

# THE HOME IGNITION ZONE



A guide to preparing your home  
for wildfire and creating defensible space

*Formerly Quick Guide FIRE 2012-1: Protecting Your Home From Wildfire*





# Reducing Your Home's Wildfire Risk Begins With You

## WHY?

Homeowners have the ultimate responsibility to proactively prepare their property for wildfire. By creating and maintaining the home ignition zone, residents can improve the likelihood of their home surviving a wildfire and reduce the negative impacts wildfires can have on their property.

In Colorado, if you live in the wildland-urban interface, it is not a matter of *if* a wildfire will impact your home and property, but *when*.

If your home is located in or near the natural vegetation of Colorado's grasslands, shrublands, foothills or mountains, you live in the wildland-urban interface — also known as the WUI — and are inherently at risk from a wildfire. This includes any areas where structures and other human developments meet or intermingle with wildland vegetative fuels.

Wildfires are a natural part of Colorado's varied ecosystems. Planning ahead and taking actions to reduce the risk of wildfires can increase the likelihood your home survives when wildfires occur.

As more people choose to live in

wildfire-prone areas, additional homes and lives are potentially threatened every year. Firefighters always do their best to protect residents, but **ultimately, it is your responsibility to protect your property and investments from wildfire.**

This guide focuses on actions that are effective in reducing wildfire hazards on your property. It is important to recognize that these efforts should always begin with the home or structure itself and progress outwards.

Also, remember that taking wildfire risk reduction steps is not a one-time effort — it requires ongoing maintenance. It may be necessary to perform some actions, such as removing pine needles from gutters and mowing grasses and weeds, several times a year. Other actions may just need to be

addressed annually or only once.

While you may not be able to accomplish all of these actions at once to prepare your home and property for wildfire, each completed activity will improve the safety of your home during a wildfire. However, it is important to remember there are no guarantees when it comes to wildfire. Implementing risk reduction actions does not guarantee your home will survive a wildfire, but it does improve the odds.

Knowing that wildfire impacts are inevitable, it is not only important for individuals to work on their own homes, but also for residents to work together to increase their community's resilience to wildfire. To become fire adapted, actions must not only be taken before a wildfire





As the 416 Fire burned near Durango in 2018, firefighters conducted burnouts near homes in the fire's path to eliminate fuel for the main fire and provide a secure control line. The work done by homeowners to create the defensible space buffer visible here gave firefighters the option to safely conduct the operation. Photo: Jerry McBride, Durango Herald

arrives but during and after a fire.

The National Cohesive Wildland Fire Management Strategy defines a fire-adapted community as “a human community consisting of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire.”

In order to increase the likelihood homes and infrastructure survive a wildfire, all landowners must work together to reduce fire hazards within and adjacent to communities. This includes work on individual home sites and common areas within communities. Every community member has a role in fire adaptation, from civic leaders, to developers, to first responders, to homeowners and land

management agencies.



**MORE THAN  
HALF**

of Colorado residents live in the wildland-urban interface and are at some risk of being affected by wildfire.

Source: CSFS WUI Risk Assessment 2017

**Access WUI risk information** [coloradoforestatlas.com](http://coloradoforestatlas.com)

**Reduce your wildfire risk** [csfs.colostate.edu](http://csfs.colostate.edu)

**Protect your community** [fireadaptednetwork.org](http://fireadaptednetwork.org)



# What Is the Home Ignition Zone?

## HOME IGNITION ZONE (HIZ)

is the home and the area around the home (or structure). The HIZ takes into account both the potential of the structure to ignite and the quality of defensible space surrounding it.

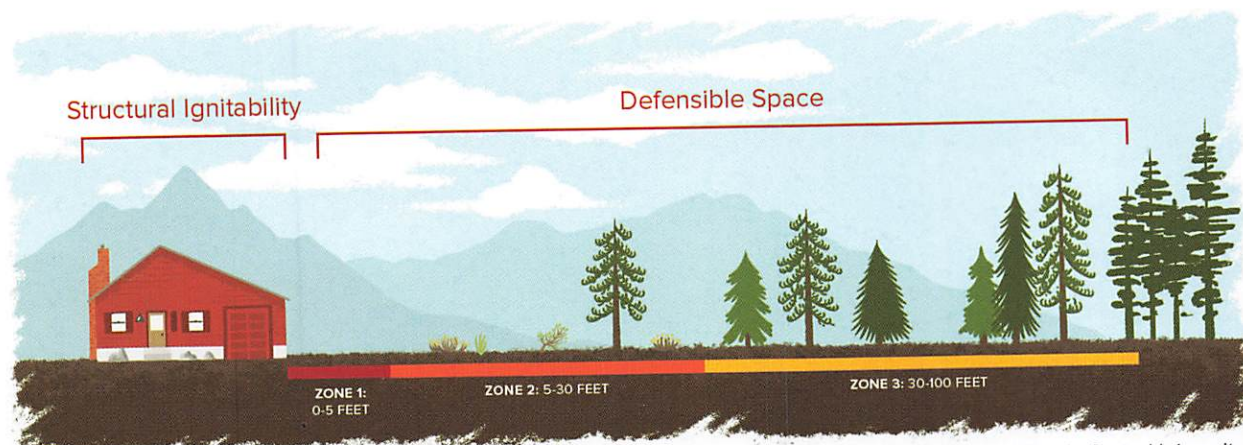


Illustration: Bonnie Palmatory, Colorado State University

**T**he two primary determinants of a home's ability to survive a wildfire include the structure's ignitability and the quality of the surrounding defensible space. Together, these two factors create a concept called the home ignition zone, or

HIZ. It includes the structure and the space immediately surrounding it.

