South Metro Fire Rescue

Wildfire-Resistant Home Construction and Improvement Guide

A Guide for Safer, Wiser, and More Efficient Home Construction and Improvements in Wildfire-Prone Neighborhoods

SOUTHMETRO.ORG

Using this Guide to Manage Your Home Ignition Zone

The communities and neighborhoods served by South Metro Fire Rescue (SMFR) in Arapahoe, Douglas, and Jefferson Counties are diverse ecologically, economically, and demographically. This diversity attracts people to live, work, and play in our district.

Many of our residents and visitors don't realize that when they move into these communities, they move into ecosystems shaped by wildfire.

Ecologically speaking, wildfires thin vegetation, recycle nutrients from dead plants and animals into soil, create habitat, and promote new growth. They also can scorch watersheds, burn homes, injure, and kill.

All ecosystems in SMFR's 287-square-mile jurisdiction evolved with wildfires. Native plants have characteristics that reveal the presence of periodic low- and moderate-intensity wildfires. Ponderosa pines, for example, have thick bark and low sap content. Gambel (scrub) oak produces dense shoots from roots after wildfires kill trunks. Mullein plants produce hundreds of thousands of seeds to repopulate burn areas.

Wildfires are not limited to rural areas or state parks. They also can burn through suburban open spaces and vacant lots, or along trail systems. Neighborhoods downwind of wildfires are vulnerable to spot fires ignited by embers (airborne pieces of burning fuels).

Preventing all wildfires is impossible, but we can reduce the impact of wildfires with mitigation.

Fire-Adapted Communities

SMFR promotes a vision for creating Fire-Adapted Communities, which is a model defined by the National Wildfire Coordinating

Group as "a human community consisting of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire." These communities include constructed fuels and growing fuels as well as human inhabitants.

This guide is one tool in that effort. Other tools include our agency's and county-level Community Wildfire Protection Plans, Neighborhood Mitigation Plans, wildfire pre-plans, training and equipping our agency's firefighters, and wildfire-themed community risk reduction efforts including the Ready, Set, Go brochure pictured above and available at www.SouthMetro.org.

Home Ignition Zones

Jack Cohen, a retired scientist at the US

Forest Service's Fire Science Laboratory in Missoula, MT, studied wildland urban interface fires and determined that the characteristics of the 100 feet of space surrounding a home (as well as the home itself) determines whether that home will survive a wildfire.

He describes that space, illustrated at right, as the "Home Ignition Zone."

Most homes and other structures ignite, he discovered, because of embers (also known as firebrands) and small flames from surface fires. Modifying landscaping and hardening homes to resist embers and surface fires is the best way to improve safety of occupants and firefighters as well as to limit damage to structures.

Home Ignition Zone illustration courtesy of Jack Cohen.

Sharing Responsibility for Safety

Colorado's largest wildfires in 2020 such as East Troublesome, Cameron Peak, and Grizzly Creek continue to be examined for lessons learned. This guide, the original of which was developed by a collaboration of stakeholders working with the Colorado Springs Fire Department, is one product of ongoing research into wildfires and their consequences in neighborhoods. It also is a product of South Metro Fire Rescue's commitment to reducing risk in its community. It balances risk reduction with aesthetics.

Mitigation can be a daunting challenge with larger properties. Consider prioritizing the work based on proximity to your home as this diagram illustrates. Landscape modifications get less intense with distance from the home. Image courtesy of the IAFC's Ready, Set, Go! (RSG) Program.

All of us -- builders, landscapers, residents, policy makers, and South Metro Fire Rescue -- share responsibility for reducing risks posed by wildfires in our neighborhoods, whether the wildfires are as large as the 460-acre Chatridge 2 Fire that burned south of Highlands Ranch or less than an acre in size.

Proper wildfire mitigation reduces wildfire risks and enhances recreational, aesthetic, ecological, privacy, and security values.

Guide Enhances Local Regulations

This guide is intended to be used in conjunction with locally-adopted

building and fire codes and covenants.

Together these documents provide all users with both legal requirements, as well as recommended guidance for optimal wildfire-resistant construction features. Builders, Homeowners, and Landscapers can apply recommendations in this guide to new construction as well as homes that already exist.

This guide does not cover interior fire protection system requirements such as monitored residential fire alarm or residential fire sprinkler systems. Those systems are designed to give occupants more time to escape burning structures. They are components of a Fire-Adapted Community, but beyond the scope of this project.

Fire Resistant is Not Fire Proof

This guide's recommendations are in two categories: Wildfire-Resistant Construction and Landscaping/Vegetation Management.

Recommendations in this guide are more effective if considered as a system or design package. Impacts of multiple modifications may be exponential rather than simply cumulative.

Firefighters engage a wildfire beside threatening a park. Photo by South Metro Fire Rescue.

This log-cabin home survived the Cameron Peak Fire in 2020, but a workshop in the foreground did not. Photo by LaVonne Ewing.

However, it is important to understand that these recommendations do not guarantee home survival in all wildfire conditions. In fact, these recommendations improve safety from low- and moderate-intensity wildfires. Fortunately, most wildfires in our district are in these categories.

Wildfires are dynamic and dangerous influenced by several factors beyond human control such as weather and topography as well as those factors humans can control such as behavior and fuel characteristics such as arrangement, density, and combustibility.

Following the recommendations within this guide can help make homes more resistant to wildfires, but fire resistant is not the same as fire proof. High-intensity wildfires and extreme fire behavior can negate all mitigation and suppression efforts.

Following these recommendations also

does not mandate decisions of firefighters or other emergency personnel engaged in fire suppression. They base their decisions on current and expected fire behavior.

This guide contains sections on Wildfire History, Fire Science, Structural Features, Fuel Management, and General Preparedness Tips. It also has a list of native, wildfire-resistant plant species (Appendix A) and a home wildfire risk assessment tool (Appendix B).

If you have questions about any of this guide's information or if you'd like to schedule a free site visit or free home wildfire risk assessment, please contact SMFR's Community Risk Reduction Bureau at ReducingRisk@southmetro.org.

2020 Chatridge 2 Fire

The Chatridge 2 Fire in the summer of 2020 was the second largest wildfire in South Metro Fire Rescue's history. It burned 460 acres south of Highlands Ranch. These photos capture some of the effort to prevent the wildfire from reaching homes. Photos by South Metro Fire Rescue.

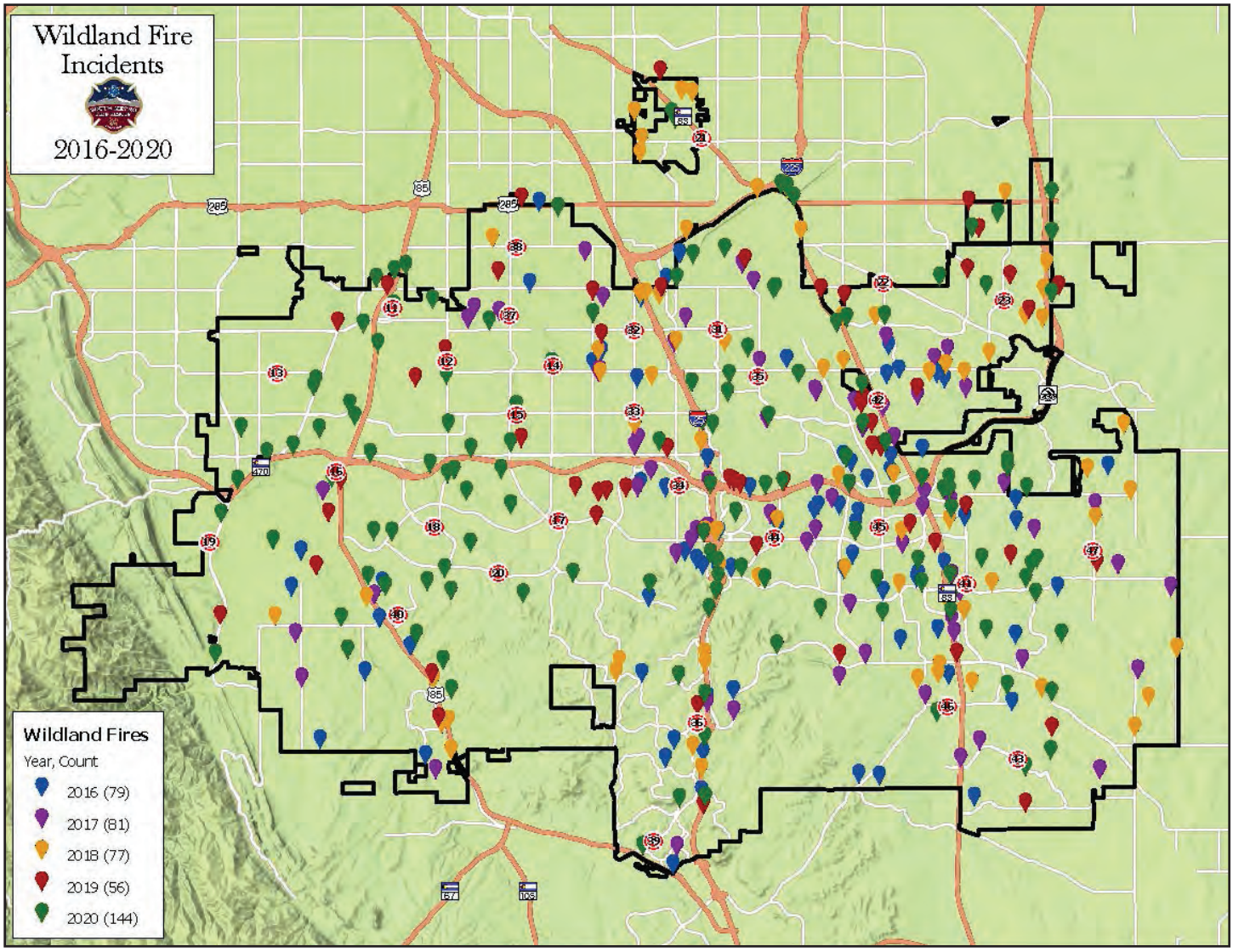
Local History of Recent Wildfires

Our communities have been threatened by several large wildfires in the last decade including Chatridge 2 in the summer of 2020 and one in Cherry Creek State Park in February 2021. Although no homes have been destroyed by wildfires in our district, several have been damaged.

