Carroll Lakes

Community Wildfire Protection Plan

June 2014

Prepared by Land Stewardship Associates LLC
(Updated by M. O'Connor)

ACCEPTANCE

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

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

The Carroll Lakes Community Wildfire Protection Plan has been reviewed and approved by the Members of the CWPP Committee.

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Michael J. O'Connor Date
Colorado Springs Fly Casting Club

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Date

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Date

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El Paso County Board of County Commissioners Date

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ATTEST

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Larry Long, District Forester Date
Colorado State Forest Service

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Terry Maketa Date
El Paso County Sheriff

Preface to the Updated Plan

The Carroll Lakes area can be characterized as a mountain community with permanent and recreational home sites scattered throughout. A good many of the home sites are members of the Colorado Springs Fly Casting Club and are located along the lakes within the center of the area. Landownership patterns are private parcels along the lakes, surrounded by Pike National Forest lands and the Farish Memorial Recreation Area (USAFA).

The Carroll Lakes Community Wildfire Protection Plan (CWPP) was written by Land Stewardship Associates in 2005. Since that time there have been many changes in the standards for CWPPS. Much of the original was retained, but much new material was added to make it more informative for residents and to meet current standards. In 2012, the Waldo Cañon Fire burned to within less than two miles of Carroll Lakes.

Many new tools such as the Colorado Wildfire Risk Assessment Portal (CO-WRAP) and improved mapping techniques were unavailable when the original were written. Data from CO_WRAP was ground truthed with the assistance of the Colorado State Forest Service. This new information was used to analyze the area and to better determine the hazards facing the community. Finally, new priorities and prescriptions were developed based on the re-evaluated data.

Participants in this plan are the Colorado Springs Fly Casting Club and Allan Durrett. The Fairish Recreational Area has a fuel mitigation plan administered by the U. S. Fish and Wildlife Service through the Natural Resources office of the Air Force Academy. Other private landowners who wish to participate in the plan may be included after an assessment and prescriptions for such properties are included as an appendix to this plan.

Objectives of the plan

Priority 1: Defensible space around the most vulnerable home sites, and primary evacuation routes.

Priority 2: Interior treatment areas closest to homes; private and "good neighbor" projects; secondary evacuation routes.

Priority 3: Protect the lakes from sedimentation after a catastrophic wildfire.

Priority 4: Improve forest health and increase forest diversity for insect and disease prevention, and improved wildlife habitat.

Because of the generally small size of material to be removed, poor markets and lack of local processing mills, it is anticipated that very little of the treatment products will be able to be used commercially. However, there will be some pockets within treatment areas where commercial use of the material may be feasible. In these cases, efforts will be made to contact mills, operators, etc. to see if commercial utilization would be feasible.

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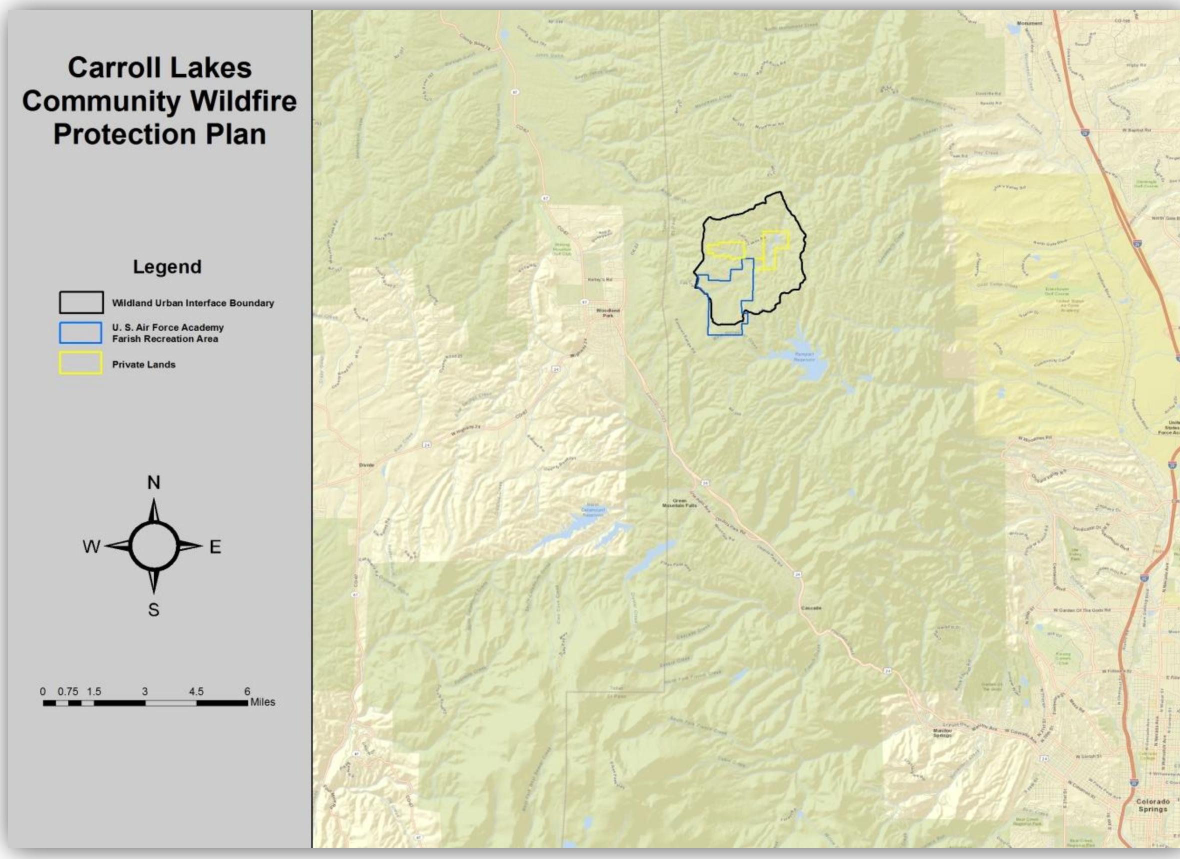
I. COMMUNITY IDENTIFICATION AND DESCRIPTION

Location and General Description

The Carroll Lakes Area is located in the upper South Beaver Creek watershed that flows into Monument Creek through the United States Air Force Academy (USAFA). There are 116 structures located on the CSFCC, Durett and Farish properties. The area is about 4 miles west of the AFA (western boundary) and about 4 miles east of the town of Woodland Park. The area is about 15 miles northwest of Colorado Springs, following highway US 24. Carroll Lakes is approximately 3,220 acres in size, and ranges in elevation from 8,900 to 9,300 feet. Eight man-made lakes (Sapphire Lake, Leo Lake, Grace Lake, Lake Judy, Aspen Lake, Boulder Lake, Columbine Lake and Rainbow Lake) run through the center of the area along South Beaver Creek.

The following vicinity map identifies communities, landownership (Pike National Forest, private and Farrish Memorial Recreation Area (USAFA), and the Wildland-Urban Interface (WUI) Boundary. Highway US 24 accesses the area from Colorado Springs. The Rampart Range Road (FR300) which begins near Sedalia, Colorado, accesses the area from the north.



