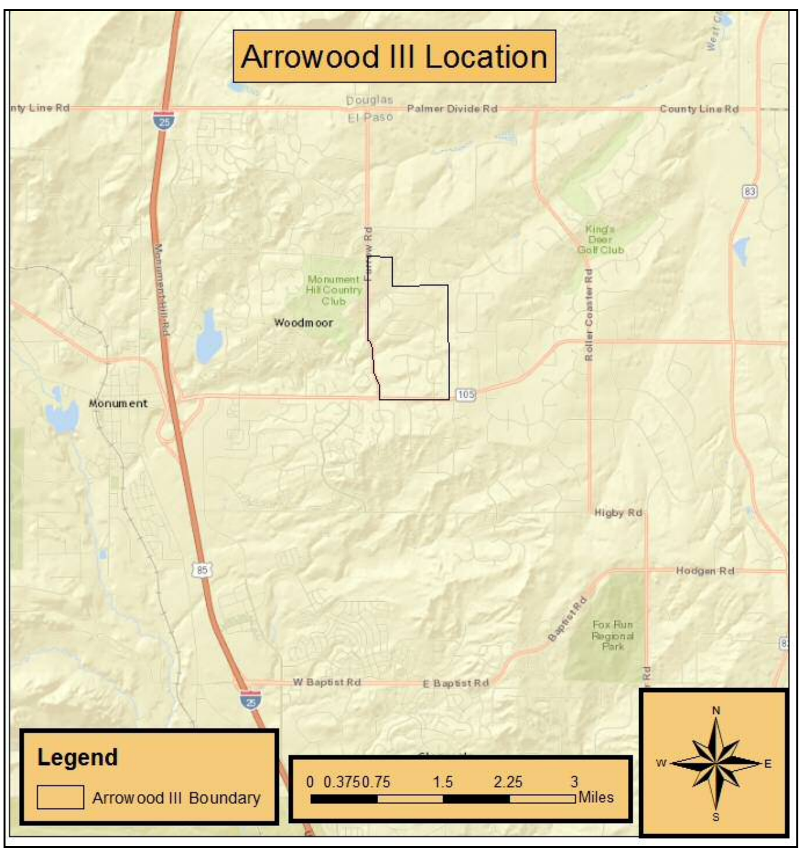
FIREWISE COMMUNITIES/USA® RECOGNITION PROGRAM

COMMUNITY ASSESSMENT – Arrowwood III, Monument, Colorado

1) Introduction

The Firewise Communities/USA program is designed to provide an effective management approach for preserving wildland living aesthetics. The program can be tailored for adoption by any community and/or neighborhood association that is committed to ensuring its citizens maximum protection from wildland fire. The following community assessment is intended as a resource to be used by the Arrowwood III residents for creating a wildfire safety action plan. The plan developed from the information in this assessment should be implemented in a collaborative manner, and updated and modified as needed.

Wildfire risk reduction and stewardship of the forest are not exclusive. Rather they are inseparable goals that must be addressed in unison. Wildfire risk reduction achieves a healthier forest that is more resistant to insect and disease epidemics.



Arrowwood III is a community of approximately 300 residents located east of the city of Monument, Colorado in northern El Paso County Colorado. Most lots within the community are two to three acres in size, and most homes are widely separated so that risk of home to home ignitions is low.

Arrowwood III was first analyzed using the Colorado Wildfire Risk Assessment GIS program (CO-WRAP). The Firewise Committee then met with the Colorado State Forest Service to do a windshield survey of the community. The purpose of the survey was to ground truth the CO-WRAP Map and to make general observations of the forest conditions and fire hazards within Arrowwood III. The final hazard map, as included in this document, was developed from the survey.

