Ignition Resistant Construction Guide

A Guide to Smart Construction and Wildfire Mitigation in the Wildland Urban Interface

2024 Update

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Purpose

Over the last several years the west has seen an increasing number of homes lost to wildland fires. Fuel loads due to 100 years of fire suppression, a warming climate, and an ever-increasing number of homes built in the Wildland Urban Interface (WUI) have led to the "perfect storm" for the catastrophic effects of fire in the west. As a result of these and the increasing costs to fight fires with limited resources, a new paradigm is evolving- homes built in the WUI must be designed and built to *survive* wildland fires. The term "defensible space" is being upgraded to "survivable space". Agencies that fight fires cannot put lives and resources in harm's way to protect structures.

Many people who live in suburban areas are not aware that their home is in the Wildland Urban Interface (WUI). As we have seen, fire brands (embers) can travel up to a half mile during a wind driven fires- depositing these embers on the community. The result can lead to an urban conflagration where the homes become the fuel. These are the fires that have the most devastation to a community. They can be the result of either forest fires or grassfires. Therefore, the ideas presented here are applicable to all homes and structures in Montana. They make the communities safer and do not add an appreciable amount of expense to a project.

Introduction

This guide was derived from the *Ignition Resistant Construction Design Manual* created and published by the Colorado Springs Fire Department, City of Colorado Springs, Colorado, with their consent. The goal is to create a user-friendly publication that unites common sense ignition resistant construction and landscaping techniques with common construction methods and homeowner desires.

This document will provide the readers with information they can use in preparing their homes against the threat of wildfire. The two primary sections of this document include Ignition Resistant Construction and Landscaping/Vegetation Management.

It is important to note and understand that ***ALL*** the suggestions included in this guide are intended to function as a system or design package. Eliminating just one element or feature from the system approach may increase a home's vulnerability to a wildfire event. For example, a home could be constructed with ignition resistant materials, but if vegetation is allowed to grow under decks or tree branches extend over the roof, then the construction materials may not be enough to protect the home from wildfire. Likewise, if a home has good survivable space but has combustible construction materials, then the home is still subject to ignition from fire embers and brands from open space or adjacent properties. In any case, **the suggestions outlined in this document do not guarantee that every home will survive a wildfire event.** Wildfire will always be dynamic and unpredictable, influenced by several factors including weather, fuels, topography, and human activity.

Residing within a Wildland Urban Interface (WUI) comes with some unique risks not generally found in other parts of your community. One such risk is the ever-present threat of wildfire. Wildfire is an event nature uses to improve the overall health of our forests. Fire removes dead, diseased, and overgrown vegetation, which in return provides nutrients for new growth and improved wildlife habitat. It is impossible to prevent wildfires from impacting communities in the WUI; as such, homeowners need to learn to live within that ever-changing environment without increasing the risk or subjecting their homes

to an increased level of threat.

It is important to understand that during a wildfire event, there are not enough resources available to protect each home as would be for a single house fire. Fire fighters must make difficult decisions as to how best deploy resources to provide the most effective fire attack. A home constructed with ignition resistant materials and that has adequate survivable space, requires fewer resources to defend than a home that does not.

Montana Wildland Urban Interface (WUI) Wildfire History

YEAR	ACRES BURNED*	ESTIMATED COST	STRUCTURES LOST
1999	84,912	$6,790,109	71
2000	886,368	$225,385,377	292
2001	138,790	$58,821,785	7
2002	107,481	$13,229,957	3
2003	756,452	$281,388,486	95
2004	16,450	$3,771,000	1
2005	90,573	$33,603,730	8
2006	814,382	$74,904,788	109
2007	710,112	$184,217,983	73
2008	145,987	$24,269,542	49
2009	49,666	$13,701,905	10
2010	50,227	$11,311,492	9
2011	154,236	$40,714,569	0
2012	993,286	$113,584,191	464
2013	114,793	$74,461,452	17
2014	27,712	$17,391,370	0
2015	353,171	$83,552,206	28
2016	88,644	$54,776,287	66
2017	1,254,713	$396,931,419	141
2018	90,669	$94,977,482	47
2019	53,942	$30,168,520	10
2020	335,242	$55,559,531	166
2021	834,654	$330,404,244	186
2022	132,733	$78,333,194	12
2023**	110,160	$146,495,500	69

* Only includes fires over 100 acres in size

** As of 12/28/2023

Types of Wildland Fire

To understand how fire impacts a structure, we must first have a basic understanding of how fire behaves. There are three primary types of wildland fire:

Ground Fire: A slow-burning, smoldering fire in ground fuels such as organic soils, duff, decomposing litter, buried logs, roots, and the below-surface portion of stumps. Ground fires are extremely slow moving and it is relatively easy to prevent these fires from igniting structures.