II. COMMUNITY ASSESSMENT

Community Values at Risk

There are four "neighborhoods" or subdivisions, including the USAFA Farish Memorial Recreation Area with 60+ home sites in the Carroll Lakes WUI area. Most have heavy fuels nearby and around them. Most homes are wood frame construction and date back to 1920-1930. Few of the structures have recognizable defensible space. Propane tanks on many home sites are too close to the building, and power lines to structures are often too low. Many have flammable material near-by, on the porch, or under decks, increasing their vulnerability. A few of the structures have wooden shingle or shake roofs. The composition and wooden roofs tend to hold pine needles and forest debris allowing accumulations that also increase vulnerability to fire brands. Most of the structures are vulnerable to wildfire damage occurring from firebrand ignition and/or radiation ignition due to the heavy forest fuels within the area.

The Carroll Lakes WUI area contains 8 small lakes used for recreation, primarily fishing, purposes. Substantial costs could be incurred in removing sediment and debris from these lakes if a wildfire occurred in the WUI, similar to the costly removal of debris in Strontia Springs reservoir following the Buffalo Creek Fire.

Because of the lack of defensible space around many home sites, natural fuel continuity and steep slopes between some of the neighborhoods, it would be very difficult to protect some home sites from wildfire during periods of high to extreme fire danger.

Access to the community is from the Rampart Range Road via Forest Service Road 312, also known as Carroll Lakes Road. At the end of Road 312, three forks lead to various areas of the community. These roads are not well marked and are generally narrow without adequate clearance for emergency vehicles. In the event of a wildfire, fire personnel would have difficulty navigation these roads. Even in other emergencies, such as a medical call, navigating the unmarked roads will cause potentially dangerous delays in response by sheriffs or paramedics.

Within the community roads branch to various houses without benefit of directional signage at the forks. Some houses are marked with an address or the owner's name, but others are not, resulting in dangerous delays for emergency response. The signs marking many homes are made of wood, and would burn in a fire, further complicating structure suppression or medical response. Homes should be marked at the end of each driveway with the address using reflective numbers and letters at least four inches high.

A secondary exit is possible through Farish Recreation area, but this is currently blocked with a barbed wire fence, and the road is not maintained. It would be suitable only as a last resort. Some other roads access the area from the Schubarth Trail, but these are unmaintained four wheel drive roads and many have been blocked since the Waldo Canyon fire to prevent vehicular traffic. They would not be viable alternatives for emergency evacuation.

From the Rampart Range Road escape would most likely be into Woodland Park. At this writing Rampart Range Road is closed towards Colorado Springs due the flash flood hazard in the Waldo Cañon burn scar.

Colorado Springs Fly Casting Club (CSFCC) Emergency Evacuation Plan

NOTICE TO EVACUATE. In case of a fire or other emergency, the primary notification to evacuate CSFCC will be issued by the El Paso County Sheriff by means of a reverse 911 call. Members should follow directions provided in the recorded message. Other notifications may come from local TV and Radio stations or from Nick/other club members. Be sure to leave the club gate open as you depart the club grounds.

If a fire is threatening the area, it is not necessary to wait for an evacuation order to leave.

EVACUATION ROUTE. The primary evacuation route is west on FR 312 to Rampart Range Road and from there south to Woodland Park. Alternate routes are north on Rampart Range Road or south thru the Air Force recreation area (Farish).

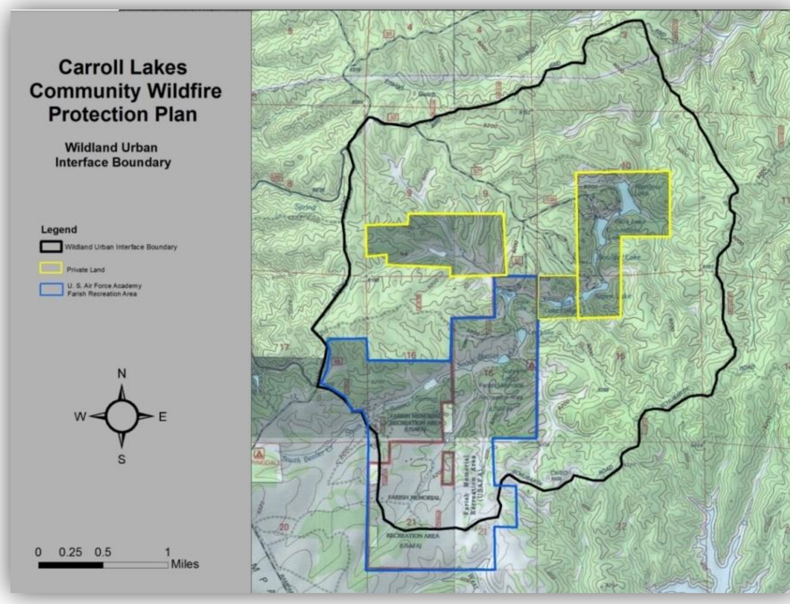
- If Rampart Range Road is blocked or unsafe to the south, leave the area via Rampart Range Road north towards Denver.

- If FR 312 is blocked or unsafe to the west, go east to the old Farish road. Use your club gate key to unlock the Durrett gate and go around the boulders which are blocking the old road. Drive carefully down the left side of the old road bed and proceed thru the fence to enter Farish property. Follow the signs thru Farish to Rampart Range Road and drive in the direction away from the fire or as otherwise directed by Farish personnel.

It is important to note that the fatalities in both the Waldo Cañon and Black Forest Fires were of residents who did not evacuate in time. In the event of a fire, the El Paso County Sheriff will determine the best evacuation routes and procedures based on expected fire behavior. Residents should heed the evacuations instructions given by the Sheriff without delay! If a fire is threatening the area, it is not necessary to wait for an evacuation order to leave.

Reverse 911 calls are not automatically routed to cellular phones. Residents who rely only on cellular phones should register their cell phones at: https://member.everbridge.net/index/1772417038942752 to be certain of notifications. Due to the local terrain, cellular telephone service is not available in most of the Carroll Lakes area, and specifically not available to the residents of the Colorado Springs Fly Casting Club who can only be reached by land telephone service provided by CenturyLink