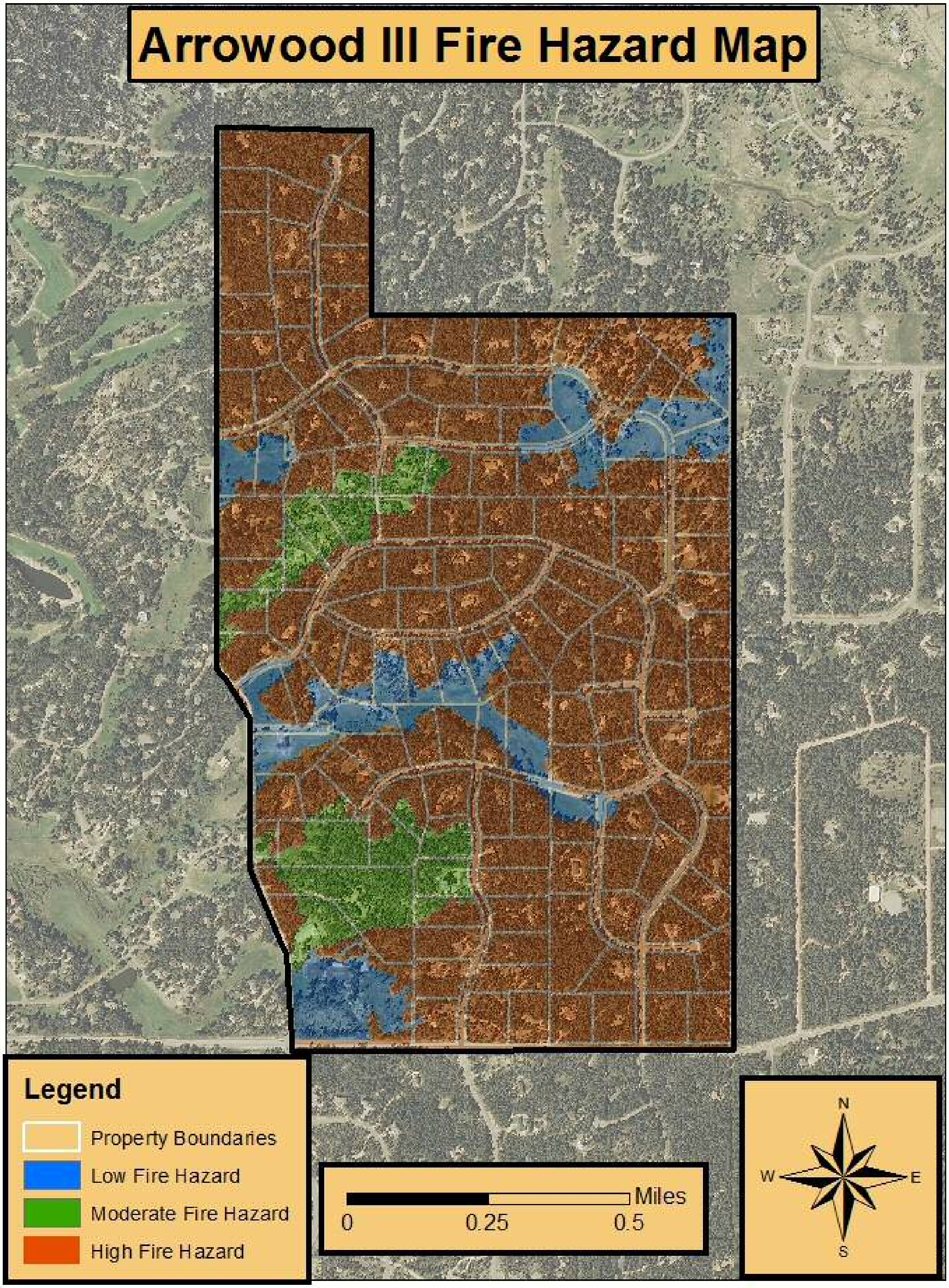
Arrowwood III's objectives are as follows:

- Reduce the risk of catastrophic wildfire and minimize the risk to people and property.
- Improve forest health so that there is reduced risk to insect and disease epidemics, particularly the risks posed by mountain pine and ips beetles, and dwarf mistletoe.
- Become a recognized Firewise Community.
- Join with other communities in the area to reduce wildfire hazard throughout the region.

2) Definition of the Home Ignition Zone

Arrowwood III is located in a wildfire environment. Wildfires will happen--exclusion is not a choice. The variables in a fire scenario are when the fire will occur, and where. This assessment addresses the wildfire-related characteristics of Arrowwood III. It examines the area's exposure to wildfire as it relates to ignition potential. The assessment does not focus on specific homes, but examines the community as a whole. A house burns because of its interrelationship with everything in its surrounding home ignition zone----the house and its immediate surroundings. To avoid a home ignition, a homeowner must eliminate the wildfire's potential relationship with his/her house. This can be accomplished by interrupting the natural path a fire takes. Changing a fire's path by clearing a home ignition zone is an easy-to-accomplish task that can result in avoiding home loss. To accomplish this, flammable items such as dead vegetation must be removed from the area immediately around the structure to prevent flames from contacting it. Also, reducing the volume of live vegetation will affect the intensity of the wildfire as it enters the home ignition zone.