The space around the home is divided into three distinct spaces of management, zones 1, 2 and 3. Pages 8-9 outline specific goals and critical steps to manage your

property within each of these zones.

To reduce wildfire hazards to your home and property, the most effective proactive steps to take are to minimize the ability of the home to ignite and to reduce or eliminate nearby fuel.

## METHODS OF HOME IGNITION

### 1. EMBER IGNITION

Embers (firebrands) are small pieces of burning material that can be transported by wind more than a mile ahead of a wildfire's flaming front. Embers can vary greatly in size, but even the smallest can start new fires (known as spot fires) on any ignitable surface they encounter, inside or outside a home. This is the most common source of home ignition during wildfires.

Flammable horizontal or nearly horizontal surfaces, such as wooden decks or shake-shingle roofs, are at greater risk for ignition from burning embers.

Many homes in the wildland-urban interface have burned because of airborne embers, so addressing structural ignitability is critical even if it appears difficult for fire to spread in the area surrounding a home.

### 2. SURFACE FIRE/ DIRECT FLAME CONTACT

If fuels are adjacent to a home, direct flame contact can ignite the house. Ensuring no such fuels exist within 5 feet of a home, particularly near windows or under decks, greatly minimizes this possibility.

### 3. RADIANT HEAT

Radiant heat is what you feel on your hands while warming them next to a campfire. This same type of heat transfer can ignite a home, whether the source of the heat is a crown fire in treetops or an adjacent home that has caught fire.



*Flying embers are the most common source of home ignition during wildfires. Preparing homes for their impact is critical. Embers can ignite leaf litter in gutters and on roofs, as well as shrubs and mulch at the base of the house, as seen in this controlled ember shower experiment. Photo: Insurance Institute for*

*Business & Home Safety*



# What Is Defensible Space?

## DEFENSIBLE SPACE

is the area around a home (or structure) that has been modified to reduce fire hazard by creating space between potential fuel sources.

**F**irefighters may not be present at your home during a wildfire — they are trained to protect structures only when the situation is safe for them. You should prepare your home and property to withstand wildfire without firefighter intervention. Having an effective defensible space combined with reducing structural ignitability is the best way to improve your home's chance of survival.

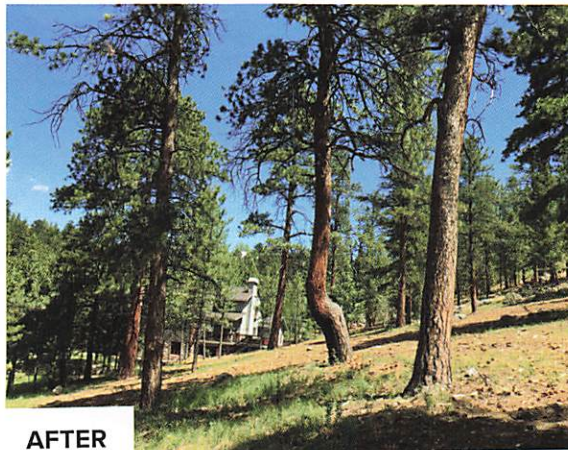
Defensible space is the area around a home or other structure that has been modified to reduce fire hazard by creating a disconnected fuel load both vertically and horizontally. In this area, natural and manmade fuels are treated, removed or reduced to slow the spread of wildfire and alter fire behavior.

Establishing defensible space reduces the likelihood of a home igniting by direct flame contact or by radiant heat exposure. It also helps limit local production of embers and reduces the chance a structure fire will spread to neighboring homes or surrounding vegetation.

## CREATING AN EFFECTIVE DEFENSIBLE SPACE

involves establishing a series of management zones. Develop these zones around each building on your property, including detached garages, storage buildings, barns and other structures.

**ATTENTION**  
*These guidelines are adapted for ponderosa pine, Douglas-fir and mixed-conifer forest types below 9,500 feet.*  
**SEE PAGE 14**  
*for guidelines adapted to other forest types.*



**BEFORE**

**AFTER**

*A Colorado State Forest Service forest management project near Evergreen cleared dense trees in a residential area to reduce wildfire risk. The same tree with a crooked trunk in the center of these photos shows how tree thinning can be a useful tool to protect property, decrease fire intensity and boost forest health. Photo: Emma Brokl, CSFS*

Recognize that fuel continuity and density play a critical role in wildfire behavior.

As you plan defensible space for your property, you can contact your nearest Colorado State Forest Service field office for guidance, or consult a forester, fire department staff or community organization appropriately trained in wildfire mitigation practices.