As the map below reveals, wildfires are commonplace in SMFR's district. They occur in and impact rural and suburban neighborhoods.

Several functional areas throughout SMFR contribute to the effort of reducing the community's risk from wildfires including risk reduction specialists, firefighters, plan reviewers, dispatchers, and GIS analysts. Our agency also partners with local governments and non-profit organizations to address these risks. Together we utilize the 6 E's of Community Risk Reduction — engineering, education, enforcement, economic incentives, emergency response, and empowerment — recognized in the US Fire Administration model.

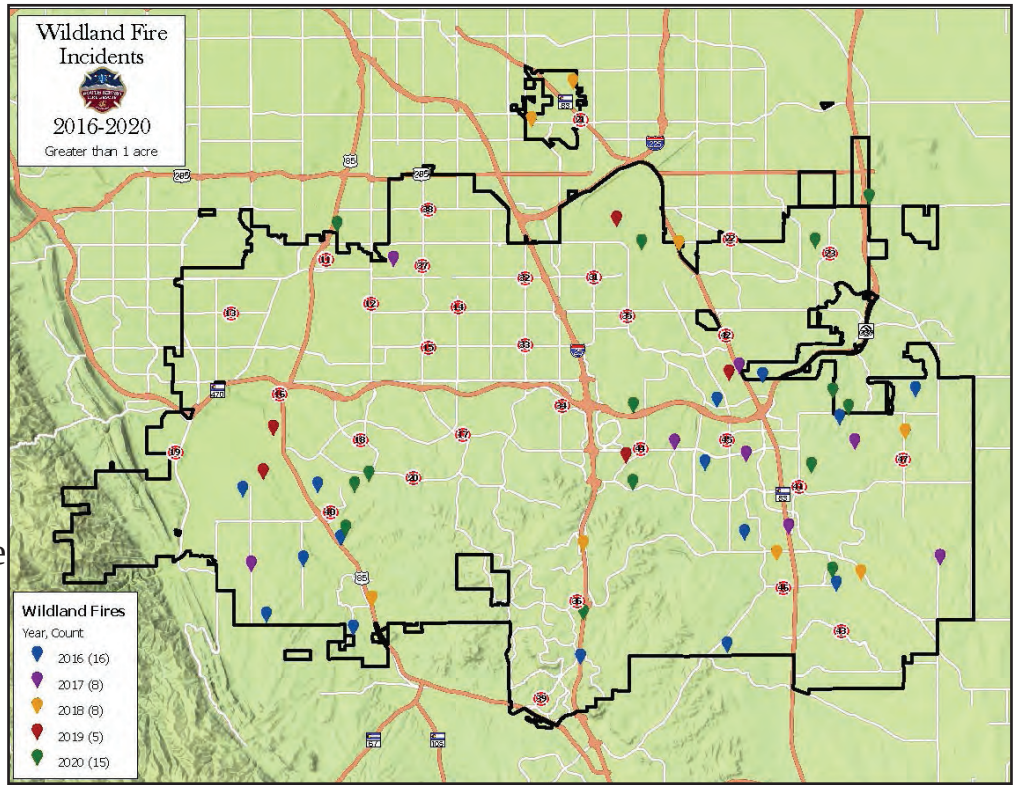
Between 2016 and 2020, our firefighters responded to an average of eighty-seven wildfires annually in SMFR's 287-square-mile jurisdiction. The number of fires varies



This map shows the locations of wildfires from the years 2016-2020. Map by South Metro Fire Rescue.

annually because of weather and fuel conditions.

Most of those fires, fortunately, burned less than one acre. The map at right shows where wildfires burned one or more acres between 2016 and 2020.



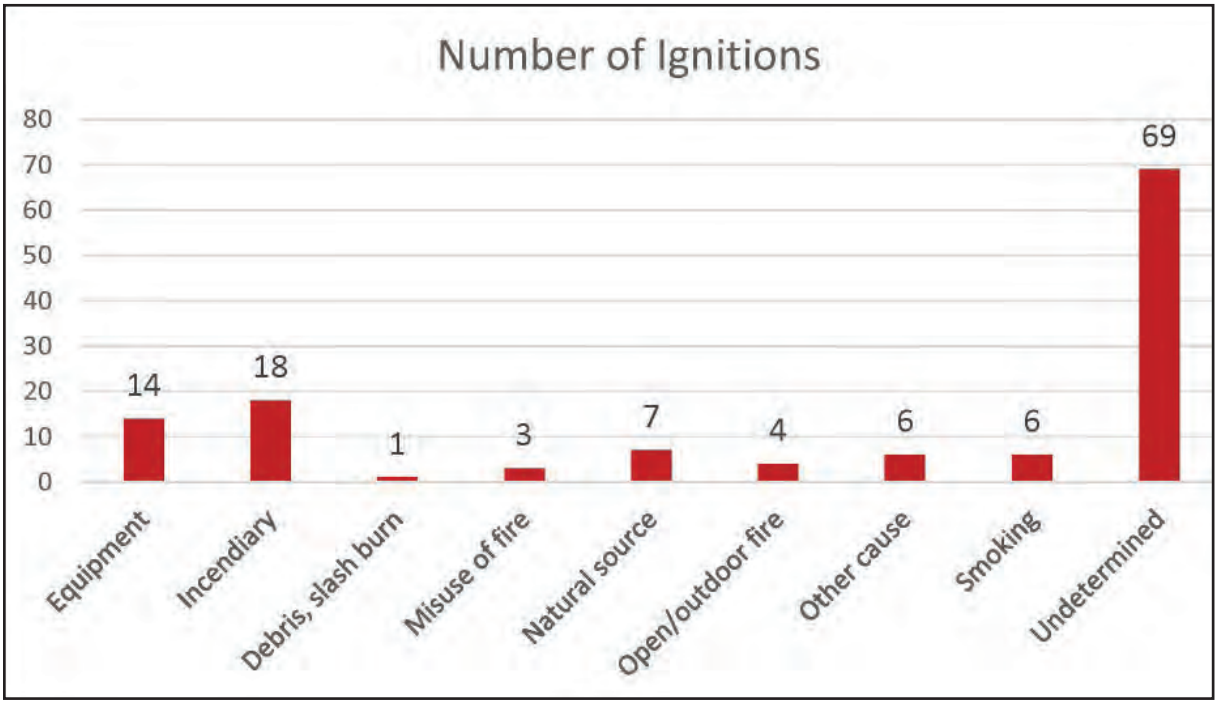
This map shows the locations of wildfires that burned one or more acres in the years 2016-2020. Map by South Metro Fire Rescue.

Annual Benchmarks

Fortunately, a majority of wildfires that burn in our district are small. One of the risk reduction goals for the district is that ninety percent of wildfires will burn less than one acre.

In 2020, ninety-one percent of wildfires in SMFR's district burned less than one acre. However, only eighty-two percent of wildfires over the previous five years burned less than one acre.

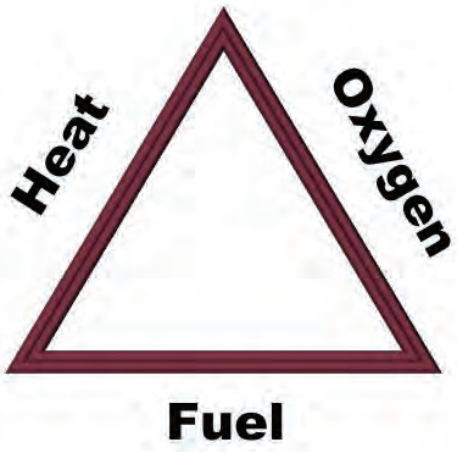
In 2020, South Metro Fire Rescue Investigators determined that at least thirty-six percent of wildfire ignitions (46 of 128) were tied to human activities, as the table below illustrates. The causes of sixty-nine wildfires could not be determined with enough proof to hold a person or an entity responsible.



Fire Science Reminders

The information and design provisions provided in this guide are the result of many years of research, observations, and studies of actual fire events. In order to understand fire's impacts on building construction, it's important to understand basic fire science and fire behavior.

The Fire Triangle is a perfect starting point for this section. Heat, fuel, and oxygen must be present in precise combinations for fire to



ignite.

Before a fuel can ignite, however, part of it must absorb enough heat to dry completely and absorb more heat that causes its molecules to break apart from their solid or liquid form into a gaseous form. The gaseous form of the solid (or vapor in the case of a liquid) continues warming to its point of ignition and catches fire.

Oils and resins within solid fuels may vaporize at different temperatures and create clouds of dry, hot flammable particles surrounding the plant. If these clouds ignite, the amount of heat available to dry and heat any remaining solid fuels increases rapidly.

Heat impacts a fuel--drying and heating it--after moving from warmer to cooler objects or spaces. Heat moves in three forms: convection, radiation, and conduction.

Convection describes the movement of hot fluids (gases or liquids) upward. Smoke alarms and sprinkler heads are placed on ceilings because hot air from fires rises. Convective air flow in the atmosphere is responsible for all weather systems, cloud formation, and wind.

Heat also radiates outward through surrounding air using electromagnetic waves that are absorbed by solids and liquids. We can feel heat from the side of a campfire because of radiant heat.

Heat also travels through solids such as metal. That form of heat movement is called conduction. A metal spoon in a bowl of hot soup warms because of conduction.

Each of these forms of heat movement explains how wildfires burn and suggest strategies for making structures and properties more resistant to wildfires.

