. Conduct yearly assessments of the projects accomplished and develop additional goals for the future.**

APPROVAL OF PLAN BY RED HILL FOREST SUBDIVISION MEMBERSHIP

Each of the following recommends that this subdivision wildfire protection plan should be adopted by Red Hill Forest.

- Hartsel Fire Protection District
- North-West Fire protection District
- Red Hill Forest Property Owners Association Board

The Red Hill Forest Wildfire Protection Plan is hereby approved and adopted by the Subdivision Board on this _____ day of _____, 2009.

Chair

Approved by North-West Fire Protection District:

Mike Roll, Chief

Approved by Hartsel Fire Protection District:

Jay Hucheson, Chief

This plan has been reviewed and approved by the Colorado State Forest Service as indicated by the following signature:

Dave Root, Assistant District Forester

The Red Hill Community Wildfire Protection Plan is hereby approved and adopted by the Park County Board of Commissioners on this _____ day of _____, 2009.

John Tighe, Chair

ATTEST:

County Clerk

APPENDIX A: INDIVIDUAL STRUCTURE TRIAGE FORM

In the event of a fire, department personnel use a similar form to determine which structures they will be able to defend safely and effectively.

Evaluate these items for individual homes

- 1. Provide for SAFETY FIRST!**
- 2. ESCAPE ROUTES and SAFETY ZONES in place.**
- 3. Poor access and narrow one-way roads.**
- 4. Bridge load limits.**
- 5. Power lines, propane tanks, septic tanks, and Haz-Mat threats.**
- 6. Inadequate water supply.**
- 7. Natural fuels 30 feet or closer to structures.**
- 8. Structures located in chimneys, box canyons, narrow canyons, or on steep slopes (30% or greater).**
- 9. Extreme fire behavior.**
- 10. Strong winds.**
- 11. Evacuation of the public.**

APPENDIX B: TREATMENT OPTIONS

The objective of fuels mitigation treatments is to alter one or more components of the existing fuel bed enough to create the type of fire behavior, which is acceptable or desired. There are four main components which can be altered, fuel moistures, arrangements, loading, and continuity. There are three main parts of the fuel bed: surface, ladders, and crowns.

Changing fuel moistures is not normally practical, except, watering grass vegetation around homes to keep it green and less flammable. Most people have well water rights that do not allow for watering.

Most fuels treatments focus on the remaining components. These include reducing the continuity, such as thinning trees, eliminating trees from specified areas all together, or removing large portions of brush or shrub fields, removing ladder fuels such as smaller trees and shrubs, and/or removing down dead material. All can alter fire behavior, while still maintaining other objectives, such as aesthetics, wildlife habitat, or landscaping needs.

Treatment Methods

There are only two basic ways to alter fuels, either by controlled burning or mechanical treatments, or a combination of both.

Mechanical

Mechanical treatment of fuels changes the structure of the fuel bed. There are many treatments, but they usually involve thinning of trees or shrub/brush fields, removal of ladder fuels, and/or altering surface fuels. The objective is to prevent crown fires in trees or brush fields, and/or reduce the intensity of surface fires.

Treatment by mechanical means is normally done by one of two broad methods: (1) mechanically removing the material for use as a product, or (2) mechanically altering the material for later removal or other treatment. Mechanical methods must be followed up by removal of the residue or slash created, or by changing that residue to a different form. Otherwise, the only accomplishment will be to change one type of high intensity fire to another form, often worse than the original situation.

The following are typical mechanical treatments:

Thinning

This is the use of handsaws, power saws, or heavy mechanized equipment to reduce the density of, primarily, conifer forests. The objective is to create openings in the forest canopy to reduce the potential of high intensity crown-to-crown fire. It can be done across large acreages or in backyards. The acceptable level of risk and other objectives determines the amount of thinning. It is normally implemented with a secondary objective of producing or salvaging some level of product, such as firewood. Forest residue or slash will be produced and needs to be treated.