# 3

## Factors Determine Wildfire Behavior

1. FUELS
2. WEATHER
3. TOPOGRAPHY

Of the three things wildfires need to start and spread, humans cannot change weather or topography, so we must concentrate on altering fuels in order to have any control over a disturbance as dynamic as wildfire.

Fuels can include vegetation like trees, brush and grass; but when near homes, fuels also include propane tanks, woodpiles, sheds and even homes themselves.



*East Troublesome Fire. Photo: Zach Wehr, CSFS*





**Top left:** Hardening your home can include choosing noncombustible building materials like stucco paired with a stone facade. This house near Salida shows you don't have to sacrifice curb appeal to reduce the ignitability of your house. Photo: CSFS

**Top right:** Preparing your home for wildfire can be accomplished as weekend projects, such as clearing vegetation from around your home's perimeter and adding noncombustible material near the foundation that won't ignite if embers land there. Photo: Wildfire Partners

**Bottom:** A metal roof and noncombustible exterior window coverings add layers of protection against wildfire, in addition to the well-maintained defensible space that surrounds this home. Photo: Wildfire Partners



## MORE ONLINE

This guide provides only basic information about structural ignitability.

The National Fire Protection Association (NFPA) and the Insurance Institute for Business & Home Safety (IBHS) together produce Wildfire Research Fact Sheets that provide additional valuable information.

Visit the "Protect Your Home" section at the CSFS website, [csfs.colostate.edu/wildfire-mitigation](http://csfs.colostate.edu/wildfire-mitigation), for links to these and other structural ignitability resources.





# Harden Your Home Against the Threat of Wildfire

## STRUCTURAL IGNITABILITY

is the likelihood the materials in and on your home will ignite during a wildfire.

The practice of reducing structural ignitability is commonly called “home hardening.”

**T**he ideal time to address home ignition risk is when the structure is in the design phase.

For existing homes, steps must be taken to reduce the structural ignitability in order to improve the likelihood of the home surviving a wildfire. The practice of reducing structural ignitability is commonly called home hardening.

### BEST PRACTICES TO REDUCE STRUCTURAL IGNITABILITY

- Ensure the roof has a Class A fire rating
- Remove all leaves, needles and other debris from all decks, roofs and gutters
- Screen attic, roof, eaves and foundation vents with 1/8-inch metal mesh
- Screen or wall-in stilt foundations and decks with 1/8-inch metal mesh
- Use tempered glass for windows; two or more panes are recommended
- Create 6 inches of vertical clearance between the ground and home siding
- Replace combustible fencing or gates, at least within 5 feet of the home

## STRUCTURAL COMPONENTS TO CONSIDER

### WINDOWS

Windows can fail either from glass breaking or frames melting before a building ignites, providing a direct path for airborne embers to reach the building’s interior. Metal screens should be installed. Windows with multiple panes provide greater protection than single-paned windows.

### VENTS

Vents that are not screened or are screened with a gap that exceeds 1/8 of an inch can be a direct entry point for embers to infiltrate a home and ignite it from the inside. Metal mesh screen that is 1/8-inch is small enough that most embers will be extinguished before making it inside.

*SOURCE NFPA/IBHS Wildfire Research Fact Sheet — Attic and Crawl Space Vents*

### EXTERIOR WALLS

The exterior walls of a home or other structure are affected most by radiant heat from a fire and, if defensible space is not adequate, by direct contact with flames. Fiber cement board, brick, stucco or other fire resistant materials are recommended.

### ROOF

The roof has a significant impact on a structure’s ignitability because of its extensive surface area. When your roof needs significant repairs or replacement, choose only fire-resistant roofing materials. Wood and shake-shingle roofs are strongly discouraged because they are highly flammable and are prohibited in some areas of the state. Metal sheets, concrete or shingles made from asphalt, tile, clay, stone or metal are all recommended roofing materials. It is critical to keep the roof and gutters clear of flammable debris.

*SOURCE NFPA/IBHS Wildfire Research Fact Sheet — Roofing Materials*

### ROOF EXTENSION

The extension of the roof beyond the exterior structure wall is called the eave. This architectural feature is particularly prone to ignition. As fire approaches a building, the exterior wall deflects hot air and gases up into the eave. If the exterior wall isn’t ignition-resistant, the effect of the excess heat is amplified.

*SOURCE NFPA/IBHS Wildfire Research Fact Sheet — Under-Eave Construction*

### DECKS/FENCES

Some decks and fences are readily combustible, whether made of synthetic (plastic/composite) or natural materials (wood). Many deck designs allow embers to accumulate between board gaps and at joists below deck boards. Embers can also fall through decks and may easily ignite flammable materials beneath, making it critical to remove all materials from underneath the deck. Regardless of how fuels below decks may ignite, these burning materials can readily ignite the deck and threaten the home.

Fencing material that attaches to the home must be considered a direct extension of the structure and should be made of a noncombustible material, at least where it is immediately adjacent to a home.