Embers

The most common heat source that causes homes to ignite in wildfires is the ember. An ember is a chunk of burning fuel lofted above and downwind from a wildfire because of convective air currents. Embers may be smaller than peas or larger than grapefruits.

Radiant heat and direct flame contact also cause homes and other structure to ignite, but embers are the usual culprit.

Wildfires typically produce blizzards of embers depending on fire intensity, the type of fuel burning, and the amount of wind.

Embers commonly start spot fires downwind of the main fire. These spot fires have been recorded as far as ten miles downwind.

Embers can carry enough heat energy to

ignite combustible structures when they land on living vegetation, dead vegetation, and buildings. Therefore, wildfire resistance also means ember resistance.

Embers and Vegetation

Living and dead vegetation both are vulnerable to igniting from embers if an ember holds enough energy to dry and heat the fuel upon which it landed.

Because dry, dead fuel is easiest to ignite, homeowners should remove piles of dead needles and leaves from within 30 feet of their homes. These piles are found commonly under decks, in window wells, along walls, and in gutters.

Dead needles and leaves in this gutter are easy fuel for spot fires caused by embers. Photo by South Metro Fire Rescue.

Embers also ignite spot fires in living vegetation. Plant species most resistant to embers have high water content such as native grasses, lawns, and flowers. Plant species most vulnerable to ignition from embers are shrubs that contain flammable oils and resins such as junipers, Pfitzers, and arborvitae. Firefighters often refer to these three species as "Little Green Cans" because they ignite so easily and can burn explosively.

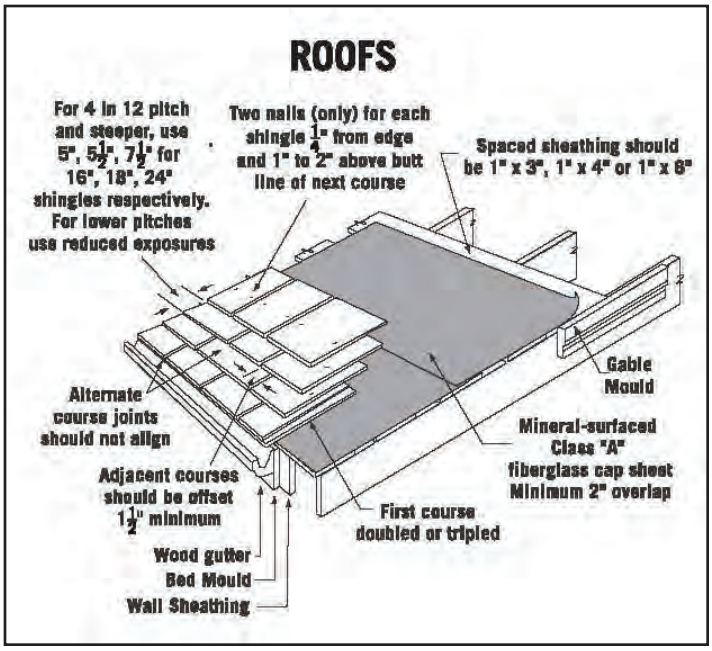
Embers and Buildings

Building components also are vulnerable to spot fires caused by embers. The most vulnerable component is the roof.

Although new building codes prevent the use of wood shingles in most cases, many homes throughout SMFR's district have wood-shake shingle roofing. As these shingles age, they become more vulnerable to ignition from embers from wildfires as well as fireworks, sparks from chimneys, and lightning strikes.

There are exceptions to this statement. Some wood-shingle roofing assemblies in SMFR's district do carry a Class-A Fire-Resistant Rating. The shingles in these

This roof is extra vulnerable to embers because needles have accumulated in the gutter below an aging wood-shake shingle roofing assembly. Photo by South Metro Fire Rescue.



This diagram shows some of the requirements for a Class A fire-rated assembly using wood shingles. Diagram is from www.firesmartroofing.com.

assemblies have been pressure-impregnated with fire-retardant polymers to provide permanent fire protection and a Class B fire rating. These Class B fire-rated shingles are installed over a mineral-surfaced cap sheet to create the Class A assembly.

These shingles could still ignite in wildfire conditions, but the underlying layers should slow the fire's growth into the building. Additional information about roofing is in the Structural Features Section.

Radiant Heat Exposure

Fire is described as an exothermic reaction: it releases heat. Once a fuel--vegetation, a structure, or other form--ignites, it radiates heat outward.

Some plant species are notorious for radiating immense amounts of heat:

- Juniper
- Pfitzer
- Cedar
- Austrian pine
- Mugo pines
- Pinyon pine
- Arborvitae
- Gambel (scrub) oak

If any of these species are burning within 30 feet of a structure with combustible siding, decking, or roofing, they may be generating enough radiant heat to ignite those surfaces.

Removing these plants from within 30 feet of structures is the best mitigation strategy. They should be managed between 30 and 100 feet of structures. Information on vegetation management is included in the Fuels Management Section of this guide.

Removing vegetation around homes is possible depending on budgets and covenants, but most homeowners don't have the luxury of adequate clearance to their neighbor's homes because of lot sizes.

Once a structure ignites, it can radiate enough heat to threaten surrounding growing and built fuels including other homes. Home-to-home ignitions are particularly likely in dense suburban neighborhoods. This source of

These junipers are too close to the home. In addition to releasing radiant heat, their convective heat could pool under the deck. Photo by South Metro Fire Rescue.

These two neighborhoods exemplify many of the risks in our fire district's wildfire-prone neighborhoods including home proximity, limited access, proximity to open space, and dense landscaping. Images from Google Earth.

radiant heat caused hundreds of homes to burn during the Waldo Canyon Fire in Colorado Springs in June 2012.

Home-to-home ignitions quickly overwhelm firefighting resources. In SMFR's district, a confirmed structure fire receives the following resources at a minimum: four engines, one tower or aerial, two ambulances, two battalion chiefs, one safety officer, one EMS supervisor, the rehabilitation unit, one or two investigators, and a public information officer.

Maintaining that level of response after home-to-home ignitions begin is impossible for a single agency and difficult even with mutual aid from neighboring agencies.

Although removing your neighbor's home isn't possible, modifying your home is effective for reducing your home's exposure to radiant heat. Information on these modifications are in the Structural Features Section of this guide.

Direct Flame Contact

Direct flame contact from burning surface fuels is the least common source of building ignition in wildfires. Direct flame contact from crown fires, in which flames rapidly move through tree canopies, or urban conflagrations, in which a wind-driven wildfire burns through entire neighborhoods also is rare, but when it happens it tends to make a strong imprint on our memories.

As devastating as crown fires and urban conflagrations are, fuel mitigation can stop these fires. A vast fuel management zone surrounding the town of Alpine, Arizona, stopped the Wallow Fire from destroying that community in 2011.

At the time, Alpine could be considered a Fire-Adapted Community that had invested time and money for mitigation projects on private property as well as public lands managed by government agencies.

A garage fire at this address ignited both the main home and the vegetation surrounding both structures. Photo by South Metro Fire Rescue.

Structural Features

This section of the guide addresses construction materials and finishes that impact a structure's wildfire resistance.

Roofing

Again, a home's or other building's roof is the most vulnerable part of a structure. Many homes that ignite in wildfires burn from the top down after embers ignite roofing materials.

A roof assembly is more than its visible covering; it includes layers of material below it as well as how all those materials are attached to the building.

Understanding how roofing assemblies are rated regarding fire resistance is importance. There are four ratings for roofing: Class A, Class B, Class C, and Unrated.

Roofing components and assemblies are tested by submitting a roofing mock-up to a testing laboratory where scientists utilize a fire brand (ember) test. This test involves placing a burning fire brand upon the roof. During the test, fire cannot penetrate the roof or cause the roof structure or sublayers to ignite before the brand is consumed and burns out.

This unrated wood-shingle roofing assembly poses a significant hazard to its owners and residents downwind if the roof ignites. Photo by South Metro Fire Rescue.

From a distance, this roofing looks like wood shingles, but it actually features tile shingles. It is a Class A fire-rated assembly. Photo by South Metro Fire Rescue.

The best fire-resistance rating is associated with a Class A roof assembly.

Many types and architectural styles of Class A roofing materials are available on the market. The variety of styles allows for flexibility in achieving the desired look of the home and complying with HOA architectural design standards while providing fire-resistive properties that are essential for creating Fire Adapted Communities.

Typical Class A roofing products include, but are not limited to the following types:

- Asphalt Shingles
- Metal / Stone-coated Metal
- Concrete (standard weight and lightweight)
- Clay Tile
- Synthetic
- Slate
- Hybrid Composite

As mentioned previously, there also is a wood-shingle roof assembly that has achieved a Class-A rating.

Exterior Siding

A home's siding is the largest overall surface of the home. The materials in which a home or other structure is wrapped play a significant role of reducing the likelihood of home-to-home or vegetation-to-home ignition.

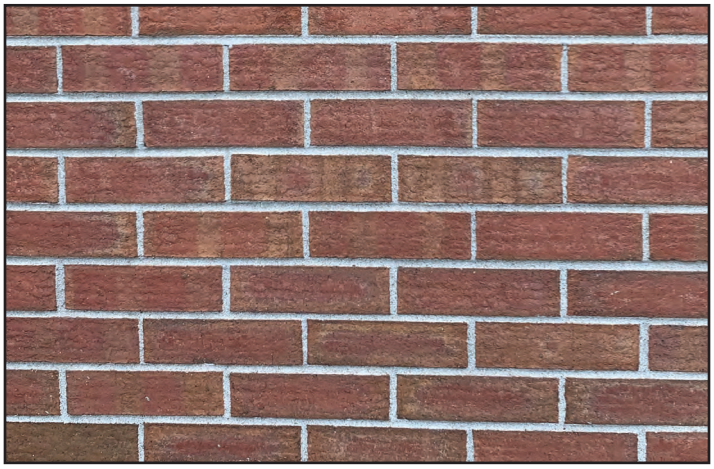
Ignition-resistant siding blocks or dissipates heat and slows a fire's progress. That gives firefighters an opportunity to contain fire to a single house or away from homes altogether.