Wildland Urban Interface Boundary



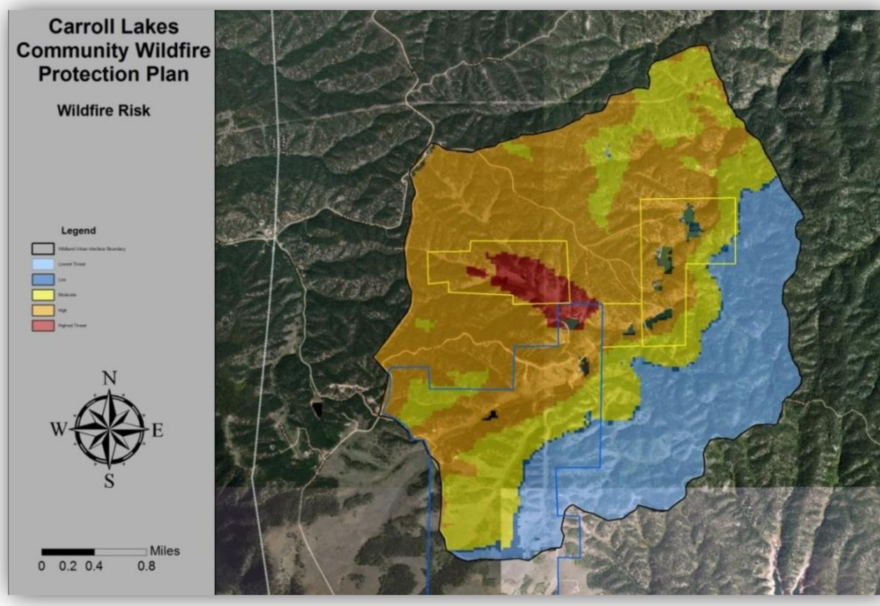
The wildland urban interface (WUI) boundary is defined as the area where a wildfire would be a threat to the community. The boundary as defined for the 2005 plan remains in effect. Rampart Range Road is the western boundary, and Forest Road 314 marks the northern boundary. Schubarth Trail is generally the southern and eastern boundary. This area defines the Beaver Creek Drainage where sedimentation from a fire would degrade the water quality of the lakes.

Wildfire Risk

Vegetation is dominated by a mixed conifer forest consisting ponderosa pine, Douglas-fir, and spruce, which is dense with many small conifers in the understory. Aspen is scattered throughout forest and will be released when treatment occurs. The release of the aspen will improve vegetation diversity and will improve wildlife habitat. North slopes are denser, with larger trees, while south slopes are also dense but trees are shorter and have less Douglas-fir present. In most areas the forest canopy is closed and dense enough to sustain a substantial crown fire. Ladder fuels, fuel near the ground that would be a pathway for a ground fire to reach the tree tops, are present throughout most of the forest—resulting in a high fire risk.

The wildfire risk map represents the Colorado Wildfire Risk Assessment Portal (CO-WRAP) analysis of the wildfire risk in Carroll Lakes. Wildfire risk is the chance that a fire might start or spread into the area. Most of the community is at a high risk for wildfire occurrence. Note also that the community's primary access road is also in a high risk area.

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



One such fire, the Hayman (2002, the largest wildfire on record in Colorado) burned about 7 miles north of the area. The Waldo Cañon fire in 2012 stopped about 1.5 miles south of the area. A substantial portion of the Hayman and Waldo Cañon fires were severely burned with high intensity burns, leaving patches of hydrophobic soils and significant erosion. The Carroll Lakes area has similar hazard and risk ratings to the Hayman and Waldo Cañon fire areas.

Fuel Model Analysis:

The area was also analyzed by Land Stewardship Associates for the 2005 CWPP using a system of prediction based on fuel models. Fuel models are areas with similar vegetation and fuel characteristics. This analysis used weather data from weather stations on extreme weather days and can be used for comparison to the CO-WRAP data.

Dense ponderosa pine, Douglas-fir, and spruce stands cover substantial portions of the planning area. Crown cover densities within these stands are well above the forty percent threshold for sustained crown fires. North-facing slopes often contain even thicker stands of Douglas-fir. Ground fuel is characterized by fuel models 8 and 9 in these forested areas. Because of a significant amount of dead and down material, a small patch of fuel model 10 is present. *Table 2* gives fire behavior predictions for the fuel models and representative weather conditions.

In the southern portion of the area, and primarily in the Farish Memorial USAF Recreation Area, openings and meadows are prevalent. Ground fuels in these openings and meadows are characterized by fuel model 1. These fuels have high rates of spread under relatively mild weather conditions.

All stands adjacent to structures with crown closures greater than forty percent are problematic. Continuous surface and crown fuel structure, both horizontally and vertically, render this area susceptible to torching, crown fire, and ignition by embers, even under moderate weather conditions.

The primary fuels within the Carroll Lakes WUI are forested land with some grass areas in the southern portions of the area. Fuel Models 8, 9, and 10 probably best depict the forested areas depending on the amount of dead and down material intermingled, the canopy closure and age (size) class of the timber. Fuel Model 8 depicts the aspen stands in the summer while Fuel Model 9 is more indicative of fall burning conditions in aspen. Fuel Model 1 best depicts grass lands.

Fuel Type 1

Fuel Type 8

Fuel Type 9

Fuel Model 1
Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material.

Fuel Model 8
Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures and low humidity's, and high winds do the fuels pose high hazards. The thinned and cleaned up stands represent this model.

Fuel Model 9
Fires run through the surface litter faster than model 8 and have longer flame height. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting and crowning. The pure stands of aspen represent this model. In the fall,

after the associated grass and forbs have cured, this fuel will burn more intensely and is temporarily more of a threat.

Fuel Model 10
The fires burn in the surface and ground fuels with greater fire intensity than the models 8 and 9. Dead-down fuels include greater quantities of 3-inch or larger limb wood resulting from over maturity or natural events such as mountain pine beetle that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees is more frequent in this fuel situation, leading to potential fire control difficulties. Within these types in most places there is dead material caused from blow down and insect mortality

Table 1: Carroll Lakes WUI Fire Behavior Predictions

FUEL MODEL	**RATE OF SPREAD** (FT/HR)	**FLAME LENGTH** (FT)	**FIRE SIZE 2 HOUR** (AC)	**SPOTTING DISTANCE** (MI)
1	11,000	6	3,700	0.4
8	224	1.5	1.5	0.4
9	1,000	4	30	0.4
10	1,617	9	14	0.4

Note: These predictions are based upon renderings of Pickle Gulch Remote Automated Weather Station (051901) weather during high–extreme fire danger.

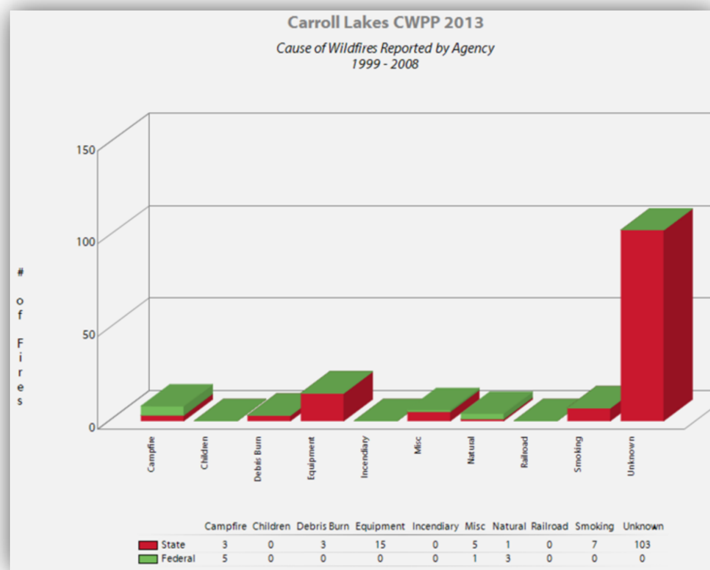
Local topography further aggravates fire behavior and control. Prevailing west winds are funneled through the communities involved. Slopes range from ten to over fifty percent with most hillsides ranging from twenty to thirty percent.