*SOURCE NFPA/IBHS Wildfire Research Fact Sheets — Fencing | Decks*



# TO MANAGE YOUR HOME, LEARN THE THREE ZONES

## ZONE 1

### 0-5 FEET FROM THE HOME

The area nearest the home. This zone requires the most vigilant work in order to reduce or eliminate ember ignition and direct flame contact with your home.

## ZONE 2

### 5-30 FEET FROM THE HOME

The area transitioning away from the home where fuels should be reduced. This zone is designed to minimize a fire's intensity and its ability to spread while significantly reducing the likelihood a structure ignites because of radiant heat.

## ZONE 3

### 30-100 FEET FROM THE HOME

The area farthest from the home. It extends 100 feet from the home on relatively flat ground. Efforts in this zone are focused on ways to keep fire on the ground and to get fire that may be active in tree crowns (crown fire) to move to the ground (surface fire), where it will be less intense.



## ZONE 1

**GOAL:** This zone is designed to prevent flames from coming in direct contact with the structure. Use nonflammable, hard surface materials in this zone, such as rock, gravel, sand, cement, bare earth or stone/concrete pavers.

### CRITICAL STEPS

- Remove all flammable vegetation, including shrubs, slash, mulch and other woody debris.
- Do not store firewood or other combustible materials inside this zone.
- Prune tree branches hanging over the roof and remove all fuels within 10 feet of the chimney.
- Regularly remove all pine needles and other debris from the roof, deck and gutters.
- Rake and dispose of pine needles, dead leaves, mulch and other organic debris within 5 feet of all decks and structures. Farther than 5 feet from structures, raking material will not significantly reduce the likelihood of ignition and can negatively affect other trees.
- Do not use space under decks for storage.

## ZONE 2

**GOAL:** This zone is designed to give an approaching fire less fuel, which will help reduce its intensity as it gets nearer to your home or any structures.

### CRITICAL STEPS

- Mow grasses to 4 inches tall or less.
- Avoid large accumulations of surface fuels such as logs, branches, slash and mulch.
- Remove enough trees to create at least 10 feet\* of space between crowns. Measure from the outermost branch of one tree to the nearest branch on the next tree.
- Small groups of two or three trees may be left in some areas of Zone 2. Spacing of 30 feet\* should be maintained between remaining tree groups to ensure fire doesn't jump from one group to another.
- Remove ladder fuels under remaining trees. This is any vegetation that can bring fire from the ground up into taller fuels.
- Prune tree branches to a height of 6-10 feet from the ground or a third of the total height of the tree, whichever is less.
- Remove stressed, diseased, dead or dying trees and shrubs.