Surface Fire: These fires burn in litter and other live and dead fuels and spread along the surface of the ground mostly by flaming combustion. Surface fires can either move slowly or quickly and can pose a significant threat to structures. However, there are a lot of mitigation techniques that are very effective in reducing the risk to structures.

Crown Fire: Fire that has ascended from the ground into the forest canopy. These fires burn in the crowns of trees and shrubs usually ignited by a surface fire. These fires typically produce the most heat and embers and create the most challenges for protecting a home.

The type of fire that impacts a structure directly relates to that structure's probable chance of survival and directly influences the strategies and tactics fire fighters can deploy to protect them. The suggestions made in this guide are designed to not only manipulate the physical construction of a structure, but to also influence the potential fire environment around it, i.e. whether the structure is directly impacted by a crown fire or a ground fire.

During a wildfire event, structures primarily become involved through fire brands and embers that come in direct contact, radiant heat transfer from structure to structure or from vegetation to structure, and in a small percentage, from direct flaming front contact. Typically, in wildland fire situations, the flaming front passes an area in a matter of minutes. Studies conducted by Jack Cohen, a Research Physical Fire Scientist with the Missoula Fire Science Laboratory, show the most prominent method of initial ignition to a structure is through fire brands and embers. Additionally, the research shows that homes are much more likely to be ignited by radiant heat of an approaching fire than to be ignited by direct flame contact.

Fire Brands/Embers:

As fires burn, they produce fire brands/embers that are pushed by the winds generated by the fire. The number of brands/embers produced and the distance they travel are dependent on the type of fire, i.e. surface fire or crown fire. It is not uncommon to have fire brands/embers igniting spot fires as much as one-half mile or more ahead of a crown fire. These embers can carry enough heat energy to ignite combustible structures as they blow against or land upon the surfaces of a home. (See Figure 1 below for an example of a roof ignited by brands/embers). Science supports and stresses the importance of ignition resistant construction. Specifically, features such as screened attic vents, composite decking and Class A roofing provide significant defense against brand/ember-initiated ignition of homes.

Figure 1

Radiant Heat Transfer:

Conifer trees and dense vegetation (See Figure 2) tend to catch fire brands/embers, and when near structures, they can produce a significant radiant heat exposure. The Fuels Management Features portion of this guide provides specific steps a homeowner can take to reduce the likelihood that burning vegetation will ignite their home. In addition, home to home ignition is a common event in wildland urban interface fires that occur in densely populated areas. In researching the Waldo Canyon Fire in Colorado Springs, CO, the Colorado Springs City Fire Department found that structures lost in the two most affected neighborhoods were a direct result of home-to-home ignition, illustrating the importance of adequate survivable space.

Figure 2

Fire Front/Direct Flame Contact:

The smallest percentage of home ignitions is due to direct flame contact or impact from the forest fire front. Typically, in these cases, the fire front approaches from open space or forest land. A fast-moving crown fire through a forested area burns with intense radiant heat that pre-heats everything within its path. As the fire front approaches, the houses on the perimeter of the neighborhood, they can be very vulnerable to easy ignition. (See Figure 4).

Figure 4 - Ignition of homes along the northern fire front. Photo courtesy of the Denver Post.

Ignition Resistant Construction Features

This section of the design guide specifically addresses the construction materials and finishes used to reduce the likelihood of ignition of a home from an exposure fire.

Class A Roofing

A Class A roof is not just the roof covering itself, but is an overall assembly required to achieve a Class A rating. Roofing products are tested by submitting a roofing mockup to a testing lab where they subject the roofing assembly to a fire brand test. This test involves placing a burning fire brand upon the roof. Figure 5 shows the three sizes of fire test brands – the largest is Class A (12”x12”), Class B (6”x6”), Class C (1”x1”). During the test, the fire cannot penetrate the roof or cause the roof structure/underlayment to ignite before the brand is consumed and burns out.

Figure 5

Combustible roofing materials, including wood, fiberglass, etc. are subject to ignition from fire embers and brands. Many homes that ignite in wildland urban interface fires burn from the top down; this is a result of ignition of the roofing materials or the combustible roof decking.

There are many types and architectural styles of Class A roofing materials available on the market today. The variety of styles allows for flexibility in achieving the desired look of the home while providing for fire resistive properties that are so important in the wildland urban interface.