The area is dominated by highly erosive, decomposed granitic soils. A severe wildfire within the WUI boundary would threaten the high quality fisheries in the community's lakes. Natural Resources Conservation Service Soil data show that 90% of the soil in the WUI are highly sesceptible to damage by wildfire.

Preparedness to Respond

Carroll Lakes is not in an established fire protection district, but is under the El Paso County Sheriff Wildland Fire Crew (EPCS-WFC) in Colorado Springs which is about 20+ miles from the area and roughly has a 45 minute to one hour response time to the area. A 911 call from the Carroll Lakes area is routed to the EPCS-WFC and they will normally ask NE Teller County (NETCO) Fire Protection District (FPD) to respond.

NETCO FPD in Woodland Park is only 6.75 miles away and is by far the closest potential responder. Current understanding of existing agreements is that they will respond to fires in the Carroll Lakes area if they have available assets. Response time to Carroll Lakes is about 15 minutes.



The USFS Pike National Forest work center has 1 Type 4 and 1 Type 6 engine. It also maintains a cache for a 5 man wildland firefighting crew.

An agreement may be needed between the USFS and the Carroll Lakes community to allow fire suppression forces to take water from the lakes in the Carroll Lake area for suppression. The District Ranger will be contacted for guidance.

III Risk of Ignition and Wildfire Occurrence

Causes of Wildfire Ignitions

Data collected from wildfire responding agencies between 1999 and 2008 indicate that the cause of most wildfires was not determined. The most likely causes of wildfire ignitions are, 1) equipment, 2) abandoned campfires, and 3) careless or thoughtless acts by people who smoke, set off fireworks, build open fires, etc.

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

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

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

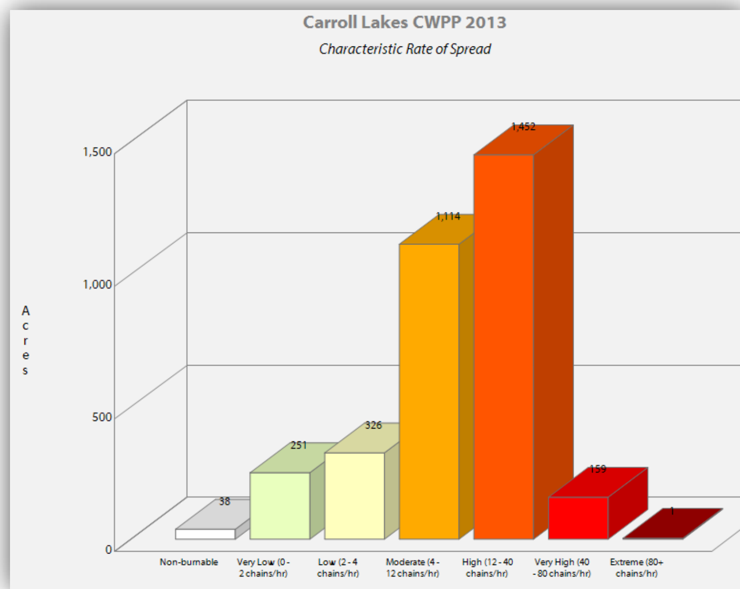
Fires originating in or near communities are the most immediate concern, but fires starting well beyond the boundaries of the planning area can have profound effects upon the communities. Rapid rates of spread and long distance spotting are the norms for fires in the vicinity. Areas classified as high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

Fire Hazards

Factors Affecting Homes in the Wildland/Urban Interface

The overall risk to the community from wildland fire is high. This section will discuss the factors considered that led to the overall rating.

The graphic at the right represents the CO-WRAP predicted rate of spread in Carroll Lakes in chains per hour. A chain is 66 feet. Thus a moderate rate of spread (4 to 12 chains per hour) would equal 264 feet to 792 feet per hour. The height of a bar indicates the number of acres in the WUI boundary on which the rate of spread is predicted. The majority of the WUI would have a moderate to high rate of spread under the average fire weather assumed by CO-WRAP.



There are 116 structures in a forested Wildland/Urban Interface (WUI). The homes in Carroll Lakes have various risks of being destroyed by a wildfire. The amount of risk depends on the vegetative fuels, topography, weather events, and the construction of the home itself. It is important to understand these conditions and factors in order to make appropriate decisions about vegetative fuels reductions.

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

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

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

The intensity and spread of a wildfire is also affected by the weather conditions existing at the moment. For example, a large thunderstorm about 20 miles north of the Waldo Cañon Fire was responsible for pushing the fire down downslope into the Mountain Shadows neighborhood. High temperatures, low humidity, and strong winds increase the probability of ignition, intensity and rate of spread. Wind direction at any given moment is the primary determinant for the direction of fire spread.

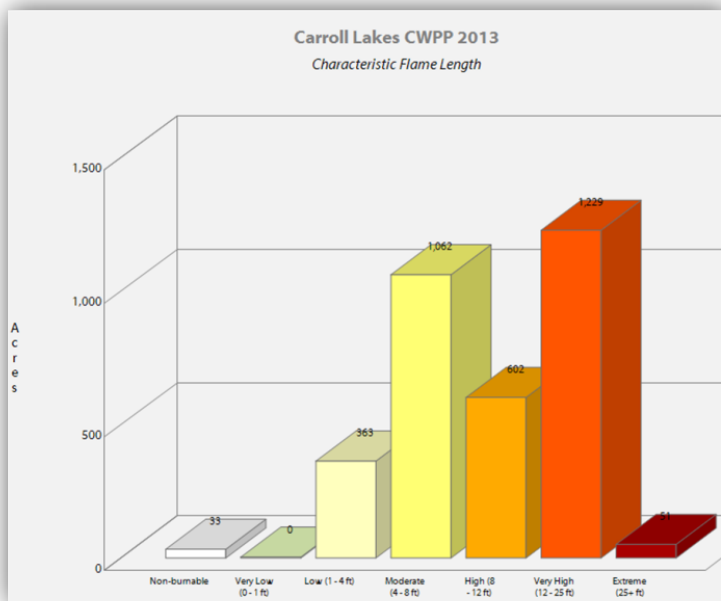
Topography: Topography includes the degree of slope and the shape of the terrain. Hot gases rise in front of the fire along the slope face, pre-heating the vegetation above a fire. As slope increases the effect of the preheating and increased spread increases, and fires may move up to four times faster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

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

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

Any dead or living branches on the lower eight feet of trees or shrubs between 6 and 18 inches tall underneath trees are called ladder fuels. Ladder fuels help convert a ground fire to a crown fire (tree tops) that moves much more quickly and with more heat.

The length of flames is directly correlated with the amount of heat a fire produces. Flame lengths less than four feet can be attacked directly by hand crews, but flame lengths greater than four feet require indirect attack methods where firefighters must work a safe distance away from the flaming front. As seen in the graph at the right, CO_WRAP predicts four to 25 foot flame length over most of the area. Fuel modification in defensible spaces and fuel treatments is designed to reduce the amount of heat produced by a wildfire.