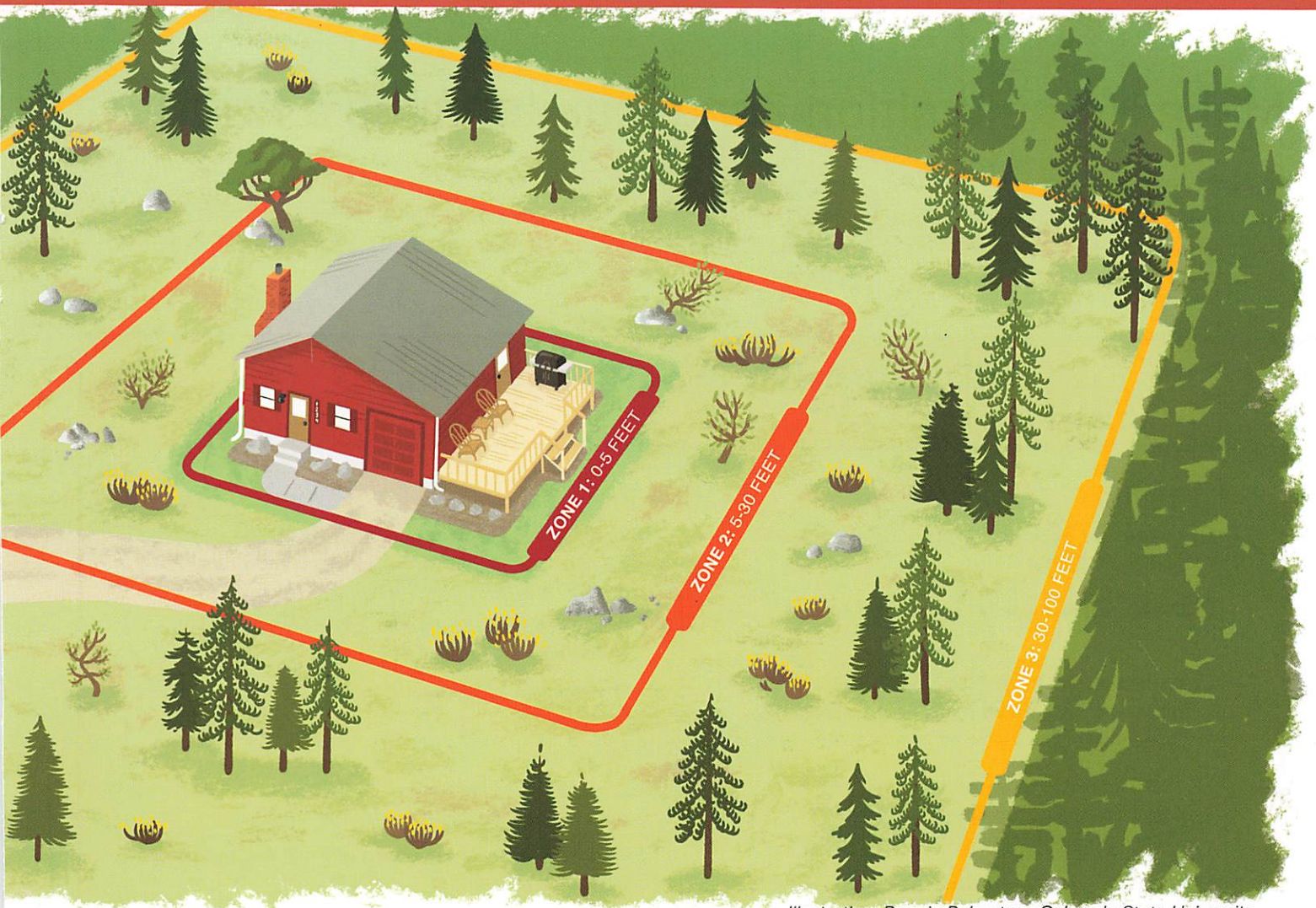


Illustration: Bonnie Palmatory, Colorado State University

## ZONE 3

This reduces the amount of vegetation available to burn and improves forest health.

- ❑ Common ground junipers should be removed whenever possible because they are highly flammable and tend to hold a layer of flammable material beneath them.
- ❑ You can keep isolated shrubs in Zone 2, as long as they are not growing under trees. Keep shrubs at least 10 feet\* away from the edge of tree branches.
- ❑ Periodically prune and maintain shrubs to prevent excessive growth. Remove dead stems annually.
- ❑ Spacing between clumps of shrubs should be at least 2 ½ times\* their mature height. Each clump should have a diameter no more than twice the mature height of the vegetation. Example: For shrubs that grow 6 feet tall, space clumps 15 feet apart or more (measured from the edge of the crowns of vegetation clumps). Each clump of these shrubs should not exceed 12 feet in diameter.

\*Horizontal spacing recommendations are minimums and can be increased to reduce potential fire behavior, particularly on slopes. Consult a forestry, fire or natural resource professional for guidance with spacing on slopes.

**GOAL:** This zone focuses on mitigation that keeps fire on the ground, but it's also a space to make choices that can improve forest health. Healthy forests include trees of multiple ages, sizes and species, where adequate growing room is maintained over time.

If the distance of 100 feet to the edge of Zone 3 stretches beyond your property lines, it's encouraged to work with adjoining property owners to complete an appropriate defensible space. If your house is on steep slopes or has certain topographic considerations, this zone may be larger.

### STEPS TO CONSIDER

- ❑ Mowing grasses is not necessary in Zone 3.
- ❑ Watch for hazards associated with ladder fuels. The chance of a surface fire climbing into the trees is reduced in a forest where surface fuels are widely separated and low tree branches are removed.
- ❑ Tree crown spacing of 6-10 feet is suggested. Consider creating openings or meadows between small clumps of trees so fire must transition to the ground to keep moving.
- ❑ Any approved method of slash treatment is acceptable in this zone, including removal, piling and burning, lop and scatter, or mulching. Lop-and-scatter or mulching treatments should be minimized in favor of treatments that reduce the amount of woody material in the zone. The farther this material is from the home, the better.



# Make Home Ignition Zone Maintenance a Priority

## WHY?

The home ignition zone requires regular, ongoing maintenance to be effective. Your home is located in a dynamic environment — trees, grasses and shrubs continue to grow, die and drop leaves each season, and there are ongoing maintenance needs on any structures on your property.

## HOME IGNITION ZONE CHECKLIST

### PREPARE YOUR HOME FOR WILDFIRE WITH THESE STEPS

#### TOP PRIORITIES

- CLEAR** roof, deck and gutters of pine needles and other debris.\*
- MOW** grass and weeds to a height of 4 inches or less.\*
- RAKE AND REMOVE** all pine needles and other flammable debris from 5 feet around the foundation of your home and deck.\*
- TREAT** or mow shrubs that re-sprout aggressively (such as Gambel oak) every 3-5 years or more depending on growth rates.
- REMOVE** branches that hang over the roof and chimney.
- DISPOSE** of slash from thinning trees and shrubs by chipping, hauling to a disposal site or piling in open areas for burning later. *Any accumulation of slash that's chipped or otherwise should be 30 feet or more from the home.\**
- AVOID** creating continuous areas of wood chips on the ground when chipping logs and/or slash. Break up the layer of wood chips by adding nonflammable material, or allow for wide gaps of at least 3 feet between chip accumulations.

\* Address as needed, more than once a year.

#### FIREWOOD

- Keep firewood stacked uphill from (or at the same elevation as) any structures, and keep the woodpile at least 30 feet away from the home.
- Do not stack firewood between remaining trees, underneath the deck or on the deck.
- Remove flammable vegetation within 10 feet of woodpiles.