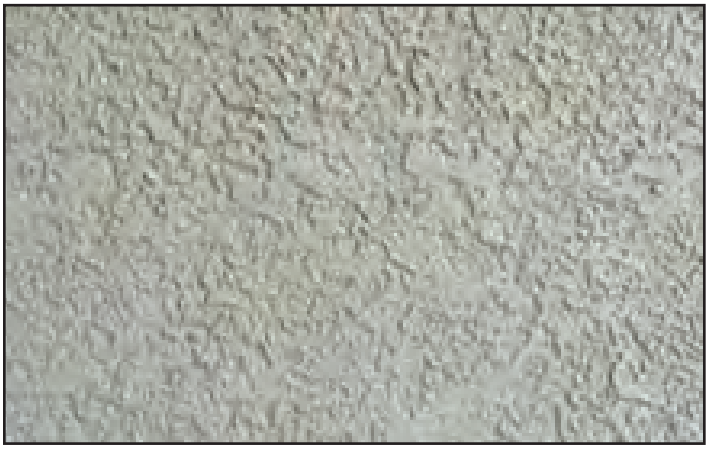
There are many different exterior siding products available to satisfy a variety of architectural styles. The most common wildfire-resistant products are natural or fabricated stone/rock, stucco, brick, and cement board.

If using noncombustible siding materials is not feasible, keep siding in good condition and replace materials in poor condition.

Cohen's research showed that wood siding will ignite if enough heat impacts it, but that siding can self-extinguish if the heat decreases after a couple minutes.

Trim branches of trees and shrubs so they don't scrape against exterior walls. Sealing holes from insects and woodpeckers also is important.





The photographs above show several types of fire-resistant exterior siding including rock, brick, and stucco. The lower-right photograph shows a home with wood siding. Although wood isn't as fire resistant as the other materials, it may self-extinguish once the external source of heat decreases. Photos by South Metro Fire Rescue.

Decorative Features

Decorative construction features such as fascia, trim board materials, and trim accents, corbels, false rafter tails, faux trusses, dry verge caps and shutters are not required to be ignition resistant, but SMFR encourages you to use non-combustible products when they are available.

Vinyl decorative features can be used when installed on ignition-resistant surfaces.

When wood products are used they should be painted or sealed to protect the wood from drying and cracking or splitting. Cracks or splits in wood create voids for embers to attach and ignite a fire.

Although these roof tiles are curved, architects and builders were careful to form the layer below to prevent airborne embers from slipping under the tiles. Photo by South Metro Fire Rescue.

Eaves & Soffits

Embers can bypass a roof on their way to the attic through eaves. Covering the underside of eaves with a soffit, which boxes or seals that space, reduces the ember threat.

Enclose eaves with fiber cement board or 5/8-inch-thick, high-grade plywood.

Another option is to fill gaps under open eaves with caulk.

The eaves in the images above and below are protected by fire-resistant soffits. Photos by South Metro Fire Rescue.

Protecting Wall Projections

The underside of wall projections, such as with a bay window, are vulnerable to convective and radiant heat. They also can hide accumulations of dead leaves or other fuels for embers.

Exposed structural components below projections are particularly vulnerable to drying and heating during wildfires.

Enclose the underside of projections with the materials used for soffits: ignition-resistant products such as fiber cement board or 5/8-inch-thick, high-grade plywood.

This projection is less vulnerable to pooling convective heat because it is protected by a layer of wood. Photo by South Metro Fire Rescue.

Exterior Doors

Exterior doors, including patio doors, can be a point of ember or fire intrusion for a structure.

A solid-core fire-rated door provides the best protection against deflection by wind, which is a rating of the forces wind place on doors. It also provides better protection against radiant heat than a hollow-core door.

Doors should be constructed of non-combustible products such as metal or composites. Wood doors are acceptable for exterior use when they are solid-core construction.

Sliding-glass doors or decorative front doors with glass panels should have tempered glass that is designed to withstand impact and meet the design standards required by building codes.

Windows

Broken windows or distorted window frames that cause glass panes to shift or fall out create holes for embers to enter your home. Window panes also can allow radiant heat to enter structures.

Similar to doors, windows also must meet or exceed rigorous testing to national standards to be approved for use in a home, but those standards weren't written for wildfire hazards.

There are three main components of windows that impact a structure's resistance to wildfire: the frame, panes, and pane glazing (or glass surface).

Many windows have vinyl frames. These frames should contain an aluminum sub-frame to help it retain its shape when exposed to intense heat.

Single-pane windows are most vulnerable to breaking during wildfires because they are a single layer of protection from airborne debris. Dual- and triple-pane windows offer multiple layers of protection.

The glass surface, which also is known as glazing, also matters.

Modern windows are constructed to be energy efficient in terms of insulation and Ultraviolet (UV) reflection properties. As a result, most modern windows perform well during a wildfire.

The insulation factor can help mitigate extreme temperature fluctuations during a wildfire, preventing panes from breaking. Glazing reflects radiant heat, which can prevent fires from starting inside a structure.

Energy-Efficient Window Risk

Energy-efficiency is not a new idea for windows. It is estimated that 81% of residential windows are energy efficient. Manufacturers increase window efficiency with double and triple panes that trap air between panes, high-quality frame materials, Low-Emissivity (Low-E) coatings, and using nontoxic gases such as argon or krypton between panes.

Low-emissivity windows have multiple

panes with a thin metallic coating on some of the surfaces. The panes allow visible light to enter a structure, but reflect radiant heat far more effectively than untreated windows.

An untreated window reflects approximately ten percent of heat; Low-E windows reflect 30-50 percent.

Window panes are supposed to be parallel to each other, but changes in barometric pressure and air temperature can cause gas between panes to contract and the exterior pane to curve with a slight outward-facing concavity. The colder the temperature, the more the gases contract and the greater the pane's curvature.

This concavity can create a phenomenon of focused sunlight similar to a magnifying glass, according to a white paper from the National Home Builders of America: "The concentrated heat generated by the focused reflected sunlight results in surface temperatures well above that encountered from direct sunlight."

This thermometer reveals some of the heat reflecting from an energy efficient window in a Castle Pines backyard in October 2020. Although 110 degrees Fahrenheit is too low to ignite a lawn, the temperature of the reflected light was high enough earlier in the day to scorch the lawn in several places and ignite a fire. A similar situation scorched the exterior wood siding of a single-family home in Lone Tree one month later. Photo by South Metro Fire Rescue.

If the following factors align, the reflected light can cause a fire outside the structure:

- Fuel must be within 30 feet of a Low-E window;
- The Sun must be low enough in the sky to reflect onto the fuel; and
- The window must be concave.

There are solutions to this risk including allowing trees to grow to block sunlight from hitting windows, adding a screen to the outside of these windows to diffuse the reflection enough to reduce fire risk, replacing windows with newer technology that contracts less, and using thicker panes that resist contracting.

Another solution is to use windows with capillary tubes between panes that connect the interior space with outside air, permitting a gradual equalization of barometric pressure. These tubes can't be used with windows containing inert gases because those gases would leak.

Attic Vents

Venting the attic is critical in preventing excessive temperatures and reducing moisture in that space. However, these vents also can be weaknesses in a home's wildfire defense that allow ember intrusion.

Cover attic, eave, and soffit vents with 1/8-inch screening to restrict the size and overall number of embers able to enter the attic. This screening will not stop all embers, but embers smaller than 1/8 inch typically lack the heat energy needed to ignite combustible framing or insulation.

Gable vents are discouraged because they are particularly susceptible to ember intrusion. If they are desirable, use them on sides of homes that do not face steep slopes or

There are several different types of vents commonly used for attics. The two upper images are soffit vents. The photograph below shows a gable vent. Photos by South Metro Fire Rescue.

All vents should have screening with holes no bigger than 1/8 of an inch to reduce the likelihood of viable embers from entering a structure. The vents at right are protectect properly. Photos by South Metro Fire Rescue.

typical prevailing winds. Screening is highly recommended for gable vents regardless of where they face.

Faux gable vents that are only decorative do not penetrate the attic and therefore do not need screening.

Ridge vents also are common but are easy to forget because they are hidden from view. However, as the photograph on the next page demonstrates, unprotected ridge vents can provide an easy route for embers to ignite a home fire.

Similar screening practices are a wise choice for other types of vents, such as those for crawlspaces and dryers.

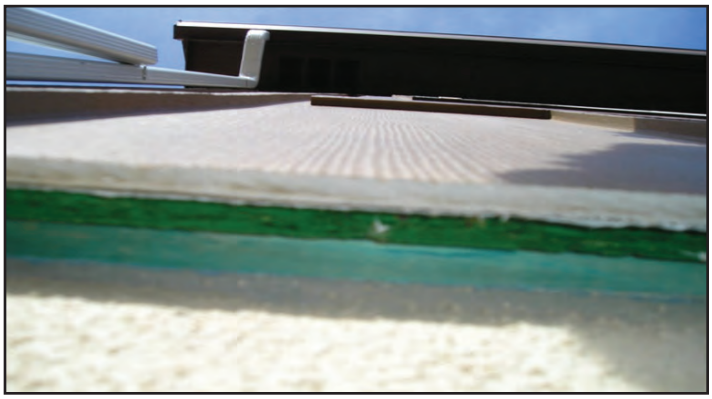
Base of Walls

Traditional building construction methods

Damage to this wood home was limited to the ridgeline, but screening the ridge vent coud have prevented that damage. Photo courtesy of Rick Trenbath.

tend to leave gaps under the lower edge of siding at the base of walls, posts, and columns. A photograph below shows a close-up view, looking up from the bottom of the wall, to reveal vulnerable gaps at the base of walls. We can see the exposed combustible sheathing (green) and foam board insulation (blue). This gap, while typically not noticeable, provides an entry point for embers and flames to bypass the exterior walls of the home.