Included in this assessment are observations made while visiting Arrowwood III. The assessment addresses the ease with which home ignitions can occur under severe wildfire conditions and how these ignitions might be avoided within the home ignition zones of affected residents. Arrowwood III residents can reduce their risk of destruction during a wildfire by taking actions within their home ignition zones. This zone principally determines the potential for home ignitions during a wildland fire; it includes a house and its immediate surroundings within 100 to 150 feet.


Arrowood III Fire Hazard Map
Legend
Property Boundaries
Low Fire Hazard
Moderate Fire Hazard
High Fire Hazard
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3) DESCRIPTION OF THE SEVERE CASE WILDLAND FIRE CHARACTERISTICS THAT COULD THREATEN THE AREA

Fire intensity and spread rate depend on the fuel type and condition (live/dead), the weather conditions prior and during ignition, and the topography. Generally, the following relationships hold between the fire behavior and the fuel, weather and topography.

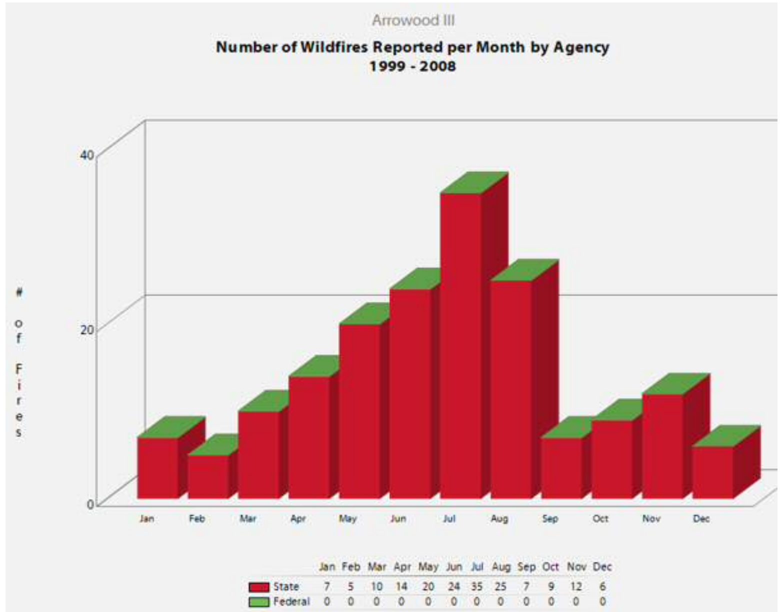
- Fine fuels ignite more easily and spread faster with higher intensities than coarser fuels. For a given fuel, the more there is and the more continuous it is, the faster the fire spreads and the higher the intensities. Fine fuels take a shorter time to burn out than coarser fuels.
- The weather conditions affect the moisture content of the dead and live vegetative fuels. Dead fine fuel moisture content is highly dependent on the relative humidity and the degree of sun exposure. The lower the relative humidity and the greater the sun exposure, the lower will be the fuel moisture content. Lower fuel moistures produce higher spread rates and fire intensities.
- Wind speed significantly influences the rate of fire spread and fire intensity. The higher the wind speed, the greater the spread rate and intensity.
- Topography influences fire behavior principally by the steepness of the slope. However, the configuration of the terrain such as narrow draws, saddles and so forth can influence fire spread and intensity. In general, the steeper the slope, the higher the uphill fire spread and intensity.

Arrowwood III and the surrounding communities have fuel conditions eerily similar to those exiting in the Black Forest and Waldo Cañon Fires. Although terrain is general flat, high winds are common at all times of the year, and wind driven fires are possible. If a fire ignites on a dry windy day, a severe crown fire with destructive potential similar to the Black Forest Fire, would be expected.