#### PROPANE TANKS

- Keep aboveground tanks at least 30 feet from the home, preferably on the same elevation as the house.
- Remove flammable vegetation within 10 feet of all propane tanks and gas meters.

#### DRIVEWAYS

- Maintain at least 10 feet between tree crowns, thinning them a minimum of 30 feet back from each side of the driveway from the house to the main access road.
- Remove ladder fuels beneath trees after thinning.
- Remove any shrubs that are within 10 feet of the outer edge of tree crowns.
- Space shrubs apart at least 2 ½ times their mature height, as measured from the edge of the shrubs.
- Post signs at the end of the driveway with your house number that are noncombustible, reflective and easily visible to emergency responders.

#### SOLUTIONS FOR MANAGING SLASH

- 1** Spread slash and wood chips over a large area to avoid heavy accumulations and large piles. Being close to the ground will help speed decomposition.
- 2** Burn slash piles, but before doing so, always contact your county sheriff's office or local fire department for current information or possible restrictions.
- 3** Lop and scatter slash by cutting it into small pieces (less than 24 inches long) and spreading it over a wide area, to a depth not exceeding 18 inches. Don't scatter material over 4 inches in diameter.





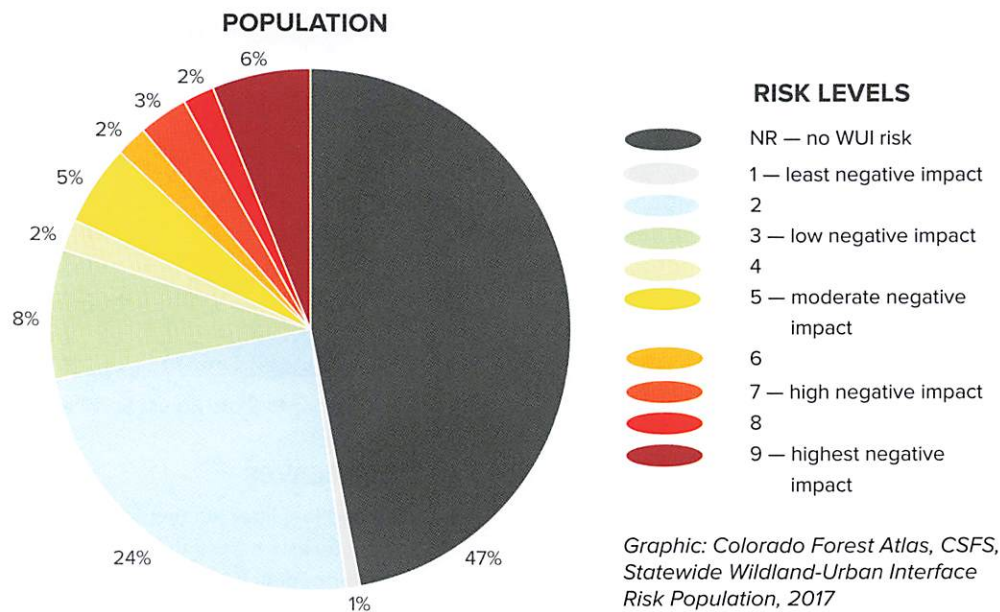
The Colorado State Forest Service works with communities to reduce wildfire risk and become recognized Firewise USA® sites, an accomplishment Piñon Ridge Estates in Chaffee County earned in 2021. CSFS forester Josh Kuehn, right, presents Craig Sommers of Piñon Ridge, with a sign for the community after residents completed the steps required for program recognition. In 2019, the Decker Fire came within a mile and a half of the neighborhood. Photo: Chaffee Chips

## More Than Half of Colorado Residents Live With Some Wildfire Risk

**T**he wildland-urban interface (WUI) includes the portions of Colorado where human development meets wildland vegetation.

The majority of Coloradans live in the WUI, in places with at least some risk of wildfire. And that number continues to increase as more residents build homes in the WUI.

As of 2017, the WUI covered about 3.2 million acres in Colorado. By 2040, the WUI area could encompass over 9 million acres in the state, according to projections from Colorado government models.



### Additional Wildfire Mitigation Resources Online

- » Colorado State Forest Service wildfire mitigation information and publications [csfs.colostate.edu/wildfire-mitigation](https://csfs.colostate.edu/wildfire-mitigation)
- » Community Wildfire Protection Planning [csfs.colostate.edu/wildfire-mitigation/community-wildfire-protection-plans](https://csfs.colostate.edu/wildfire-mitigation/community-wildfire-protection-plans)
- » Insurance Institute for Business & Home Safety [ibhs.org/risk-research/wildfire](https://ibhs.org/risk-research/wildfire)
- » Colorado Wildfire Risk Viewer and Risk Reduction Planner [coloradoforestatlas.org](https://coloradoforestatlas.org)
- » National Fire Protection Association: Firewise USA® [nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA](https://nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA)
- » Fire Adapted Communities Learning Network [fireadaptednetwork.org](https://fireadaptednetwork.org)



# Fuel Types and Arrangements

## FUEL

is any material that will burn.