As winds blow embers against the foundation, any gap left between the siding and foundation can leave the stud-wall cavity exposed. This gap provides an entry point for embers into combustible wall cavities and concealed spaces of a home.



A gap between siding and the foundation at the base of a wall. Photo by Colorado Springs Fire Department.

Fire can burn undetected and unimpeded in the concealed spaces for long periods before venting to the exterior where it is discovered or venting to the interior where it will trigger smoke alarms.

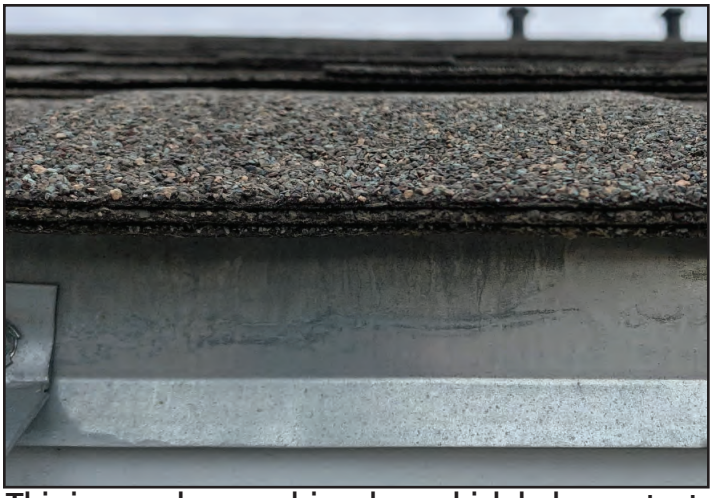
This gap should be protected with screening or sealed with caulking, fire resistive foam, mortar, or similar products.

There may be a need or desire to provide a weep or drainage to prevent moisture and condensations collection within the wall. Make sure these drains or weeps are not closed when sealing the bottom edge of walls.

Gutters

Metal gutters will not burn, and they tend to stay in place during a fire. Vinyl gutters tend to ignite when exposed to significant heat or fire, but they often melt away from the structure, thus limiting the amount of heat or flame exposure to the roof decking or fascia.

A piece of metal flashing, otherwise known as a drip edge, often is placed along the exposed face of the roof decking to prevent moisture damage. It also prevents flame exposure and ember intrusion along the exposed edge of the roof decking under the



This image shows a drip edge, which helps protect the roof assembly from moisture and embers. Photo by South Metro Fire Rescue.

shingles of roofing material.

Drip edging should cover the edge of the roof deck, extend into the gutter and be installed tightly against the gutter material, as shown in the diagram at right. In cases of a long roof line, additional flashing may need to be installed behind the gutter and drip edge to prevent exposure of the fascia.

A greater concern is the accumulation of combustible debris such as dead leaves and pine needles within the gutters. Any debris within the gutter that ignites exposes roof decking and fascia to convective, radiant, and conductive heat as well as direct flame contact.

From a fire safety standpoint, it is more important to prevent the accumulation of combustible debris in the gutter than to be concerned with the actual material of the gutter itself. If gutter caps are not used to prevent accumulation of combustible debris, then homeowners must be vigilant to ensure their gutters are cleaned on a regular basis.

Cleaning debris from gutters also helps ensure they clear water effectively during rainstorms and reduces ice build-up.

If these dead leaves catch fire, heat may flow under the asphalt shingles igniting the roof assembly and attic. A screen, such as one in the photo at right, prevents combustible debris from accumulating in gutters. Photos by South Metro Fire Rescue.

When homeowners harden their homes and mitigate fuels around their properties, firefighters can focus on attacking the fire before it reaches a Fire-Adapted Neighborhood. Photos by South Metro Fire Rescue.

Decks

Decks and outdoor living spaces are an important aspect of the Colorado lifestyle. Because we spend so much time in these areas cooking, eating, chatting, and simply enjoying the view, it's important that we maximize deck safety.

Similar to a roof, a deck should be considered as an assembly of components. Deck assemblies are vulnerable to ignition from direct-flame impingement, radiant heat, convective heat, and embers landing on its surface as well as objects placed on the surface.

The point at which the deck connects to the home should have adequate metal flashing to provide additional protection against ignition where there is potential for an increased accumulation of embers.

Decking materials are tested and classified based on their resistance to surface ignitions and flame spread across their surface. There are three levels of classification: Class A, Class B, and Class C.

Class A decking materials have the best performance at resisting flame spread. Many natural wood products inherently have a Class C rating, with the exception of some exotic hardwoods or other products not typically selected for decking materials.

When choosing decking surfaces there are two primary material types on the market: wood and composite.

Wood is the most common product found in the construction of decks. It is easy to work with, but it requires significant maintenance to prevent drying and splitting.

Composite decking, on the other hand, is relatively free of maintenance. It neither rots nor splits. Thus, it is a better material in wildfire-prone neighborhoods.

While composite decking is fire-resistant, that material is usually limited to planking.

An example of composite decking material. This material will resist ignitions from embers landing on it, but the deck assembly is vulnerable to heat sources below it. Convective heat pooling below planking can dry and heat these beams and cause the assembly to catch fire. Photos by South Metro Fire Rescue.

Support columns, beams, and other framing may still be constructed of wood. Therefore, it's important to consider heat sources under decks as well as beside and above them.

Heat can pool under decking if combustible materials are stored below decks, if debris is allowed to accumulate under planking, or if vegetation on a slope below the deck is burning.

While using standard lumber is common, some builders and homeowners are utilizing alternative materials for deck construction including metal framing and concrete planking. Another technique is wrapping support columns in stucco rather than leaving them exposed. However, remember to enclose the base of such columns similar to the base of walls to eliminate a potential ember trap.

Ember Traps on the Deck

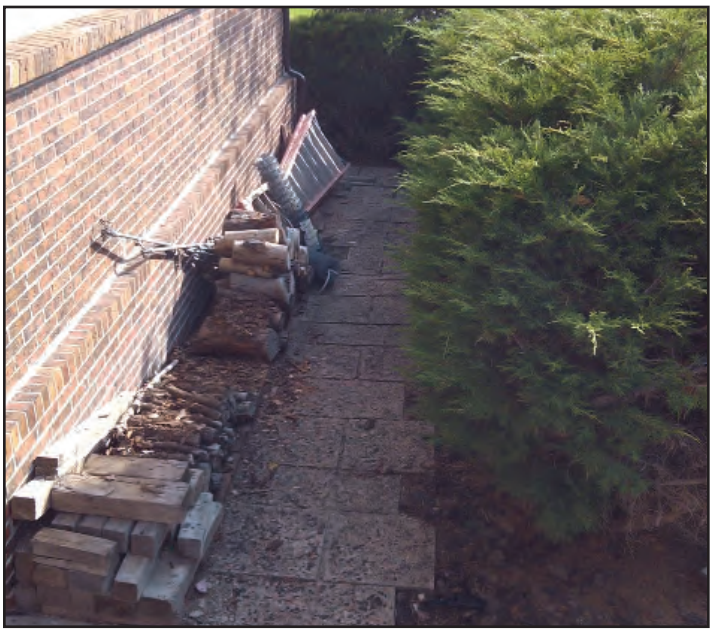
An ember trap, as described previously, is a place where embers can land and, if fuel is present, potentially ignite a spot fire. Decks often have ember traps placed on them by homeowners.

Firewood is a common ember trap that is piled on decks or porches. While having a small pile nearby during snowstorms is reasonable, the main firewood pile should stacked beyond the Inner Zone and level with the home.

This firewood pile on a deck poses a significant hazard for homeowners. Photo by South Metro Fire Rescue.

A firewood pile below a home could release convective heat that flows toward the home while a pile above could topple and cause burning logs to roll toward the structure.

Other common ember traps on decks are pillows and upholstered coverings for furniture. Store those furnishings inside between uses to reduce the risk of embers landing on them.



This firewood pile is beside a brick wall, but it also is bordered by a large juniper. If both the firewood pile and juniper are burning, they could produce enough heat to impact the stucco wall and eaves. The pile below is better located because it is away from the home and at a similar level. Photos by South Metro Fire Rescue.

Chimneys

Spark arresters are required on chimneys in accordance with the mechanical and building codes for all new installations of solid-fuel and wood-burning appliances. They are recommended for existing chimneys.

Unlike most of the components described in this guide, Spark arresters are designed to prevent your home from starting a wildfire rather than protecting your home *from* a wildfire. Spark arresters are designed to

A spark arrester on a chimney. Photo by Colorado Springs Fire Department.

catch embers that are produced during normal operation of a fireplace or wood burning appliance.

Spark arresters should be constructed of woven or welded wire screening of 12 USA standard wire gauge and have openings not exceeding a half inch.

Fencing

Although fencing is usually considered part of a yard, it may contact the structure. As a result, it should be considered part of a home's defense against wildfire.

This wood fence was no match for a grass fire. Photo by South Metro Fire Rescue.

Wood and metal are the most common materials for fencing, but they both increase wildfire risk. Wood fencing dries rapidly and after igniting can lead fire to flammable

From a distance, this fence resembles weathered wood, but closer examination reveals it is made of concrete. As a result, it will resist wildfires as well as moisture, freezing, UV rays, and animals far better than wooden fencing. Photo by South Metro Fire Rescue.

landscaping and structures much like a fuse.

Metal fencing won't ignite, of course, but it can conduct heat from burning vegetation to a the siding of a structure.

Alternative fencing materials that are better suited for wildfire-prone neighborhoods include composites and concrete. Each of these materials can be manufactured to resemble wood fencing. In addition to

resisting wildfires, they providing aesthetic value and require minimal maintenance.

Alternative Methods and Materials

There are many different construction methods and materials available in the construction of homes and other buildings. Technology, new products, and construction methods are frequently introduced into the home building markets.