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

Exterior Cladding & Siding, Eaves and Soffits

The home's siding is the largest overall surface of the home. The material in which the exterior of the home is wrapped plays a significant role in preventing home to home, or vegetation to home ignition. In exposure to fires, the siding of a home is subject to extremely high radiant heat, which can ultimately ignite the home.

Ignition resistant siding helps prevent house to house ignition, thereby slowing the fire's progress and giving the fire department an opportunity to contain a fire to the original structure of origin.

There are many different exterior cladding and siding products available to satisfy a variety of architectural styles. The most common, as shown in Figure 6 below, are natural or fabricated stone/rock, stucco, and cement board.

Figure 6

Decorative construction features such as fascia, trim board materials and trim accents, corbels, false rafter tails (Figure 7), faux trusses, and shutters can be constructed of wood, vinyl, composite materials, or non-combustible products. FireSafe Montana strongly encourages the use of 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 must be painted or sealed to protect the wood from drying out and cracking or splitting. The cracks or splits in wood create a void for embers to attach to and propagate ignition.

Figure 7

Protection of Overhangs and Structural Projections

Projections of homes are areas that are vulnerable to heat and ember collection. While not common, the undersides of some building projections are left open to expose structural members. The exposed structural members are generally combustible and can act as a heat collection and ignition point on the home.

Enclosing the underside of projections with ignition resistant products will help reduce the likelihood of fire starting in these areas. See Figure 8 below for examples on how to properly protect the underside of the projections. In the example photos, the horizontal surface is constructed with cement board as would commonly be used for soffit and fascia material.

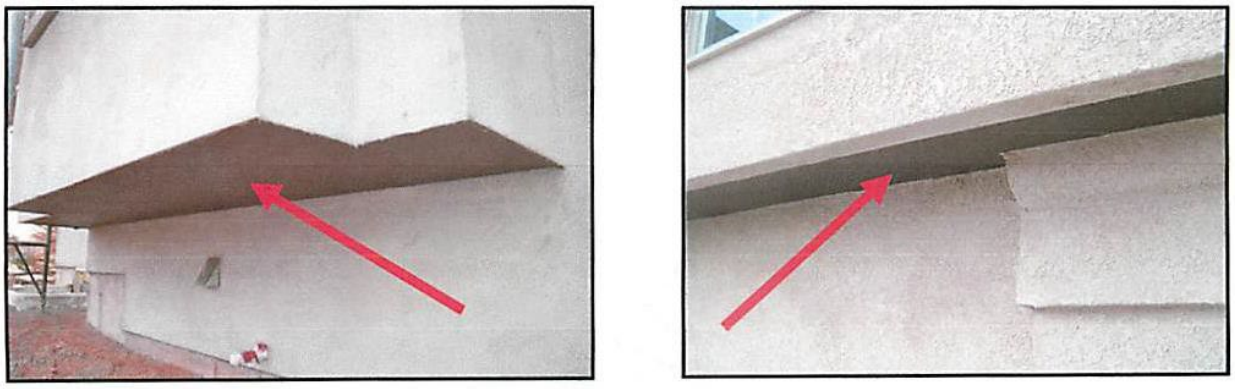

Figure 8

Exterior Doors

As with any entry point into a home, exterior doors can leave the house vulnerable to fire intrusion. A solid core door not only provides the best protection against deflection by wind, but it also provides protection against radiant heat as compared to a lighter weight hollow core door. Doors should be constructed of non-combustible products such as metal or composites. Wooden doors are acceptable when they are solid core construction.

Sliding glass doors or decorative front doors with glass panels shall have tempered glass that is designed to withstand impact (Figure 9). In an effort not to restrict architectural design and curb appeal, the exception to this section allows for entry doors with decorative glass, which may or may not be tempered.

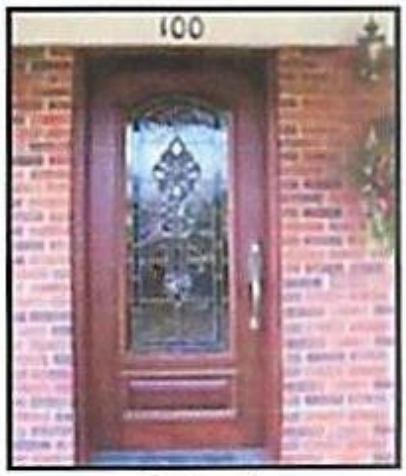

Figure 9

Windows

There are two main components of windows that are vulnerable to fire: the first is the frame construction, and the second is glazing (or glass surface). If vinyl windows are used, they should contain aluminum sub-frame to help the window retain its shape when exposed to increased heat. Melting or distortion of the frame can cause glass panes to shift or fall out.