Mastication

Mastication is used to thin conifer trees, reduce or eliminate brush or shrub fields, eliminate ladder fuels, and/or change surface fuels such as large down logs. Specially designed equipment is used to chew up trees, brush, or dead wood. It is very effective in brush, shrubs, and trees, and is a thinning method when there is no value to the trees (which is often the case here in Colorado). The size of the material left depends on the type of equipment used. Sizes range from small chips to large chunks of logs.

Pruning

Pruning is removal of lower branches to reduce the potential for fire spread into the tree crowns. It is more common as a follow up treatment, after thinning, to prevent or reduce the likelihood of the remaining trees from “torching” and being killed or throwing burning embers onto nearby structures. It is also used to prepare areas for broadcast burning.

Slash treatments

Slash treatments may be needed to cleanup the residue from the primary mechanical treatments. These fall into two categories: (1) removal of all slash, or (2) alter the slash to reduce intensity. Removal is primarily accomplished by prescribed burning, and will be discussed further below. However, chipping and removal can also be utilized.

The other secondary treatments consist mostly of lowering the height of the remaining material and changing its size to smaller pieces. This reduces the intensity of any fire that occurs and speeds up decomposition.

Both removal and alteration are also used, at times, to prepare areas for controlled burning. It can reduce the risk and the amount of smoke produced.

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 12 inches or less. It may be the only practical treatment in areas where chippers are unavailable, prohibitively expensive, or in inaccessible locations. It is usually the lowest cost treatment since no special equipment, other than a chainsaw, is required.

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

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

Chipping:

Chipping is the grinding up of the slash into small pieces, usually less than a few inches in diameter. Material can be chipped and left, or removed for off-site disposal or as a product.

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

Chipping is a common method of slash disposal in the defensible zones around structures. Chips do not significantly contribute to fire 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. Chips should be spread along the ground to a depth of less than four inches.

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

Trampling, Crushing, or Roller Chopping

This is using heavy equipment, usually a dozer, to run over the slash, breaking it down in both size and height. It can be done with just the tracks or by also pulling a heavy, water filled drum with cutting blades welded on it.

It is very effective and can also crush and break up heavy fuels such as down logs. However, the slash must dry, usually for several seasons, to make this treatment truly effective. There is an increased fire hazard in the interim.

There is an additional benefit to crushing or trampling. The material is not only broken down, but also driven into the soil. This can add nutrients to the soil faster, create small pockets in the soil surface for holding water, and decrease the potential for erosion.

Piling

This is the use of mechanized equipment, or by hand, of placing the residue or slash into piles for later disposal by burning. This will be discussed in more detail below under burning.

Burning

This is the use of controlled burning, either broadcast (over an entire area) or pile, done under specific conditions, as either a primary or secondary fuels treatment. Broadcast burning can be utilized by itself to thin, remove forest or brush fuels, reduce ladder fuels, and/or reduce surface fuels such as litter, duff, and down dead woody material.

Pile burning is normally utilized as a secondary treatment to remove slash residue, either as a final stand-alone treatment, or to prepare for broadcast burning.

Pile Burning

Any form of open burning requires a permit from the fire protection district, and burning must be done only under the conditions stipulated in the permit.

Piles can be constructed with equipment or by hand. Piling with heavy equipment should only be done with a brush rake and not a regular blade. Piling with a regular blade will include significant amount of dirt, which will make the pile harder to burn, create more smoldering and smoke, and will hold heat longer adding to the risk of an escape at a later date.

For most landowners, the slash is piled by hand and burned when conditions are safe—usually several inches of snow on the ground that will persist for a couple days. This will depend on what type of material is contained in the pile. Material greater than five inches will take longer to burn and will hold heat for more time. Piles burn best when they are relatively compact, contain material less than one inch in diameter, and the height is greater than the diameter. This arrangement promotes hotter burning and less smoke.