Our goal is to help you build homes for Fire-Adapted Communities that resist ignitions from wildfires and increase safety for occupants and firefighters. In fact, wildfire-adapted homes should be able to withstand low- and moderate-intensity wildfires with little or even no intervention from firefighters.

Nothing in this guide is intended to prevent the use of products that have been tested and proven to provide equivalent or greater levels of protection than what has been identified here. Consideration of alternative building products generally requires manufacturer's literature and independent product testing reports describing flame spread characteristics of proposed materials.

Local building departments have more information regarding their requirements for alternative building materials and methods.

South Metro Fire Rescue does not endorse any specific product or material. Its firefighters, Fire Marshal's Office personnel, and community risk reduction specialists do consider how materials, structural components, and the structures themselves could react during wildfires based on knowledge of fire science.

Recommendations in this guide regarding structures and vegetation are designed to prevent situations like the one pictured here where a home was destroyed by the Cameron Peak Fire in 2020. Photos by LaVonne Ewing.

Vegetation Management

This section of the manual addresses vegetation surrounding homes, including native vegetation and that added by landscapers, how to apply better landscaping design to reduce the likelihood of home ignition. Landscaping is a significant component of creating a Fire-Adapted Community.

Properly managing vegetation includes selecting plant materials that have a greater resistance to wildfire and providing adequate clearance to homes and related structures.

Plant Selection

South Metro Fire Rescue's jurisdiction spans elevations between 5,300 and 8,000 feet above sea level. Our climate is semi-arid and prone to drought conditions.

Choosing drought-resistant plant species isn't enough; some of those species contain volatile oils such as resin and sap. South Metro Fire Rescue has compiled a list of native, fire-resistant plants and included them in Appendix A of this guide. These species typically have high moisture contents, produce little dead material annually, contain relatively little resin/sap, have thick bark, or have other attributes that make them fire resistant.

When developing and maintaining your landscaping, remember that diversity is essential. Multiple species and multiple ages of each species create vibrant ecosystems that resist fire, disease, and other hardships.

Three Zones of Vegetation Management

Vegetation Management can be differentiated between three zones surrounding a home or other structure as shown on page 3. These zones work together to decrease the intensity of wildfires as they approach homes and other structures.

Homeowners in this neighborhood have little vegetation immediately surrounding their homes and have a fuel moat between their yards and their fenceline. Additionally, the open space is managed with a mow strip along the fenceline to create an additional barrier against wildfires. Photo by South Metro Fire Rescue.

Landscape designers and homeowners who view their property as a system have the greatest success in slowing wildfire spread toward their families.

In many cases, however, private property doesn't cover more than the Inner Zone. In these cases, neighborhood safety relies on multiple neighbors and managers of open space areas modifying their landscaping. If all residents and land managers are responsible for their land, the neighborhood will increase its fire-adaptation.

The **Inner Zone** is defined as the 30 feet immediately surrounding a structure including

its roof line and decks.

Contrary to fears, this area does not have to be clear-cut of vegetation. It is the best area to begin selecting, placing, and maintaining healthy vegetation using the techniques covered in this section.

Plants within 30 feet of the building should be have a high moisture content for most of the year or be adapted to resist wildfire ignition. Most deciduous trees and shrubs are ideal for this zone.

Gambel oak, also known as scrub oak, is one exception to that guidance because it contains flammable oils.

Ponderosa pines also are suitable for this zone because they have less sap and thicker bark that protect them from ignition.

However, trim branches from these trees and shrubs to prevent them from scraping

Prune branches that scrape against soffits, gutters, and siding to protect those components from wear and reduce the risk from wildfire ignitions. Photo by South Metro Fire Rescue.

against walls and soffits, and trim branches to create a window of space six feet tall above roofing.

The **Middle Zone** covers the rest of your Home Ignition Zone as defined earlier. This area has a mix of vegetation management styles that become less intense with distance from the structure.

Common treatment in this zone includes thinning dense groves of trees and shrubs and removing low-hanging branches (also known as ladder fuels) to prevent flames from climbing from surface fuels into tree canopies.

Depending on their location and what they could strike after falling, dead trees may be kept for wildfire habitat in this zone and the next one.

The **Outer Zone** encompasses the rest of your property. It features the least intense management of vegetation.

Plants in this zone can be left alone for the most part because any wildfires out there will provide ecological benefits without threatening people and property.

If the Outer Zone does burn, wildfire intensity should decrease as it travels into the Middle Zone and decelerate more if not stopping when it hits the Inner Zone.

The Inner Zone of the home in the foreground should provide good protection against a wildfire in the open space. The junipers growing along the deck in the distant home are vulnerable to embers and could ignite the home. If it catches fire, the homes on either side could ignite from radiant heat in home-to-home ingitions. Photo by South Metro Fire Rescue.

General Landscaping Considerations

The following pages include general information about types of vegetation commonly found in South Metro Fire Rescue's jurisdiction. Specific information can be learned during a home wildfire risk assessment, which is a free service provided by SMFR's Risk Reduction Specialists.

These assessments typically last thirty minutes. To request an assessment, contact the Community Risk Reduction Bureau at ReducingRisk@southmetro.org.

As discussed previously, a fuel can produce a flame length 1.5 times its height. Firefighters don't directly attack wildfires with flames greater than four feet in length because of safety concerns. Therefore, it's important for property owners and managers to create a landscape that limits flame lengths.

Eliminating trees and tall shrubs certainly limits potential flames lengths, but trees and tall shrubs provide visual screening, shade, wildlife habitat, and other benefits.

Lower branches can be trimmed to prevent flames from climbing into tree canopies and growing beyond the reach of firefighters.

Trees with and without ladder fuels. Photos by South Metro Fire Rescue.

For most mature trees, prune the low-hanging branches at least six feet above the ground. For younger trees with trunk circumferences small enough that you can wrap your hands around them, remove ladder fuels a couple feet above the ground.

Maintaining at least seventy percent of the canopy helps ensure the tree's health.

Ground Cover

Ground cover includes any materials or surfaces at grade. As a fuel, ground cover species generally don't produce high heat energy, but they do provide for rapid fire spread when fuel moisture is low.

Considerations regarding ground cover include height of the materials, clearance to structures, and fuel moisture.

Native grasses and lawns are common types of ground cover. Keeping grasses mowed to a height of less than four inches and irrigated within the Inner Zone will reduce the rate of wildfire spread as well as fire intensity.

Another form of ground cover is mulch. Combustible mulch near homes can be a catch basin for embers. Avoid mulches that tend to be light weight. Denser bark is better while rock and stone are the best choices around the perimeter of the home. Rock or stone mulch should always be used when vinyl gutters are present on the home to limit the heat exposure to them.

Dead leaves and pine needles can become ground cover if they aren't removed periodically. Both are easy fuel for wildfires. Additionally, dead pine needles turn soil acidic, which can prevent other diverse ground cover species from growing, and Gambel oak leaves transform soil chemistry to make it most suitable for more Gambel oak.

Shredded wood mulch can be a place of fire ignition if the mulch starts to degrade. In that

case, its degradation can release enough heat to ignite a fire.

Bushes and Shrubs

These species are intermediate level plants that generally grow between one and six feet tall. They often create a ladder between

Gambel oak without ladder fuels. Photo by South Metro Fire Rescue.

ground cover and tree canopies, but species such as Gambel oak can grow tall enough that it has its own ladder fuels.

Protect the canopy of mature Gambel oak by removing lower limbs to a height of at east six feet above the ground.

Maintenance of bushes and shrubs includes removing debris and dead branches from the base (understory) of the plant and limiting the size of clusters of multiple plants to no more than 100 square feet.

Limiting the size of groves or clumps of shurbs such as oak breaks horizontal continuity, which can limit the spread of fire as well as disease.

Trees

Many tree species preferred by landscapers for both aesthetic and fiscal reasons have little to no fire resistance.

There are several factors to consider when selecting trees to plant or maintain around a home. There are several native fire-resistant species such as ponderosa pines, aspens, and maples

Also consider how the tree will grow as it matures. A young tree may look good when it is planted, but consider how wide it will get upon maturity. The tree may grow so large that it impacts both your home and your neighbor's home with long branches, falling needles, or lengthening roots. Provide plenty of clearance between trees, other vegetation and structures.

A certified arborist can be a great resource for determining the overall health of existing trees around a home.

This mature tree is wedged between two townhomes. Photo by South Metro Fire Rescue.

Addressing

If we can't find you, we can't help you. That's true for emergency responders as well as package and food delivery companies, utility crews, and family members.

It's critical for homeowners to post their addresses effectively, which means the numerals can be seen from both directions of traffic and in all weather conditions.

This address is posted effectively. Photo by South Metro Fire Rescue.

Use numerals at least four inches tall and use a color that contrasts with the background. Metallic numerals aren't the best solution because their contrast may depend on weather conditions.

Access to Utilities

Wise vegetation management also maintains access to utilities including propane tanks, gas meters, electrical boxes, and other equipment.

Homeowners who rely on propane should remove shrubs and trim grasses within ten feet of tanks. Also consider where a propane leak would flow. Propane is heavier than air. If it leaks from the tank, it will flow downhill much like water.

Use earthen berms to direct potential spills away from your home or other buildings on your property.

Trim trees so branches neither scrape against electrical boxes nor scrape against electrical lines. For most utility companies, the homeowner is responsible for lines between a pole and the structure while the company is responsible for lines between poles.

Trim vegetation within a ten-foot radius of utility poles to reduce available fuel for wildfires caused by sparks from a malfunctioning transformer. Such a cleared area also protects against electrocuted critters from falling from poles into vegetation.

Placing pea gravel at the base of poles also reduces the risk of a wildfire spreading outward from the pole.

A Systems Approach

Like building construction, good fuels management practices include a systems approach within the home ignition zone.

Overall clearance to the main structure is essential to providing a buffer or fire break between combustible vegetation and the home.