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

Nor are hazardous fuels around a home limited to natural vegetation. Landscaping is often a fire hazard. During wildfires, many homes are lost because of the vegetation planted around the structure. Juniper (Pfizer) shrubs planted near foundations, landscape timbers, wood mulches and wood fences are often sources of home ignitions. Landscapes should be planned with the threat of wildfire in mind.

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

How Structures Catch Fire

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

Radiation: Wildfires can spread to a home by radiating heat in the same way a radiator heats rooms in the wintertime. Radiated heat is capable of igniting combustible materials from a distance of 100 feet.

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

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

A 2006 report by Traci Weaver emphasized the danger of home ignitions from burning embers.[1] Multiple wildfires raged across prairie and shrub land in North Central Texas from Dec. 27, 2005 to April 30, 2006. They killed 17 people, burned 1.6 million acres, and destroyed 440 homes. Many of the destroyed homes were made of brick, stone, and had metal roofs. Investigators pin-pointed the main cause of home destruction to burning embers that fell on top of, or were blown under, wooden porches without screening. Other losses were linked to firebrands entering attic vents, eaves and soffits, or radiant heat of burning grass that ignited wood decks.

Prior to the Waldo Cañon Fire, the 2002 Hayman Fire burned 138,000 acres and 132 homes in 20 days. After Hayman, the homes burned were thoroughly studied to determine the manner in which they were burned. USDA Forest Service scientists Jack Cohen and Rick Stratton reported on the causes of home destruction in the *Hayman Fire Case Study*.[2] Surprisingly, 662 homes within the parameter of the fire were not destroyed. Many of the homes that survived did so without intervention by firefighters. The study objective was to determine if there were common factors among these surviving homes that might be helpful in preventing loss of homes in future wildfires.

They found that "torching" or intense crown fires within 30 feet of a structure destroyed 70 homes. If a house was destroyed but the surrounding trees did not burn, they assumed that

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[1] Weaver, Traci, (2006): *Texas Fires Shed New Light on What it Meant to be Firesafe.* Texas Forest Service.
[2] Graham, Russell T., (2003): *Hayman Fire Case Study*. USDA Rock Mountain Research Station, Report RMRS-CTR-114.

embers or firebrands ignited it. Based on this logic, they concluded that 62 (47%) of the 132 homes destroyed in the Hayman Fire were ignited by surface fires or firebrands.

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

<u>Home construction and Vulnerability to Wildfire:</u>

The construction materials, location and even the shape of a structure influence its vulnerability to wildfire.[3] It is not the intent of this CWPP to suggest extensive alterations to homes that already exist in the community. Understanding how home construction affects the vulnerability of the structure to a wildfire helps residents plan defensible space projects to compensate for construction differences. When remodeling or home improvement projects are done, plans can be made to reduce the ignitability of the buildings.

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

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

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

Many homes in Carroll Lakes have metal roofing that is a desirable roofing material. However, home autopsies have shown that the small ridges in metal roofs where on panel over lays another can be openings where fire brands may collect directly on the plywood sub roof, leading to ignition of the plywood. The holes underneath such ridges should be plugged with caulking or a similar material.

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

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

hot gasses and fire brands. Enclosure of exposed eves (called a soffit) helps prevent this. It is best to construct soffits so that the lower edge of the soffit meets the wall at a 90^o angle. This reduces the amount of heated air and fire brands that might be trapped.

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

In addition to the roof, decks are extremely vulnerable to fire. The deck surface is exposed to fire brands and fire brands can collect underneath decks. Possibly the worst mistake any homeowner can make is to store any combustible material beneath a deck. Countless homes have been lost because of firewood, scrap lumber, even gasoline stored beneath a deck. Even motorized equipment, when left under a deck, with gas in the tank has caused home losses during fires.

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

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

Fire resistance of windows and doors 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.

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

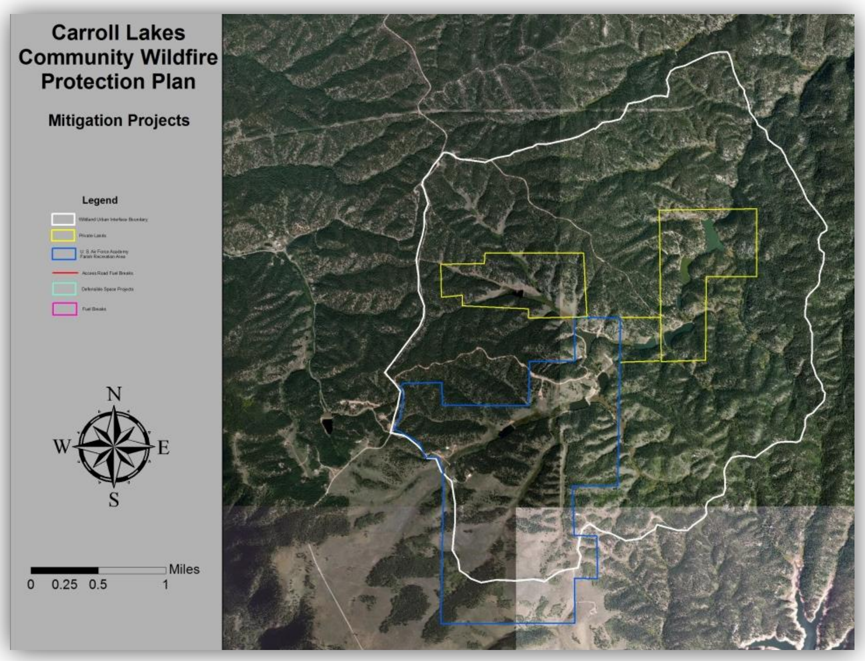
Wooden doors are obviously able to burn during a fire. The thicker the door the more resistant it will be. Metal doors are far superior, and glass in doors is subject to the same vulnerabilities as window glass. Well maintained weather stripping in outside doors will help prevent fire brands from entering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

III. COMMUNITY MITIGATION PLAN

In consultation with interested parties during the March 2005 meeting at Woodland Park, *Fuel Treatment Table* and the fuel treatment map below were developed. They depict in detail the strategy for addressing mitigation needs in terms of fuel reduction within Carroll Lakes WUI.

The strategy basically addresses fuel treatments and defensible space needs in numerous areas over a several year period. Twenty one (21) treatment areas on over 1,852 acres, and about 13 miles of shaded fuel breaks along travel-ways have been identified. The areas include private land, planned and proposed public land (Pike National Forest and Air Force Academy) parcels between the private parcels, and a series of “shaded fuel breaks” along travel routes and roads, existing 4x4 trails and a selected strategic ridgeline to break up fuel continuities. Over the near future, the USFS, Pike National Forest will be evaluating HR I and HR J to validate or modify the treatment unit boundaries and/or add more treatment units. In addition, several treatment areas on public land have been identified where work can be accomplished through the CSFS by using authorities contained in “Good Neighbor Agreements”.