It is important that burn piles not located directly adjacent to or under the canopy of trees or other flammable material. Separation should be greater on the down wind side. It is easy to scorch living trees from the heat of the burning pile, even in winter. Avoid making burn piles on top of stumps. Stumps will hold heat for extended periods of time.

Often piles must sit through the summer in order to dry, or piles from one season may be left over the next summer if proper burning conditions were not available during the winter. In each case the dry woodpiles will sit through a burning season with the risk of ignition.

The fire should be monitored during the day and for several days thereafter. The center of a pile usually burns completely, but often wood around the edges does not. To ensure that the slash at the edge of each pile burns it is necessary to “chunk in” the piles periodically. This means that as the fire at the middle of the pile burns down, wood from the edges should be thrown into the center to insure complete burning of all slash.

The ash pile must be monitored and may need to be cooled below the point of combustion, which is a process called “mopping up.” This is especially important on south and west slopes where the snow melts off quickly and may be followed by dry windy weather.

For several years after a pile is burnt, an unsightly black ring remains where the heat of the fire scorched the soil. Many landowners find these unpleasant to look at. They may also present an opportunity for noxious weed to colonize the bare soil. Breaking up the burned soil with a rake and reseeding with native plants is recommended.

Broadcast Burning

This method is more often used by the Federal or State land management agencies than by private landowners. Private landowners, interested in broadcast burning, should contact a knowledgeable consultant or the Colorado State Forest Service since there are numerous legal issues. A great deal of expertise is required to carry out the burn.

Broadcast burning can be a “stand alone” treatment for fuels mitigation, or the final step following mechanical treatments and even pile burning. It is an effective method for reducing surface fuels, reducing the density of shrubs, and reducing ladder fuels. It can also be used to thin larger trees, but it obviously can’t be done with the precision of mechanical treatments. It is more effective in thinning the smaller trees and in patches or groups of trees.

Land management agency burns require a burn plan. The burn plan is an extensive legal document that describes the conditions under which the burn may be carried out, the organization required, and all the other activities that must be done. There is also a closely monitored smoke permit process with the State of Colorado that must be followed.

Broadcast burning can also be used to accomplish other objectives, such as regenerating decadent grass and shrubs, providing a seedbed for new trees, promote growth of wildlife forage, and many other items. There are also limits on its effectiveness for fuels treatments. Sites may be so dense or contain so much down dead material that a burn might kill everything. Certain species, like spruce and lodgepole pine, can easily be killed, even with light under burning, since these species naturally burn in high intensity fires that kill almost all the trees. Burned sites also have to be monitored for other problems, such as undesirable noxious weeds, *ips* beetles or other issues.

APPENDIX C: DEFINITIONS AND TERMS

Age Class – A classification of trees of a certain range of ages.

Aspect – The direction in which any piece of land faces.

Biological Diversity – The variety of living organisms considered at all levels of organization, including the genetic, species, and higher taxonomic levels, and the variety of habitats and ecosystems, as well as the processes occurring therein.

Bole – The main stem or trunk of a tree.

Canopy – The more or less continuous cover of branches and foliage formed collectively by adjacent trees and other woody species in a forest stand. Where significant height differences occur between trees within a stand, formation of a multiple canopy (multi-layered) condition can result.

Citizen Safety Zone – An area that can be used for protection by residents, and their vehicles, in the event that the main evacuation route is compromised. The area should be maintained, clear of fuels and large enough for all residents of the area to survive an advancing wildfire without special equipment or training.

Coarse Woody Material – Portion of tree that has fallen or been cut and left in the woods. Pieces are at least 16 inches in diameter (small end) and at least 16 feet long.

Cohort – A group of trees developing after a single disturbance, commonly consisting of trees of similar age, although it can include a considerable range of tree ages of seedling or sprout origin and trees that predate the disturbance.