Pruning of limbs reduces ladder fuels, which prevents ground cover fires from moving to tree canopies where fire can spread freely and rapidly.

Overlooking just one piece of the fuels management model will reduce the overall protection of the home.

Growing Our Impact

Get involved with your homeowners association or civic association to help make wildfire mitigation a priority. South Metro Fire Rescue's Community Risk Reduction Bureau can help coordinate neighborhood clean-up days, chipping programs, mitigation projects such as Ready-Set-Goat!, and homeowner presentations.

Contact the Community Risk Reduction Bureau at ReducingRisk@southmetro.org.

Wildfire Risk Reduction has Strategic Significance

Working together with builders, homeowners, landscapers, renovators, and others is part of South Metro Fire Rescue's mission statement: **South Metro Fire Rescue is a world-class organization that serves the public by protecting lives and property through our dedication to training, prevention, mitigation, and response**.

Wildfire risk reduction is a component of multiple strategic initiatives for the agency including Community Connectivity, Workforce Connectivity, Growth Management, and Accreditation.

This guide is one tool for us to achieve those goals as it is one tool for users to help us create fire-adapted communities that are safer for residents, visitors, and firefighters. Wildfire safety and prevention is an individual and collective responsibility.

When homeowners protect their properties and evacuate promptly, firefighters are able to engage the wildfire directly and limit its spread into neighborhoods. Photos by South Metro Fire Rescue.

The information provided here is an overview and by no means all-encompassing in terms of the methods and materials available for ignition-resistant construction, landscaping, and home improvement. We encourage you to contact South Metro Fire Rescue and your local building officials if you have questions. You may find information at www.southmetro.org.

References

Colorado State University. *Fire Wise Plant Materials*, Fact Sheet No. 6.305, National Resource Series – Forestry

Insurance Institute for Business & Home Safety. Wildfire Home Assessment & Checklist.

_____. Protect Your Property from Wildfire: Rocky Mountain Edition

_____. Lessons Learned from Waldo Canyon – Fire Adapted Communities, Mitigation Assessment Team Findings

NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471. NFPA 1144 – Reducing Structure Ignition Hazards from Wildland Fire

South Metro Fire Rescue. Fire-Adapted Communities.

_____. Fire-Resistant Native Plants for the Arapahoe/Douglas County Wildland Urban Interface.

_____. Guidelines for Wildfire Resistant Landscaping in an Urban Setting

_____. Ready Set Go

Special appreciation to the Colorado Springs Fire Department for sharing the original "Ignition Resistant Construction Design Manual." CSFD had collaborated with the Colorado Springs Housing and Building Association, the Colorado South Chapter of the American Institute of Architects and a dedicated committee of reviewers to produce the document upon which this manual is modeled.

This firefighter stands ready to prevent flames from a wildfire in Cherry Creek State Park from reaching homes. Photo by South Metro Fire Rescue.

Appendix A: Fire-Resistant Plant List

This appendix contains a list of wildfire-resistant plants suitable for properties in South Metro Fire Rescue's service area between elevations of 5,300 and 6,800 feet above sea level. The district does serve elevations up to 8,000 feet but those areas are not residential.

All of these plants are Colorado natives. Thus, they should be available in nurseries and familiar to landscaping firms that operate in our region.

This list is not exhaustive and information contained about each species is incomplete in that we are not botanists. We are community risk reduction specialists, plan reviewers, and wildland firefighters. The species are grouped by role: groundcover, low shrubs, Large shrubs and trees, and flowers.

All photographs in this appendix are from South Metro Fire Rescue unless noted otherwise.

Groundcover

Common Name	Latin Name	Watering	Lighting	Bloom Month
Creeping grape holly	*Mahonia repens*	Low	Shade	March-May
Kinnikinnick	*Arctostaphylos uva-ursi*	Medium	Either	N/A
Mat penstemon	*Penstemon caespitosus*	Low	Sun	June
Mouse ear chickweed	*Cerastium strictum*	Medium	Partly Shaded	May-June
Northern bedstraw	*Galium boreale*	Medium	Shade	May-June
Pine mat manzanita	*Arctostaphylos nevadensis*	Medium	Partly Shaded	N/A
Rosy pussytoes	*Antennaria rosea*	Medium	Partly Shaded	June
Small-leaf pussytoes	*Antennaria parvifolia*	Medium	Partly Shaded	June

Creeping grape holly

Pine mat manzanita

Low Shrubs

Common Name	Latin Name	Watering	Lighting	Bloom Month
Adam's needle	*Yucca filamentosa*	Medium	Partly Shaded	June
Antelope bitterbrush	*Purshia tridentata*	Low	Sun	June-Aug
Apache Plume	*Fallugia paradoxa*	Low	Sun	June-Oct
Banana/broad-leaf yucca	*Yucca baccata*	Very Low	Partly Shaded	June
Bog birch	*Betula glanulosa*	High	Partly Shaded	N/A
Buckbrush/Mtn. Lilac	*Ceanothus fendleri*	Medium	Sun	July
Golden currant	*Ribes aureum*	Low	Filtered	April-May
Greenleaf manzanita	*Arctostaphylos patula*	Medium	Partly Shaded	N/A
Little-leaf mockorange	*Philadelphus microphyllus*	Medium	Sun	June
Little-leaf mtn. mahogany	*Cercocarpus intricatus*	Very Low	Sun	N/A
Mountain ninebark	*Physocarpus monogynus*	Low	Sun	June
Native wild rose	*Rosa woodsii*	Medium	Partly Shaded	June-July
Ocean spray/rock spirea	*Holodiscus dumosus*	Low	Partly Shaded	June
Rabbitbrush	*Chrysothamnus spp.*	Very Low	Sun	July-Aug
Redtwig dogwood	*Cornus stolonifera*	High	Either	N/A
Shrubby cinquefoil	*Potentilla fruticosa*	Medium	Partly Shaded	May-Sept
Spanish bayonet	*Yucca glauca*	Very Low	Partly Shaded	June
True mtn. mahogany	*Cercocarpus montanus*	Low	Sun	N/A
Wax flower	*Jamesia americana*	Medium	Either	June
Western sand cherry	*Prunus besseyi*	Low	Sun	May

Apache plume

Greenleaf manzanita

Large Shrubs and Trees

Common Name	Latin Name	Watering	Lighting	Bloom Month
American wild plum	Prunus americana	Medium	Partly Shaded	April
Aspen	Populus tremuloides	Medium	Sun	N/A
Boulder raspberry, thimbleberry	Rubus deliciosus	Medium	Partly Shaded	April-May
Filbert, beaked hazelnut	Corylus cornuta	High	Partly Shaded	N/A
Hawthorn	Crataegus spp.	Medium	Sun	May
Mountain mahogany	Cercocarpus ledifolius	Low	Sun	N/A
Peachleaf willow	Salix amygdaloides	High	Partly Shaded	N/A
Pin/fire/wild/red cherry	Prunus pensylvanica	Medium	Partly Shaded	May
Ponderosa pine	Pinus ponderosa	Low	Sun	N/A
River birch	Betula fontinalis	High	Partly Shaded	N/A
Rocky Mountain maple	Acer glabrum	Medium	Partly Shaded	N/A
Saskatoon alder-leaf serviceberry	Amelanchier alnifolia	Medium	Partly Shaded	April-May
Silver buffaloberry	Shepherdia argentea	Medium	Partly Shaded	April
Tall ninebark	Physocarpus opulifolius	Medium	Partly Shaded	May
Thinleaf alder	Alnus tenuifolia	High	Partly Shaded	April
Utah serviceberry	Amelanchier utahensis	Low	Sun	May
Wasatch maple	Acer grandidentatum	Medium	Partly Shaded	N/A
Western chokecherry	Prunus virginiana melanocarpa	Medium	Partly Shaded	April-May
Western mountain ash	Sorbus scopulina	Medium	Partly Shaded	May