The CO-WRAP program provides some insights into the potential destructiveness of a wildfire burning in Arrowwood III. When studying the program's outputs, it must be born in mind that CO-WRAP uses the long term average of weather to make its estimates. Thus CO-WRAP predicts an average fire, not the worst possible case. Under severe weather conditions of high temperatures, low humidity and strong winds, fire behavior would be much more intense than predicted.

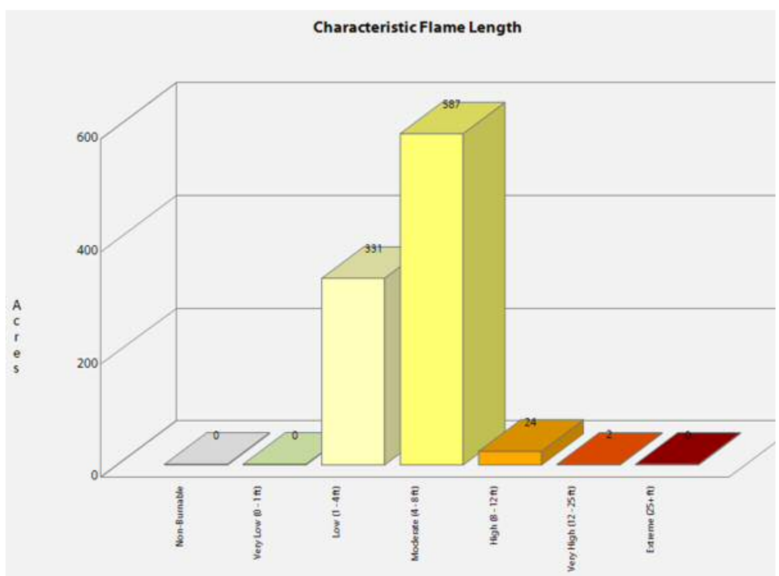
CO-WRAP outputs under average weather conditions for Arrowwood III are almost identical to the outputs of the areas burned in the Black Forest Fire. One need travel only as far as the Black Forest burn scar to understand the effect of severe weather upon predicted fire behavior.

The CO-WRAP graph titled, *Number of Wildfires Reported by Agency,* shows that most wildfires are reported between April and August, but wildfires are reported during every month of the year. Anytime when fuels are dry and there are winds wildfire is a threat.



Flame length is directly correlated with the amount of heat produced by a wildfire. Flame lengths greater than four feet produce lethal amounts of heat, and hand crews cannot attack such a fire directly. When flames exceed four feet, crews must fall back to construct fire lines in safer areas, hoping to halt the fire when it reaches that point. The ground between the flame front and the fire lines is necessarily sacrificed to the advancing fire.

CO-WRAP predicts, *under average weather conditions,* flame lengths of 4 to 25 feet over two-thirds of Arrowwood III, indicating that direct attack of a fire would be extremely dangerous in the community. A community wide program of forest thinning and defensible space is necessary to protect the community in the event of a wildfire.



Weather is, of course, of great concern during wildfire season. At such time as fire weather is severe, homeowners should remember not to leave flammable items outside. This includes rattan doormats, flammable patio furniture, firewood stacked next to the house, or other flammables.

4) SITE DESCRIPTION

Vegetation is ponderosa pine, with components of Douglas-fir and Gambel oak in some areas. The forest canopy is generally closed with abundant ladder fuels in the understory. As a result, fire hazard was judged to be high throughout most of the community. There are a few open drainages in the community, but none of these completely bisect Arrowwood III, and would not serve as adequate fuel breaks.

The result of the assessment is that wildfire behavior will be dominated by the residential characteristics of this area. The good news is that by addressing community vulnerabilities, residents will be able to substantially reduce their exposure to loss. Relatively small investments of time and effort will reap great rewards in wildfire safety.

5) ASSESSMENT PROCESS

The Community Assessment began with the use of the Colorado Wildfire Risk Assessment Portal (CO-WRAP) analysis of Arrowwood III and the surrounding areas. The CO-WRAP information obtained was transferred onto aerial photos and analyzed to produce a draft fire hazard map. On February 29, 2016 Duane Steinke, Bill and Elizabeth Mayo and Steve Merveldt of the Arrowwood III HOA, and Dave Root of the Colorado State Forest Service met to ground truth the draft map. The final fire hazard map was developed based on the observations of that meeting.