Essential to the success of the plan is the involvement of the private landowners. Implicit to the plan is “ownership of the fire problem” by private landowners. While CSFS and the local FPDs have worked hard to promote defensible space and land management, private landowners must accept responsibility for completing work on their own lands. Incorporated in the private land treatments is the task of working with individual landowners to improve defensible space in the ignition zone around the buildings.



Identified in the *Fuel Treatment Table* are the parcel of land, size, ownership, treatment priority, time frame, lead agency and general type of treatment.

Fuel Hazard Reduction

PRESCRIPTIONS FOR WILDFIRE HAZARD REDUCTION

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

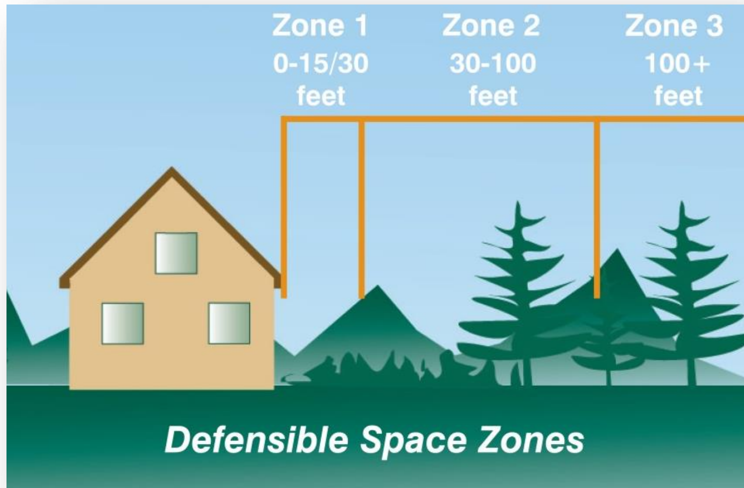


Diagram of the home ignition zone showing the three thinning zones.
Graphic Courtesy of Colorado State Forest Service

THE HOME IGNITION ZONE:

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

Protecting Homes in the HIZ: Thinning around homes is different than thinning for fuel breaks. Thinning in the HIZ is designed to protect structures from the heat of wildfires. Defensible space includes both thinning around structures to reduce the heat from burning vegetation and reducing flammability of the structures to protect them from wind born embers, radiation and convective heat. Further information about increasing the survivability of structures is found on the CSFS website at:
http://csfs.colostate.edu/pages/pub-csfs2.html#wildfire .

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

*__Zone One__***:** This is the closest zone to a structure, and extends 15-30 feet from the outermost edge of a structure including any decks. The management goal is to reduce or eliminate most large trees or shrubs within this zone so that the convective heat will not ignite the structure. A few tall trees may be left in zone one if the lowest branches are pruned so that they are well above a fire resistant roof. It is best to limit this to one or two trees near a structure. Treat such trees as part of the structure and create 15-30 feet of space outside the tree.

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

__Zone two:__ The width of zone two depends on the slope around the house. If the average slope angle is less than 5%, zone two extends out 70 feet from zone one (100 feet total distance around the house). As slopes increase, increase the width of zone two on the downhill side of the house, and increase the spacing between tree crowns.

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

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

__Zone three:__ The guideline for zone three is to thin the forest primarily to improve forest health. Spacing is less critical in this area but spaces should be made in the canopy. A useful rule of thumb is that a tree should receive sunlight from all four sides.

Silviculture and Wildfire Mitigation

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

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

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

Shade Intolerant Trees

Shade intolerant trees are those that require full sunlight to sprout and grow to maturity. Shade intolerant trees are those that first colonize a site after a disturbance, such as wildfire, removes the existing trees. For this reason, ecologists call these pioneer species. Aspen, the most shade intolerant of local species, will send up new sprouts within days after a fire destroys the old trees. Shade intolerant trees common to this area include aspen and ponderosa pine.

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

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

Following are some important species of shade intolerant trees with respect to fire mitigation:

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

Aspen: As noted earlier, aspen are the most shade intolerant of local trees. Unlike the ponderosa, aspen bark is thin and the tops of the trees are killed by even the coolest fire. The root system however is insulated from the fire's heat by the ground, and when the tree tops die, the roots respond by vigorously resprouting.

As a deciduous tree, aspen will not carry a fire in the tree crowns, thus fires drop to the ground in aspen stands. For this reason aspen are desirable trees to retain in fuel breaks and defensible spaces. Furthermore, aspen are desirable wildlife trees, and many stands are becoming shaded out by conifers due to years of fire suppression.

Since wildfire mitigation practices almost always require thinning, many landowners assume that aspen should be thinned as well, but they should not. Thinning aspen is rarely recommended since the falling trees wound the remaining trees. The bark on aspen is so thin that any wound will expose the tree to many different fungal diseases that are eventually fatal. Fire mitigation in aspen should be limited to removal of dead trees if care is taken to avoid wounding live trees, cleaning up down dead wood, and removing conifer regeneration from the aspen understory.

Shade Tolerant Trees

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

*Spruce***:** Colorado blue and Engelmann spruce are so similar that they may be considered together for discussion of fire mitigation. Colorado blue spruce is usually found in lower altitudes (below 9,000 ft) while Engelmann spruce is usually found above 9,000 feet. The ability of seedlings to survive in the shade of mature trees usually creates dense forests with a closed canopy above and thickets of ladder fuels below. The typical fire regime in spruce is an infrequent stand replacing crown fire.

Spruces tend to be shallow rooted and excessive thinning of the upper canopy can result in wind throw in the remaining trees. Typically fire mitigation prescriptions for spruce require creating openings of one tenth acre or larger with clumped trees between the openings. Removal of small trees in the understory of the clumped trees reduces ladder fuel.

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

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

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

Thinning from below on the Black Forest School Section. These trees were first thinned in about 1980, and dense regeneration was thinned again in 2008.

<u>Thinning & Fuel Reduction</u>

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

For simplicity, trees can be divided in three levels in the forest canopy. The largest trees at the highest level of the canopy are called dominants. These are usually the most vigorous since they have the largest root systems, most leaf area and receive the most sunlight. Next are the co-dominant or intermediate trees. These trees occupy the middle level of the canopy, but tend to be crowded and of smaller diameter. They are less vigorous with smaller root systems and fewer leaves as the result of crowding by the dominant trees. At the lowest level of the forest canopy are the overtopped trees. These are completely shaded by the dominant and co-dominant trees.

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

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

Slash Treatments

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

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

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

Lopped and scattered slash can also lead to problems with ips or turpentine beetles. The 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 the beetles 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 however. Chips should be spread along the ground to a depth of less than four inches.

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

Community Chipping Projects: Many communities have found that an effective way to promote mitigation is to sponsor a community chipping program. They have discovered that landowners are quite willing to undertake the effort of thinning trees if there is a simple low cost way to remove the slash. Community chipping usually consists of one of two approaches.

First is the community slash site where landowners may drop of the slash at a designated area. The slash is then ground and given away as mulch or used in some sort of reclamation activity. Most sites are open on designated days and manned by volunteers from the sponsoring community. Some slash sights that are not gated and are unmanned have reported some problems with illegal dumping, although this seems to be a rare occurrence. Rather than collection sites other communities have paid for roll off dumpsters to be placed at certain locations for collection of slash.