**W**hether in a wildland or urban location, when fuels are abundant and there's no space between them, a fire can quickly become uncontrollable and destructive. But when fuels are scarce and separated, a fire cannot build momentum and intensity, which makes it more manageable.

The closer together the fuels are near

your home, the bigger the threat they pose.

Fuel hazard measures look at both horizontal and vertical fuels, factoring in the type, amount and arrangement of fuels (called continuity and uniformity). Horizontal continuity is how the fuels are arranged laterally across the ground or among plant canopies. Vertical continuity refers to fuels extending from the ground into the crowns

of trees and shrubs.

Fuels with a high degree of both vertical and horizontal continuity are the most hazardous, particularly when they occur on slopes.

Mitigating wildfire hazards in the home ignition zone disrupts this fuel continuity, which helps reduce a fire's intensity and potential sources of home ignition.

## SURFACE FUELS



Colorado State Forest Service

### GRASSES

Grasses are perhaps the most pervasive and abundant surface fuel in Colorado. When available to burn, grasses can catch fire easily, and grass fires often spread rapidly. They also burn out quickly and do not release as much energy as fires in larger fuel types, like trees. Nonetheless, grass fuels can readily ignite structures that are directly adjacent to them.



Colorado State Forest Service

### NEEDLES/LEAVES

Needles and leaf litter accumulate naturally in forests across the state. Long needles from pines like ponderosa and broadleaf litter from trees like aspen, cottonwood and maple do not compact as readily as other leaf types. Fire in these fuels can spread rapidly, particularly during windy conditions.

Shorter needle litter from spruce, fir and lodgepole pines compacts more readily and does not generally spread as fast.

Needles and leaves that ignite anywhere on or adjacent to a structure can cause damage and loss.



Colorado State Forest Service

### LOGS/BRANCHES/SLASH/ WOOD CHIPS (MULCH)

Naturally occurring woody material on the ground and debris left from cutting down trees and shrubs (slash) are an important part of the fuel complex near structures.

This larger and denser material generates more heat than smaller fuels do, and it can be problematic when it is burning near structures.

Ultimately, the farther away from a structure that large amounts of these materials can be moved, the better.

**MORE:** A guide to mulched materials is available on the Colorado Forest Restoration Institute website, [cfri.colostate.edu](http://cfri.colostate.edu).





A firefighter monitors a burnout on the 416 Fire in southwest Colorado in 2018. This effort to manage the wildfire by eliminating fuels left of the train tracks illustrates how fire can transition through different fuel types and arrangements. Photo: Kyle Miller, Wyoming Interagency Hotshot Crew

## VERTICAL/LADDER FUELS



Kari Greer

### LADDER FUELS

Ladder fuels are burnable materials such as smaller trees and brush that provide a means for fire to climb vertically and continue into aerial fuel sources. Ladder fuels allow a fire to leave the ground level and burn up into the branches and crowns of larger vegetation. Lower branches on large trees also can act as ladder fuels.

These fuels are potentially very hazardous but are generally easy to mitigate. Pay close attention to ladder fuels near homes, as they are extremely hazardous and especially important to address.



InciWeb

### BRUSH/SHRUBS

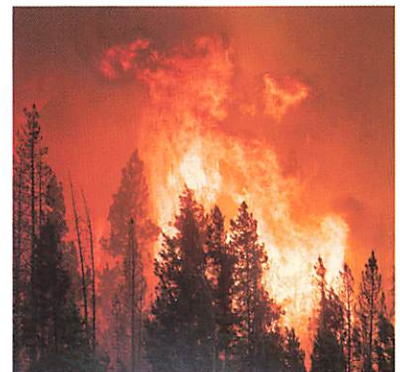
Examples of common brush fuels in Colorado are sagebrush, bitterbrush and mountain mahogany.

As with any type of fuel, brush that is close together and adjacent to homes is hazardous.

In dry climates like Colorado, brush fuels are generally dense and contain more material in a given space than grasses. Brush also usually grows larger and burns longer and more intensely than grass when it ignites.

This makes brush fires more complex, particularly when the brush grows under trees or in large, uniform stands.

## CROWN (AERIAL) FUELS



Kari Greer

### CROWN FUELS

An intense fire burning in surface fuels can transition into the upper portion of the tree canopies and become a crown fire. Crown fires are dangerous because they are intense, often move rapidly, can burn large areas, and produce embers that can travel great distances and start spot fires well ahead of the main fire.

Crown fire hazard can be reduced by thinning trees to decrease crown fuels, reducing surface fuels under the remaining trees and eliminating vertical fuel continuity from the ground into the crowns.

See recommendations on pages 8-9 of this guide.



# Forest Types

**R**ecommendations in this guide refer primarily to ponderosa pine, Douglas fir and mixed-conifer ecosystems below 9,500 feet in elevation.

Those who live in or near other forest types can follow these additional recommendations.



## PIÑON-JUNIPER

Fires in piñon-juniper forests tend to burn intensely in the crowns of trees under windy conditions.

When thinning these trees on a property, create a mosaic pattern that is a mixture of individuals and clumps of three to five trees. The size of each clump will depend on the size, health and location of the trees. The minimum spacing between the crowns of individual trees is 10 feet, increasing for larger trees, clumps and stands on steeper slopes.