6) IMPORTANT CONSIDERATIONS

The Firewise Communities/USA program seeks to create a sustainable balance that will allow communities to live safely while maintaining environmental harmony in a WUI setting. Homeowners already balance their decisions about fire protection measures against their desire for certain flammable components on their properties. It is important for them to understand the implications of the choices they are making. These choices directly relate to the ignitability of their home ignition zones during a wildfire.

The following are common issues observed in the Arrowwood III community. These areas will be the focus of corrective actions to reduce the vulnerability to wildfire.

6.1 **Densely treed vacant lots**

The Firewise Committee will work with the owners of these lots to reduce the fuel content, especially the ladder fuels and perimeter. The objective will be to protect adjacent properties.

6.2 **Roadside fuels**

In the event of a wildfire in these areas, emergency and fire-fighting equipment would not be able to move into the neighborhood to protect or administer assistance for the smoke and fire too close to the road.
The Firewise Committee will work directly with the county which owns the right-of-way along the streets. The objective will be to encourage county officials to clean the roadside

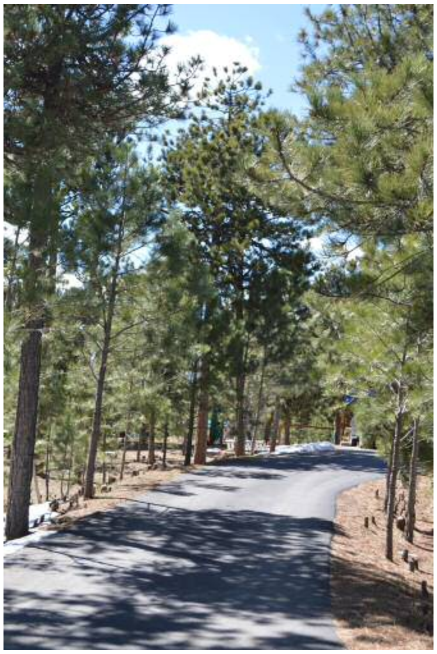
as soon as possible. The committee may also organize work parties to assist the county in removal of this hazard.

6.3 Ladder fuels

Densely treed and low hanging or fallen branches provide ladder fuel for the fire to quickly climb to the crown of the tree and then spread rapidly and out of control. Once in the crown of the trees, there is little hope in stopping the spread to structures due to the explosive nature of burning needles.
The Firewise Committee work with and encourage owners to thin and trim their trees to reduce ladder fuels in the area.

6.4 Driveways are too narrow and/or have fire fuel too close to edges to allow

a. Emergency evacuation
b. Emergency medical assistance
c. Emergency vehicle access



Another danger to homes in the area is that driveways are to narrow, or at a minimum, have trees too close for emergency vehicles to ingress/egress. Fire-fighting vehicles cannot approach the house to attempt saving it. Therefore, even if the owner has cleared a defensible area immediately around the house, fire-fighters will not approach and will leave the house to chance.

Many homeowners in the community have done a good job of eliminating ladder fuels, indicating desire, and support for mitigation, but most landowners need to do more thinning of the upper forest canopy to separate connected tree crowns. See the prescription for defensible space and forest thinning in the following section.

Address markings are usually dark metal numerals mounted on the wooden mail box supports. Houses would be better identified with four inch reflective numerals on non-flammable posts at the end of the driveway. During smoky conditions, at night or both, these markings will allow firefighters to know that there is a house nearby. During low visibility conditions common during fires, firefighters have often missed homes they could not see from the road. The reflective numerals and non-flammable posts allow firefighters to identify houses. Well-marked driveways also greatly aid emergency medical personnel to find homes during medical emergencies.

Dense pockets of young trees are common along the streets. This fuel can create a dangerous situation during evacuation and is hazardous to firefighters who must access the community during a fire. For safer ingress and egress, trees in the rights of way should be thinned, and thinning should extend onto the private properties adjoining the roads.

Similarly, driveways should provide adequate access for fire engines and provide safe access to the home. Twelve feet of horizontal clearance and 13 feet of vertical clearance are required for emergency access. Thinning to zone two defensible space standards should extend for fifty feet along both sides of driveways.