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

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.

Pile Burning: Any form of open burning requires a permit. The sheriff in each county is by law the county fire marshal, but often the authority to issue burn permits is delegated to the local fire protection district. Anyone contemplating pile burning should check with the sheriff's office in the early planning stage to determine the proper procedure to obtain a burn permit. Burning must be done only under the conditions stipulated in the permit. In El Paso County where air quality is a problem, private land burning, is also regulated through the State Department of Public Health and Environment, and requires a smoke permit. The open burning page of the DOPHE website for the department is:
http://www.cdphe.state.co.us/ap/openburnfaq.html

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 amounts of dirt, which will make the pile harder to burn, create more smoldering and smoke, and will hold heat longer which adds 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 should not be located directly adjacent to or under the canopy of trees or other flammable material. Separation should be greater on the downwind 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 smolder 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 do not occur 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 to a low flame, wood from the edges should be thrown into the center to insure complete burning of all slash.

The burned slash pile must be monitored and may need to be cooled below the point of combustion, 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.

Maintenance

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

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

Late October is the best time to inspect trees for attack by mountain pine beetles. Beetles 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.

IV. IMPLEMENTATION AND MONITORING

Implementation

The table below lists all of the 21 mitigation projects identified, their priority rankings and the lead agency for the projects. In addition to the projects in *Table 4*, approximately 40+ home sites are rated as high or extreme wildfire hazard and are in critical need of defensible space improvement (see *Appendices C* and *D* for specific needs and *Appendix K* for guidelines when creating defensible space). In total, about 60+ small and large projects have been identified.

Fuel Treatment Table – Carroll Lakes Community Wildfire Protection Plan (need to update timeframe column)

Treatment Area	Acres	Miles	Ownership	Priority	Time Frame	Lead Agency	Treatment
Private Land	**186**						
HR A (CL)	18	NA	Pvt	1	2005	CSFS	Mech/Hand
HR B (CL)	17	NA	Pvt	1	2005	CSFS	Mech/Hand
HR C (D)	11	NA	Pvt	1	2005	CSFS	Mech/Hand
HR D (D)	11	NA	Pvt	1	2005	CSFS	Mech/Hand
HR E (R)	129	NA	Pvt	2	2006	CSFS	Mech/Hand
Good Neighbor	**59**						
HR K	42	NA	USFS	2	2006	CSFS	Mech/Hand
HR L	17	NA	USFS	2	2006	CSFS	Mech/Hand
Pike NF USFS	**1,120**						
HR F	490	NA	USFS	1	2005	USFS	Mechanical
HR G	276	NA	USFS	1	2006	USFS	Mechanical
HR H	60	NA	USFS	1	2006	USFS	Mechanical
HR I	196	NA	USFS	3	2006	USFS	Mechanical
HR J	98	NA	USFS	3	2006	USFS	Mechanical
Farish USAFA	**18**						
HR M	18	NA	USAFA	2	2006	USAFA	Mechanical
Roadside Thin	**469**	**12.9**					
RT 1 (FR312)	NA	3.6	USFS/Pvt	1	2005	FS/CSFS	Mech/Hand
RT 2 (FR300)	NA	2.0	USFS	1	2005	USFS	Mech/Hand
RT 3 (FR309)	NA	1.0	USFS	1	2005	USFS	Mech/Hand
RT 4 (FR307)	NA	.2	USFS	2	2006	USFS	Mech/Hand
RT 5 (FR314)	NA	1.7	USFS	2	2006	USFS	Mech/Hand
RT 6 (FR307A)	NA	2.8	USFS	2	2006	USFS	Mech/Hand
RT 7 (FR721)	NA	.8	USFS	2	2006	USFS	Mech/Hand
RT 8	NA	.8	USFS	2	2006	USFS	Mech/Hand

Monitoring

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

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

The action Plan for the South Platte Wildfire Protection Plan, identifies the responsibilities and roles (tasks) necessary to finalize the Carroll Lakes Community Wildfire Protection plan and to implement the agreed upon priorities.

Action Plan for the Carroll Lakes Community

Task	Lead Agency	Date	CSFS	USFS	Fire Depts	AFA	County	Neighborhoods
Community Wildfire Protection Plan								
Finalize Plan		4/14						
Review Draft Plan	CSFS	5/14		x	x		x	
Finalize Fuel Treatment Map and Attribute Table	USFS		x	x	x	x		
Gain public understand, acceptance and support	All	ongoing						
Develop Communications Plan	CSFS	6/14	x	x	x	x	x	
Hold public open house—explain, ask input, train	Fire Dept	6/14	x	x	x	x	x	x
Sign Plan	All	6/14	x	x	x	x	x	x
Evacuation								
Improve, gate and manage emergency route FR312 to FR309	USFS/USAFA	2015	x	x	x	x	x	x
Defensible Space Improvement								
Coordinate efforts to develop Defensible Space	CSFS/NRCS	2014	x		x			x
Mailing and Visit Homeowners	Fire Depts	2015	x					x
Provide Assistance in Preparing Cost Share Grant Requests	CSFS	Yearly	x					x
Technical Assist to Landowners	CSFS&Fire Dept	ongoing	x					
Marking trees	CSFS	ongoing						
Tree/debris removal	CSFS	ongoing		x		x		x
Local Protection								
Petition NW Teller District for coverage of Carroll Lakes	Pvt. Landowners	2015			x	x	x	x
Good Neighbor Projects								
Complete NEPA on Projects—TES clearance	USFS	ongoing	x			x		
Coordinate project with adjacent landowners	CSFS	ongoing	x	x		x		x
Annual Project Planning (complete by Sept each year)			x					x
Estimate costs and schedule for next years work—PNF	USFS	2016	x				x	x
Estimate costs and schedule for next years work—Landowners	Pvt. Landowners	yearly	x					x
Annual Monitoring								
Annual Meeting of Partners (field review of accomplishments)	CSFS	Yearly	x	x			x	x
Update CWPP per review by partners	CSFS	1016	x	x			x	x
Mtg to determine interest/extent of monitoring	CSFS	2016	x	x			x	x

Carroll Lakes
Community Wildfire Protection Plan

Appendices

APPENDIX A

CARROLL LAKES INSECT AND DISEASE CONDITIONS

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

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

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.

Western Spruce Budworm

The western spruce budworm (WSBW), a defoliating insect of Douglas-fir and spruce, is the greatest threat at present. Depending on the intensity of defoliation, budworm may damage or kill the host tree.

A severe outbreak of WSBW in the late 1980s damaged or killed large areas of Douglas-fir throughout the region. Trees with dead branch tips or those with forked or dead tops are legacies of the previous epidemic. Many of the dead Douglas-fir were first weakened by budworm and then killed by Douglas-fir beetles.