Pruning trees for defensible space is not as critical in piñon-juniper forests as it is in pine or fir forests. Instead, it is more important to space the trees so it is difficult for a fire to move from one tree clump to the next. These trees should only be pruned to remove branches that are dead or are touching the ground. Live branches can be pruned up to 3 feet above the ground, or a third the height of the tree, whichever is less. Removing shrubs growing beneath piñon and juniper canopies is recommended.

Pruning live branches or removing and processing these trees is not recommended between April and October, when the piñon Ips beetle is active in Colorado. Thinning activity that stimulates sap flow in summer months can attract these beetles to healthy trees. It is acceptable to remove dead trees and dead branches during the summer.



## LOGGEPOLE PINE

Older lodgepole pine stands generally do not respond well to selective thinning, but instead respond better to removing all trees over a defined area to allow healthy forest regeneration.

Selectively thinning lodgepole can open the stand to severe windthrow and stem breakage. However, if your home is located within a lodgepole pine forest, you may prefer selective thinning instead of removing all the standing trees.

Thinning older stands of lodgepole pine to the extent recommended for defensible space may require several attempts spaced over a decade or more. No more than 30 percent of the trees in a mature stand should be removed in each thinning operation. Focus on removing trees that are obviously lower in height or suppressed in the forest canopy. Leaving the tallest trees will make the remaining trees less susceptible to windthrow.

Another option is leaving clumps of 30-50 trees. Clumps are less susceptible to windthrow than solitary trees. Allow a minimum of 30-50 feet between tree crowns on the clump's perimeter and any adjacent trees or clumps of trees.

To ensure a positive response to thinning throughout the life of a lodgepole pine stand, trees must be thinned early. Begin when trees are small saplings and maintain low densities within the stand as the trees mature.





## GAMBEL OAK

Maintaining Gambel oak forests that remain resistant to the spread of wildfire can be a challenge because of their vigorous growing habits. Gambel oak trees grow in clumps or groves, and the stems in each clump originate from the same root system. Most reproduction occurs through sprouts from this deep, extensive root system.

Treat Gambel oak near your home every three to five years, or more often depending on growing conditions. Sprouts should be mowed at least once a year. Herbicides can be used to supplement mowing and control regrowth when treating whole clumps.

This species can be “trained” to grow more like a tree than a shrub in some locations. Remove small diameter oak within clumps and any sprouts growing parallel to the ground.



## SPRUCE-FIR

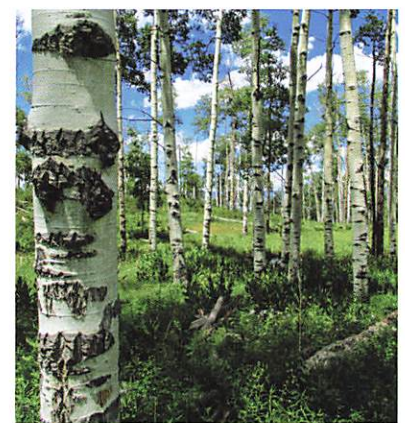
Spruce and fir trees tend to grow in association with each other.

Mature spruce and fir are prone to windthrow when heavily thinned. Light thinnings or leaving groups of trees will help mitigate this problem.

Their hardiness against the wind may not be a problem if a tree has grown to maturity in the open and isn't surrounded by other trees.

Spruce and fir tend to have crowns that extend to the ground. Eliminating lower branches that act as ladder fuels is recommended.

The spruce and Ips bark beetles are native to Colorado and infest Engelmann spruce and Colorado blue spruce. They are particularly attracted to recently fallen green trees and limbs, so it is important to remove any cut branches in a timely manner so surrounding healthy trees are not infested.



Photos: Colorado State Forest Service

## ASPEN

Tree spacing and ladder fuel guidelines do not apply to mature stands of aspen trees.

Generally, no thinning is recommended in aspen forests, regardless of tree size, because the thin bark is easily damaged, which can make the tree highly susceptible to fungal infections.

However, in older stands, numerous dead trees on the ground do require removal. Conifer trees often start growing in older aspen stands and can grow up through these old, downed aspens. A buildup of these trees eventually will increase the fire hazard of the stand, so young conifers should be removed from these areas.

Brush also can increase fire hazard in aspen stands and should be thinned to reduce flammability.

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## Cover Photography

### FRONT

**Top left:** Cleaning debris from gutters is a critical step to prevent home ignition. Photo: Wildfire Partners. **Top right:** Firefighters from Colorado's Platte Canyon Fire Protection District defend a home during a wildfire. As the population expands into the WUI, homeowners must take responsibility to prepare their homes for wildfire. Photo: Kari Greer. **Bottom:** Of 1,000 homes threatened in the 2016 Cold Springs Fire near Nederland, only 8 burned, due in part to homeowners who readied their properties and followed home ignition zone recommendations. Photo: Wildfire Partners

**BACK** Mitigation work helped spare this Boulder County home near Nederland during the Cold Springs Fire of 2016. Photo: Wildfire Partners





# ADAPT TO WILDFIRE

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