The primary area of concern related to windows is the glass surface. Today's windows are constructed to be very energy efficient in terms of insulation properties and UV reflection. As such, most modern windows perform extremely well during a wildfire. Dual pane windows can withstand a flame front as it moves quickly into or through a community by reflecting the radiant heat energy.

Just like placing a hot glass in cold water, the extreme temperature fluctuation in a wildfire will cause the glazing in a window to crack. The insulating factor of a dual pane window will help protect against the temperature differences. Single pane windows do not perform as well and are vulnerable to cracking and breaking due to the intense heat of wildfire.

Most homes built today already include dual pane windows as an energy conservation and efficiency feature.

Attic Vents

Ember intrusion is a very significant factor in determining whether a home will survive a wildfire event. Attic venting is critical in preventing excessive temperatures and moisture in attics; however, venting also leaves homes very vulnerable to ember intrusion. Using vents with 1/8" metal screening is important in restricting the overall number of embers able to enter the attic (Figure 10). This screening will not stop all embers, but generally speaking, embers less than 1/8" do not have the heat energy needed to ignite combustible framing or insulation within the attic space.

Consider a campfire; as the fire pops and cracks, small embers fly out of the fire. The small embers will generally burn out before falling to the ground. The small embers do not have enough heat energy to continue to burn. Now, think of the larger embers or brands that pop from a campfire and land on the ground. Many of the larger embers will still be glowing, if not flaming, when they land. These larger embers or brands are the ones that need to be kept out of the attic spaces as they have enough heat energy to ignite combustible structural members. Even with the smaller vent screens, potentially hundreds of smaller embers will enter the attic. The primary goal is to prevent thousands of larger/hotter embers and brands from entering the home, as there will be a much higher risk of ignition.

As an added safety measure, homeowners should not use attics for the storage of combustible materials as they may ignite from embers as well.

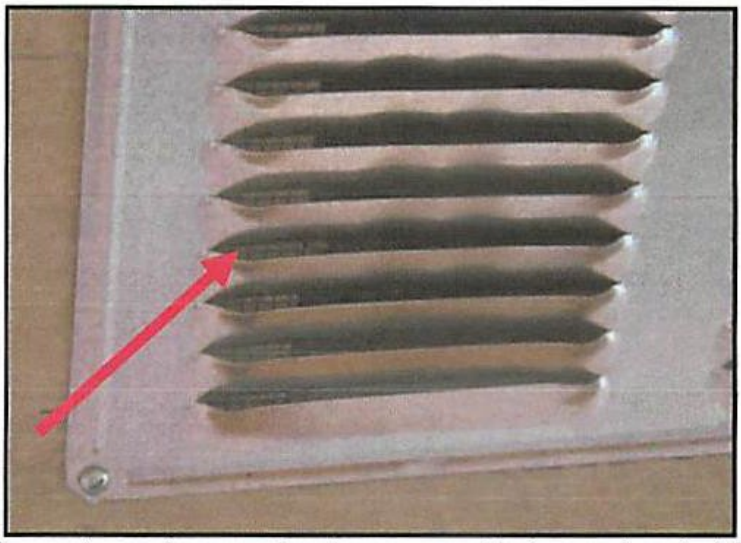

Figure 10. The 1/8" screening can be seen where it contrasts with the wood on the left side of the vent.

There are several different types of vents commonly used for attics, which include soffit (Figure 11), roof (Figure 12), ridge, (Figure 13), and gable (Figure 14) vents. Each of these vent types are required to include 1/8" metal screening.