The grayish, mottled adult moths are active in July and August when females lay eggs on the underside of needles. Eggs hatch within days and the larvae migrate to bark scales where they overwinter. The following spring, larvae invade the new buds and feed on the emerging needles. Webbing around the new growth is an obvious sign of budworm activity and if heavy defoliation continues for three to five years, the tree will die. If shorter-term defoliation occurs, the branch tips or the entire top of the tree could die.

Colorado State FOREST SERVICE

Natural predators or severe winter weather helps control budworm populations, which keeps them at non-threatening levels. Spraying with *Bacillus thuringensis* may be useful to protect high value trees, but is not practical on a large scale.

WSBW larva feeding on the needles of Douglas-fir. Note the typical webbing in the bottom of the photo. Colorado State Forest Service photo by David Leatherman.

Dwarf Mistletoe

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

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

The most obvious symptom of dwarf mistletoe infection is the dense, distorted growth of the branches, called witch's brooms because they appear to be twisted or tied in knots. The shoots of ponderosa and lodgepole dwarf mistletoe are visible on the branch as thick fingerlike growths extending out of the branch or trunk. The shoots of ponderosa and lodgepole dwarf mistletoe are long and obvious to casual observation, but Douglas-fir dwarf mistletoe shoots are shorter than the needles and are not easy to see.

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

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

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

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.

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.

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

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

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

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

Following are treatment options for beetle-infested trees:

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

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

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

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.

Douglas-fir Beetle

Douglas-fir beetles May become an increasing problem in Carroll Lakes if defoliation from western spruce budworm continues to weaken the trees. Considering the stresses of mistletoe and drought the potential of attack is present. Some similarities exist between Douglas-fir beetle and MPB, but there are important differences that require different treatment strategies for infested trees.

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

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

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

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

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

Pitch streamers on the bark of a beetle-infested Douglas-fir. Not all infested trees will exhibit pitch. Trees should be checked for boring dust in the early fall. Colorado State Forest Service photo by Dave Root.

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 Overlook Colony. The other species are always present in the forest, but are not currently at epidemic levels. Ips beetles usually attack trees less than four inches in diameter and, in such circumstances, may be useful in thinning dense stands of young trees. Thus, it usually is not considered as threatening as its larger cousin. Ips will attack larger trees if they are severely weakened by disease (most often dwarf mistletoe), or are damaged by construction, lightning strikes or in horse corrals where soil compaction injures the roots. Like the mountain pine beetle, ips burrow beneath the bark and inoculate the tree with bluestain fungus, often following mountain pine beetles into larger trees.

The differences between mountain pine beetle and ips are significant to anyone implementing a forest management program. In contrast to MPB, which produce one generation per year, ips may produce up to four. Ips become active in spring when the weather exceeds 50 degrees F, developing from egg to adult within eight weeks. They continue to attack trees until the first fall frosts. For this reason, preventive spraying should be done with 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. Slash cut late in fall that is subsequently infested can be treated or piled and burned over the winter, but untreated slash left over the winter will produce live broods the following April. Due to their short lifecycle, solar treatment of ips-infested logs is ineffective. Bucking larger diameter logs and promptly splitting them into firewood accelerates the drying process and usually is effective in preventing ips infestations.

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

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.

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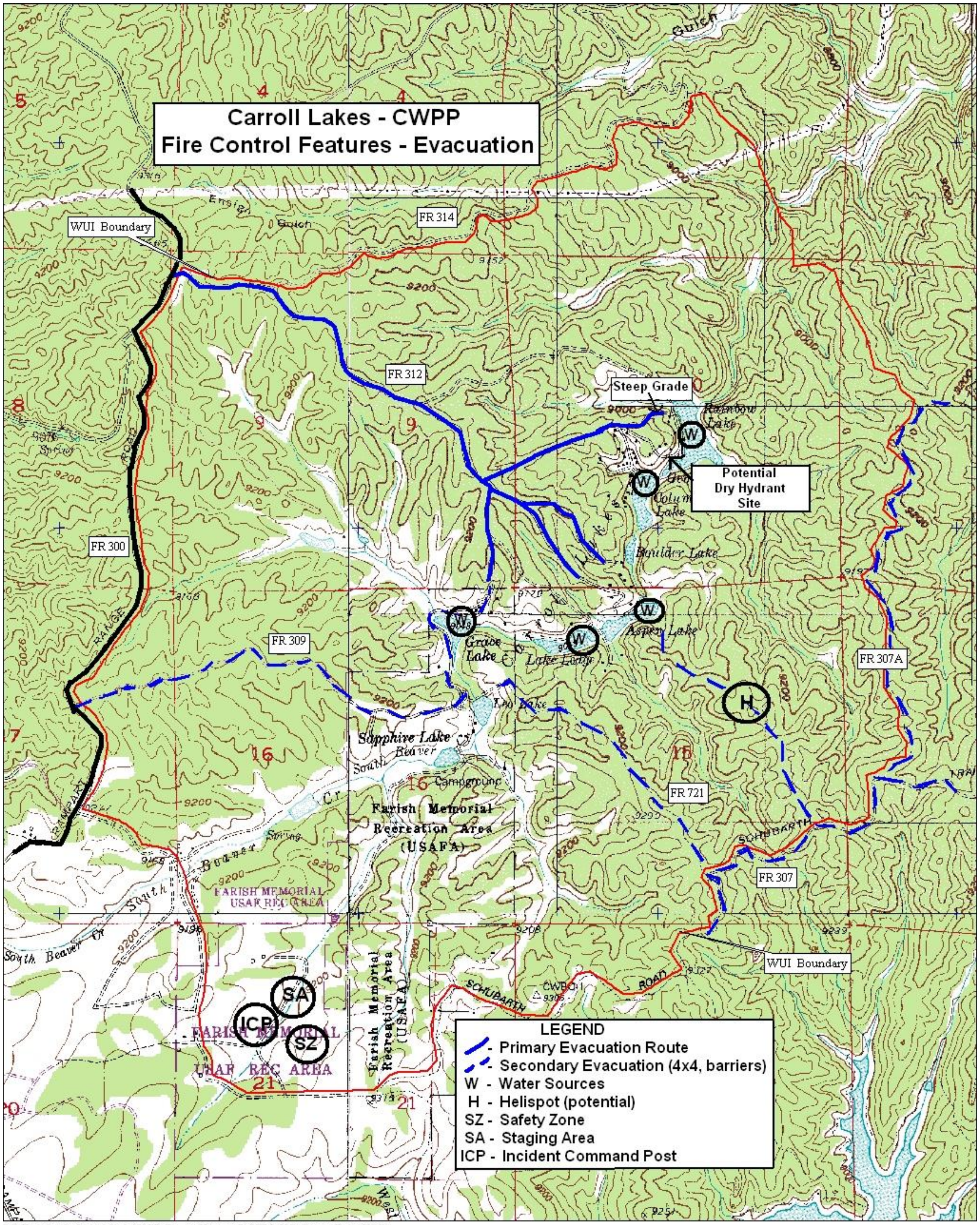
APPENDIX B Fire Control Features/Evacuation Map



3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096 Source Data: USGS   700 ft Scale: 1 : 24,000 Detail: 13-0 Datum: NAD27

Appendix D
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.