Rocky Mountain maple

Utah serviceberry

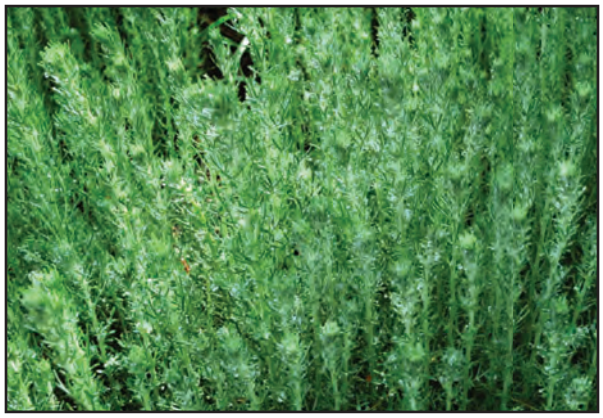
Flowers

Common Name	Latin Name	Watering	Lighting	Blooming
Aspen sunflower	*Helianthella quinquenervis*	Medium	Sun	
Black-Eyed Susan	*Rudbeckia hirta*	Medium	Sun	July-Sept
Blanket Flower	*Gaillarida aristata*	Low	Sun	July-Sept
Blue mist penstemon	*Penstemon virens*	Medium	Filtered	May-June
Broom groundsel	*Senecio spartioides*	Very Low	Sun	Sept-Oct
Colorado blue columbine	*Aquilegia caerulea*	Medium	Shade	June-July
Columbian monkshood	*Aconitum columbianum*	Medium	Sun	June-July
Common harebell	*Campanula rotundifolia*	Low	Filtered	May-Oct
Dotted gayfeather	*Liatris punctata*	Very Low	Sun	Aug-Oct
Fringed sage	*Artemisia frigida*	Low	Sun	N/A
Germander penstemon	*Penstemon teucrioides*	Low	Sun	June-July
Geyer onion	*Allium geyeri*	Low	Partly Shaded	June
Leafy potentilla	*Potentilla fissa*	Medium	Filtered	
Mariposa lily	*Calochortus gunnisonii*	Medium	Sun	July-Aug
Missouri iris	*Iris missouriensis*	Medium	Sun	May
Narrow-leaf chiming bells	*Mertensia lanceolata*	Medium	Filtered	May-June
Native beebalm	*Monarda fistulosa*	Medium	Filtered	July-Oct
Native yarrow	*Achillea lanulosa*	Low	Partly Shaded	July
Nodding onion	*Allium cernuum*	Low	Partly Shaded	June
Pasque flower	*Pulsatilla patens*	Medium	Filtered	March-May
Pearly everlasting	*Anaphalis margaritacea*	Low	Sun	August
Porter aster	*Aster porteri*	Low	Sun	Aug-Sept
Prairie coneflower	*Ratibada columnifera*	Low	Sun	July-Sept
Prairie sage	*Artemisia ludoviciana*	Low	Sun	N/A
Purple Coneflower	*Echinacea purpurea*	Low	Sun	July-Aug
Sand lily	*Leucocrinum montanum*	Low	Sun	May
Scarlet gilia	*Ipomopsis aggregata*	Medium	Filtered	June-Aug
Skullcap	*Scutellaria brittonii*	Medium	Filtered	Aug-Sept
Small sunflower	*Helianthus pumilus*	Medium	Sun	June-July
Smooth aster	*Aster laevis*	Low	Partly Shaded	Aug-Sept
Smooth goldenrod	*Solidago missouriensis*	Low	Sun	July-Aug
Spreading golden banner	*Thermopsis divaricarpa*	Medium	Filtered	May
Spring beauty	*Claytonia lanceolata*	Medium	Shade	March-April
Sulphur flower	*Eriogonum umbellatum*	Medium	Filtered	June-July
Western spiderwort	*Tradescantia occidentalis*	Medium	Filtered	June-Aug
Western wallflower	*Erysimum asperum*	Medium	Filtered	June-July
Wh. Stemless ev. primrose	*Oenothera caespitosa*	Low	Sun	June-Aug
Whiplash daisy	*Erigeron flagellaris*	Low	Sun	June-July
Wild blue flax	*Linum lewisii*	Low	Filtered	May-Sept
Wild geranium	*Geranium caespitosum*	Medium	Filtered	May-Oct
Yellow columbine	*Aquilegia chrysantha*	Low	Filtered	June-Aug
Yellow stonecrop	*Sedum lanceolatum*	Medium	Filtered	July-Aug

Blue columbine

Blanket flower

Sulphur flower



Fringed sage

Appendix B: Home Wildfire Assessment Tool

South Metro Fire Rescue personnel use this 4-page form, based on the National Fire Protection Association's (NFPA) 1144 Form, to evaluate structures for risk of wildfire damage. You are welcome to use it as well.

Remember, SMFR offers home wildfire risk assessments at no cost to residents. To schedule an appointment for this 30-minute service, email the Community Risk Reduction Bureau at ReducingRisk@southmetro.org.

Address: _____

Homeowner Name(s): _____

Subdivision/Community: _____

Evaluator: _____ Date Evaluated: _____

SITE HAZARD RATING	RATING	
HOME IDENTIFICATION		
Address is clearly marked with 4" reflective numbers	0	
Address is difficult to read (small numerals, obstructed view, visible in one direction, not all-weather)	5	
Address is not marked	10	
DRIVEWAY CHARACTERISTICS		
Is private driveway at least 12' wide with 15' vertical clearance?		
Yes	0	
No	10	
Is private driveway gated?		
No	0	
Yes	10	
If private driveway is gated, is it locked?		
Gate is not locked	0	
Gate locked but able to be unlocked by responders	3	
Gate locked, unable to be unlocked by responders	10	
Driveway Length		
<150 feet with turnaround	0	
>150 feet with turnaround	2	
<150 feet without turnaround	4	
>150 feet without turnaround	5	
STREET SIGNAGE		
Noncombustible, reflective signage, 4" lettering	0	
Combustible, not reflective or not present	5	
MEANS OF ACCESS		
Ingress & Egress		
Two or more roads in/out from home	0	
One road in/out from home	7	
Road Width		
At least 24 feet wide	0	
Less than 24 feet wide	3	
All-Season Road Conditions		
Surfaced Road, Grade <5%	0	
Surfaced Road, Grade >5%	2	
Non-surfaced Road, Grade <5%	2	
Non-surfaced Road, Grade >5%	5	
Other than All-Season Road	7	

TYPE OF GROUND COVER (Primary Type within 30' of Structure)		
Sand, Gravel, Etc.	0	
Grasses up to 6 inches tall	2	
Grasses 6-12 inches tall	4	
Grasses greater than 12 inches tall	6	
Shrubs with leaves	3	
Shrubs with needles	5	
SURROUNDING TREES (How many and what type surround the home?) Select the **ONE** that best describes the tree community		
Hardwoods (trees with leaves)		
No trees within 30 feet	0	
10 trees within 30 feet	2	
10-20 trees within 30 feet	3	
20+ trees within 30 feet	4	
Conifers (trees with needles)		
No trees within 30 feet	0	
10 trees within 30 feet	3	
10-20 trees within 30 feet	6	
20+ trees within 30 feet	10	
Mixed Hardwoods and Conifers		
No trees within 30 feet	0	
10 trees within 30 feet	3	
10-20 trees within 30 feet	4	
20+ trees within 30 feet	6	
LANDSCAPING		
Are plants clear of the structure?		
Shrubs are at least 5 feet from structures	0	
Shrubs are less than 5 feet away or directly contact structure	10	
Mulch		
Non-flammable type (pea gravel, lava rock, chunky bark)	0	
Flammable material	10	
Overhanging Limbs		
Trimmed at least 8 feet above structure	0	
Less than 8 feet above structures	10	
Ladder Fuels (low-lying branches and tall shrubbery)		
Are ladder fuels trimmed at least 8 feet above ground?	0	
Are ladder fuels untreated or lower than 8 feet above ground?	10	
PERIMETER		
Firewood		
At least 30 feet away from structure and on a lateral contour	0	
At least 30 feet away from structure and above or below structure	5	
Stacked on porch or against home	10	
Propane/Gas Tanks (excluding grill tanks)		
More than 30 feet away from home	0	
Less than 30 feet away from home	5	
Tank is obstructed with overgrown brush	10	
Electrical Supply		
Lines above ground	3	
Lines below ground	0	

TOPOGRAPHY within 300 feet of structure		
Slope <9%	1	
Slope 10-20%	4	
Slope 21-30%	7	
Slope 31-40%	8	
Slope >41%	10	
ADDITIONAL ENVIRONMENTAL CONTEXT		
Chimney, Saddle or other Topo that influences fire	2	
History of burning from lightning, arson, highway, railroad	5	
Severe winds, dry conditions typical	5	
Proximity of adjacent structures could influence fire spread	6	
BUILDING CONSTRUCTION		
Roofing		
Class A - slate, concrete tile, fiberglass shingles	0	
Class B - metal, aluminum shingles	3	
Class C - felt-tar based shingles, asphalt shingles, asphalt/tar/gravel	8	
Nonrated - Wood shakes	20	
Siding		
Non-combustible siding	0	
Combustible siding	10	
Decks		
Non-combustible material	0	
Combustible material	5	
Space under deck is free of litter, debris	0	
Space under deck has litter, debris	5	
Attic Vents - Covered with 1/8 mesh screening?		
Yes	0	
No	5	
Gutters and Eaves		
Gutters are cleaned of debris and Eaves are covered	0	
Gutters are not cleaned, but Eaves are covered	5	
Gutters are not cleaned, and Eaves are uncovered	10	
Fencing		
Non-combustible material in contact with structure	0	
Combustible material in contact with the structure	5	
Structure Setback Relative to Slope		
>30 feet from structure to slope	0	
<30 feet from structure to slope	5	
LOCAL FIRE PROTECTION		
Water Source Availability		
Pressurized Hydrants within 1,000 feet of structure	0	
Pressurized Hydrants >1,000 feet but in subdivision	2	
Cistern or dry hydrant (maintained) within 1,000 feet	3	
Cistern or dry hydrant (maintained) >1,000 feet but in subdivision	5	
Ponds, creeks capable of all-season sustaining drafting in subdivision	7	
No water available	10	
Organized Response Resources		
Station <5 miles from structure	0	
Station >5 miles from structure	3	
Fixed Fire Protection (if known)		
Residential sprinkler system	0	
Monitored fire alarm	2	
None	5	

Hazard Assessment	
Low Hazard	0-72
Moderate Hazard	73-102
High Hazard	103-163
Extreme Hazard	163-247

What does the Wildfire Hazard Rating Mean?

Low Hazard:	Your home has a STRONG chance of surviving a low to moderate intensity wildfire without the influence of firefighters, which ultimately enables those firefighters more time to evacuate residents with special needs and fight the fire directly.
Moderate Hazard:	Your home has a FAIR chance of surviving a low to moderate intensity wildfire on its own or with the influence of firefighters. Minor improvements will increase your home's resistance to wildfire.
High Hazard:	Your home is VULNERABLE to igniting during a low to moderate intensity wildfire. Firefighters may not be able to commit resources to save your home because of its vulnerabilities.
Extreme Hazard:	Not only is your home VULNERABLE to ignition during a low to moderate intensity wildfire, its condition make it UNSAFE for firefighters to attempt to defend it. Remember that even small modifications can make the difference between losing or saving your home.

Connect with SMFR on Social Media

South Metro Fire Rescue has a robust presence on social media. Please join us on any of the following free platforms:

www.facebook.com/SouthMetroFireRescue

When you register, sign up for alerts from South Metro Fire Rescue

@southmetropio

www.broadcastify.com/listen/feed/23085

Sign up based on your neighborhood

www.southmetro.photography

South Metro Fire Rescue

9195 E. Mineral Avenue
Centennial, CO 80112
720-989-2000
info@southmetro.org
www.southmetro.org

CFAI Commission on Fire Accreditation International