7) OBSERVATIONS AND RECOMMENDATIONS

Homes are mostly newer, built in the last 30 years. All homes have class A roofs. Older homes are constructed of wood siding, while most newer homes are stucco. Roads are paved and meet modern standards for width, but, as noted in the previous section, many areas the streets have dense vegetation up to the right of way. The dense vegetation along the roads could make ingress and egress hazardous in the event of a wildfire. There are a few dead end cul-de-sacs, but these have adequate space to turn around structural fire engines.

There are four exits from the community, two onto Furrow Road and two onto Colorado Highway 105. Both of these main roads are two lane roads without shoulders, served by many subdivisions, and are not protected by fuel breaks, these routes will be hazardous in the event of a large scale evacuation. As these routes serve many communities in the area, a cooperative effort between El Paso County, The Colorado Department of Transportation and adjoining landowners is necessary to increase public and firefighter safety during a large wildfire.

8) SUCCESSFUL FIREWISE MODIFICATIONS

When adequately prepared, a house can likely withstand a wildfire without the intervention of the fire service. Further, a house and its surrounding community can be both Firewise and compatible with the area's ecosystem. The Firewise Communities/USA program is designed to enable communities to achieve a high level of protection against WUI fire loss even as a sustainable ecosystem balance is maintained.

A homeowner/community must focus attention on the home ignition zone and eliminate the fire's potential relationship with the house. This can be accomplished by disconnecting the house from high and/or low-intensity fire that could occur around it.

This home would not survive a wildfire, and firefighters could not defend it.


This home would likely survive even without firefighter intervention.

GENERALIZED PRESCRIPTIONS FOR WILDFIRE HAZARD MITIGATION:

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.

Defensible Space vs. Fuel breaks:

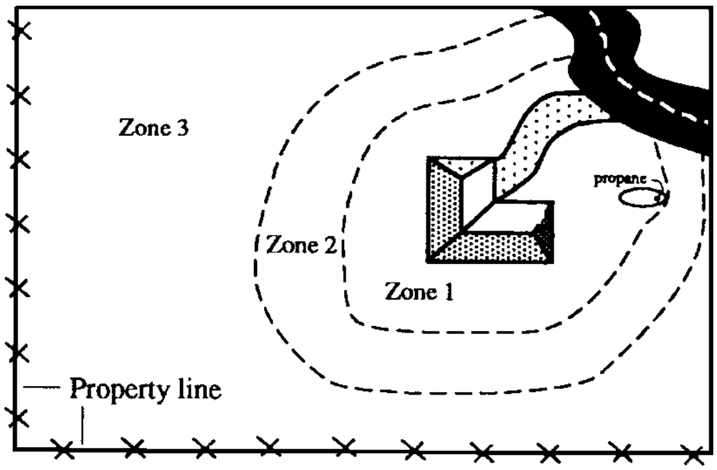


Diagram of defensible space showing the three thinning zones.

In a broad sense there are two generalized categories of mitigation. First is defensible space thinning around structures to increase the chance that the structure will survive a wildfire (Zone 1 = 15 to 30 feet). 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 (Zone 2 = Zone 1 + 70 feet). 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.

Protecting Homes with Defensible Space

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 borne 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 outer most 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 they 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.

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 50 feet from each edge of the drive. This is important to allow safe access and egress for emergency vehicles. Adequate clearance should be maintained to allow access to large structural fire trucks. Twelve feet of horizontal clearance and 13 feet of vertical clearance 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 some spaces should be made in the canopy. A useful rule of thumb is that a tree should receive sunlight from all four sides.

Home Construction and Survivability:

Homeowners are reminded that street signs, addresses, road widths and fire hydrants do not keep a house from igniting. Proper attention to their home ignition zones does. They should identify the things that will ignite their homes and address those.

The construction materials, location and even the shape of a structure influence its vulnerability to wildfire.[1] It is not the intent of this assessment 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 on a roof 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. Gutters should be metal since plastic gutters may burn.

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

[1] Bueche, David, Tim Foley, Peter Slack, (2012): *Firewise Construction: Site Design and Building Materials.* Colorado State Forest Service.

heated gasses and firebrands can enter attics or crawl spaces through vents. All vents should be screened with metal screening with openings of 1/4 inch or less. Soffit vents should be located as close to the edge of the eve as possible. Vegetation around foundation vents can create unintended vulnerability, particularly on the downhill side. Landscaping with stone or rock around crawlspace vents is recommended.

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 under 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 or foundations. 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.