Community Assessment – An analysis designed to identify factors that increase the potential and/or severity of undesirable fire outcomes in WUI communities.

Crown Class – A class of tree based on crown position relative to the crowns of adjacent trees.

Crown Fire – Fire that advances through the tops of the trees.

Defensible Fuel Reduction Zones – Areas of modified and reduced fuels that extend beyond fuel breaks to include a larger area of decreased fuels. These would include managed stands with reduced amounts, continuities, and/or distributions of fuels that would provide additional zones of opportunity for controlling wildfire.

Defensible Space – An area around a structure where fuels and vegetation are modified, cleared or reduced to slow the spread of wildfire toward or from a structure. The design and

distance of the defensible space is based on fuels, topography, and the design/materials used in the construction of the structure.

Density Management – Cutting of trees for a variety of purposes including, but not limited to: accelerating tree growth, improved forest health, to open the forest canopy, promotion of wildlife and/or to accelerate the attainment of old growth characteristics if maintenance or restoration of biological diversity is the objective.

Dominant – Crowns extend above the general level of crown cover of others of the same stratum and are not physically restricted from above, although possibly somewhat crowded by other trees on the sides.

Co-Dominant – Crowns form a general level of crown stratum and are not physically restricted from above, but are more or less crowded by other trees from the sides.

Down, Dead Woody Fuels – Dead twigs, branches, stems, and boles of trees and shrubs that have fallen and lie on or near the ground.

Extended Defensible Space – A defensible space area where treatment is continued beyond the minimum boundary. This zone focuses on forest management with fuels reduction being a secondary consideration.

Fire Behavior Potential – The expected severity of a wildland fire expressed as the rate of spread, the level of crown fire activity, and flame length. Derived from fire behavior modeling programs utilizing the following inputs: fuels, canopy cover, historical weather averages, elevation, slope and aspect.

Fire Hazard – The likelihood and severity of Fire Outcomes (Fire Effects) that result in damage to people, property, and/or the environment. Derived from the Community Assessment and the Fire Behavior Potential.

Fire Mitigation – Any action designed to decrease the likelihood of an ignition, reduce Fire Behavior Potential, or to protect property from the impact of undesirable Fire Outcomes.

Fire Outcomes (Fire Effects) – A description of the expected effects of a wildfire on people, property and/or environment based on the Fire Behavior Potential and physical presence of Values-At-Risk. Outcomes can be desirable as well as undesirable.

Fire Risk – The probability that an ignition will occur in an area with potential for damaging effects to people, property and/or the environment. Risk is based primarily on historical ignitions data.

Fuel Break – A natural or constructed discontinuity in a fuel profile utilized to isolate, stop or reduce the spread of fire. Fuel breaks may also make retardant lines more effective and serve

as control lines for fire suppression actions. Fuel breaks in the WUI are designed to limit the spread and intensity of crown fire activity.

Hazard – The combination of the wildfire hazard ratings of the WUI communities and the fire behavior potential as modeled from the fuels, weather and topography of the study area.

Intermediate – Trees are shorter, but their crowns extend into the general level of dominant and co-dominant trees, free from physical restrictions from above, but quite crowded from the sides.

Risk – The likelihood of an ignition occurrence that results in a significant fire event.

Shelter-In-Place – A method of protecting the public from an advancing wildfire involving instructing people to remain inside their homes or public buildings until the danger passes. This concept is a dominant modality for public protection from wildfires in Australia where fast moving, short duration fires in light fuels make evacuation impractical. The success of this tactic depends on a detailed preplan that takes into account the construction type and materials of the building used, topography, depth and type of the fuel profile, as well as current and expected weather and fire behavior.

Suppressed – Also known as overtopped. Crowns are entirely below the general level of dominant and co-dominant trees and are physically restricted from immediately above.

Values-At-Risk – People, property and environmental features within the project area, which are susceptible to damage from undesirable fire outcomes.