Thinning for Fuel Breaks:

Fuel Break thinning is most analogous to zone two of survivable space except that rather than being centered on a structure, fuel breaks are linear. Because winds and preheating from flames tend to push fires uphill, ridge tops (as opposed to midslope fuel breaks) are superior locations. Many fuel breaks are centered on roads. It is desirable to place fuel breaks along roads to provide safer evacuation routes from communities during wildfires, and the access provides firefighters a safer and more convenient place to attack an approaching fire.

On flat terrain, a fuel break should have a minimum width of 300 feet. Wider fuel breaks are always superior, and where they are located on slopes, width should be increased. Where fuel breaks are located on slopes, the spacing between tree crowns should also be increased. Refer to the CSFS publication *Fuel Break Guidelines for Forested Subdivisions and Communities* available from the Woodland Park District or on the web at:

http://csfs.colostate.edu/pdfs/fuelbreak_guidellines.pdf

One objective of any mitigation project should be to enhance the diversity of forest stands. Bitter experience has shown that when all trees are the same species and the same age, catastrophic losses to insects or disease are sure to follow. Most insects or diseases are specific to certain species of tree and certain ages. Thus, diverse forest stands are less prone to complete mortality from one cause. If a forest stand consists of one species attempt to leave trees of different ages, or thin in such a way that regeneration of new trees is promoted. A forester can recommend methods of thinning that reduce fire hazard and increase forest diversity.

When thinning for fuel breaks it is not necessary, or even desirable, to remove all dead trees or pick up all dead wood from the forest floor. Some standing dead trees, or snags, should remain as habitat for wildlife. The most desirable snags are trees larger than ten inches in diameter that are widely spaced. Avoid leaving more than three snags per acre. Do not leave dead trees in zones one and two of defensible space or where they might fall across roads or power lines.

Likewise, some down wood is desirable. Large concentrations of down woody material should be removed, but isolated down logs in varying degrees of decay can remain as cover and habitat for small mammals.

While it is wise to rake up pine needles within five feet of foundations and 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.

Arrowwood III residents are reminded to be conscious of keeping high-intensity fire more than 100 feet from their homes. It is important for them to avoid fire contact with their structures. This includes firebrands. The assessment team recommends the establishment of a 'fire free zone', allowing no fire to burn within ten feet of a house by removing fuels located there. It is a bad idea for fire to touch a house during a wildfire. Remember that, while wildfire cannot be eliminated from a property, it can be reduced in intensity.

Shoup Road, looking west on July 2, 2013, one month after the Black Forest Fire.

Although both sides burned at the same moment in time, forest thinning changed the intensity of the fire. On the right, forests had not been thinned and destruction was total. On the left side, the forest had been managed. The fire dropped to the ground, and the trees survived. The brown needles on the trees near the left side of the road were scorched by the intense heat, but did not burn. Note the rapid rate of understory recovery in the thinned area.

9) NEXT STEPS –

After reviewing the contents of this assessment and its recommendations, the Arrowwood III Firewise Board in cooperation with the Tri Lakes Fire Protection District will determine whether or not it wishes to continue seeking Firewise Communities/USA recognition. The Firewise Communities/USA representative will contact the Firewise Board representative by 29 July 2016 to provide its decision.

If the site assessment and recommendations are accepted and recognition will be sought, the Arrowwood III Firewise Board will create agreed-upon, area-specific solutions to the Firewise recommendations and create an action plan in cooperation with the Tri Lakes Fire Protection District.

Assuming the assessment area seeks to achieve national Firewise Communities/USA recognition status, it will integrate the following standards into its plan of action:

- Sponsor a local Firewise board, task force, committee, commission or department that maintains the Firewise Community program and status.
- Enlist a WUI specialist to complete an assessment and create a plan from which it identifies agreed-upon, achievable local solutions.
- Invest a minimum of $2.00 annually per capita in its Firewise Communities/USA program. (Work done by municipal employees or volunteers, using municipal or other equipment, can be included, as can state/federal grants dedicated to that purpose.)
- Observe a Firewise Communities/USA Day each spring that is dedicated to a local Firewise project.
- Submit an annual report to Firewise Communities/USA. This report documents continuing participation in the program.

Even though the home visible in the background and was in the direct path of the Black Forest Fire, it survived due to well-planned defensible space.