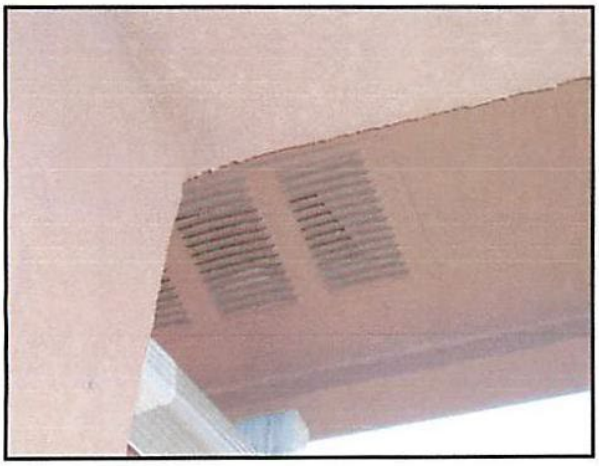

Figure 11

Figure 12

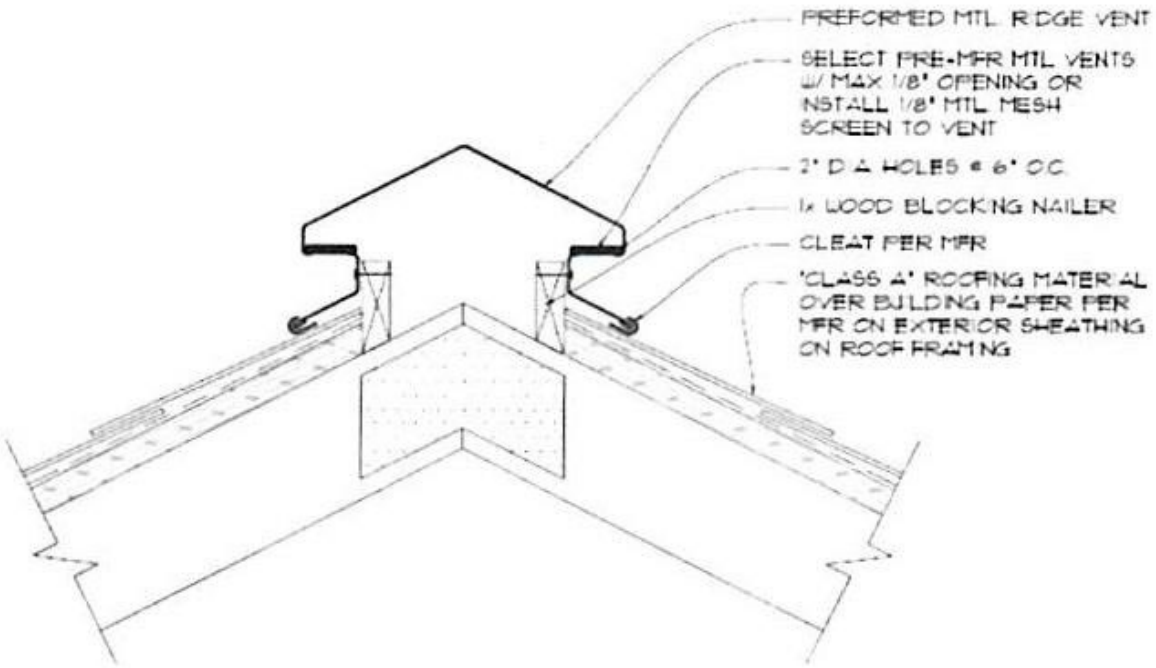

Figure 13

Gable vents (Figure 14) are highly discouraged as they are more susceptible to ember intrusion and should only be considered on sides of homes that do not face steep slopes or typical prevailing winds. Figure 15 is an example of a faux gable vent and is for decorative purposes only. The decorative vent does not penetrate the attic and therefore does not require screening.

Figure 14

Figure 15

Other types of vents, such as those for crawlspaces are also vulnerable to ember intrusion. The same screening practices for these would be a wise choice.

Gutters

Studies have been conducted to evaluate the performance of both metal and vinyl gutters during wildfires. While the gutter material certainly has an impact, of greater concern is the combustible debris (leaves, pine needles, etc.) that can accumulate in gutters and ignite during a fire.

Metal gutters will not burn, and they tend to stay in place during a fire. Any debris within the gutter that ignites will burn and expose the roof decking and fascia to heat and direct flame contact. Vinyl gutters tend to ignite when exposed to significant heat or fire, but they will melt away from the structure, thus limiting the amount of heat or flame exposure to the roof decking or fascia. From a 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 foreign combustible debris (Figure 16), then homeowners must be vigilant to ensure the gutters are cleaned out on a regular basis.

Figure 16

Standard practice is to install a piece of metal flashing, otherwise known as a drip edge along the exposed face of the roof decking. This design is common from the moisture prevention aspect, but it is also found to be very effective in preventing flame exposure or ember intrusion along the exposed edge of the roof decking under the shingles of roofing material. This drip edge shall cover the edge of the roof deck, extend into the gutter, and shall be installed tightly against the gutter material (Figure 17). In cases of a very long roof line, additional flashing may need to be installed behind the gutter and drip edge to prevent exposure of the fascia.

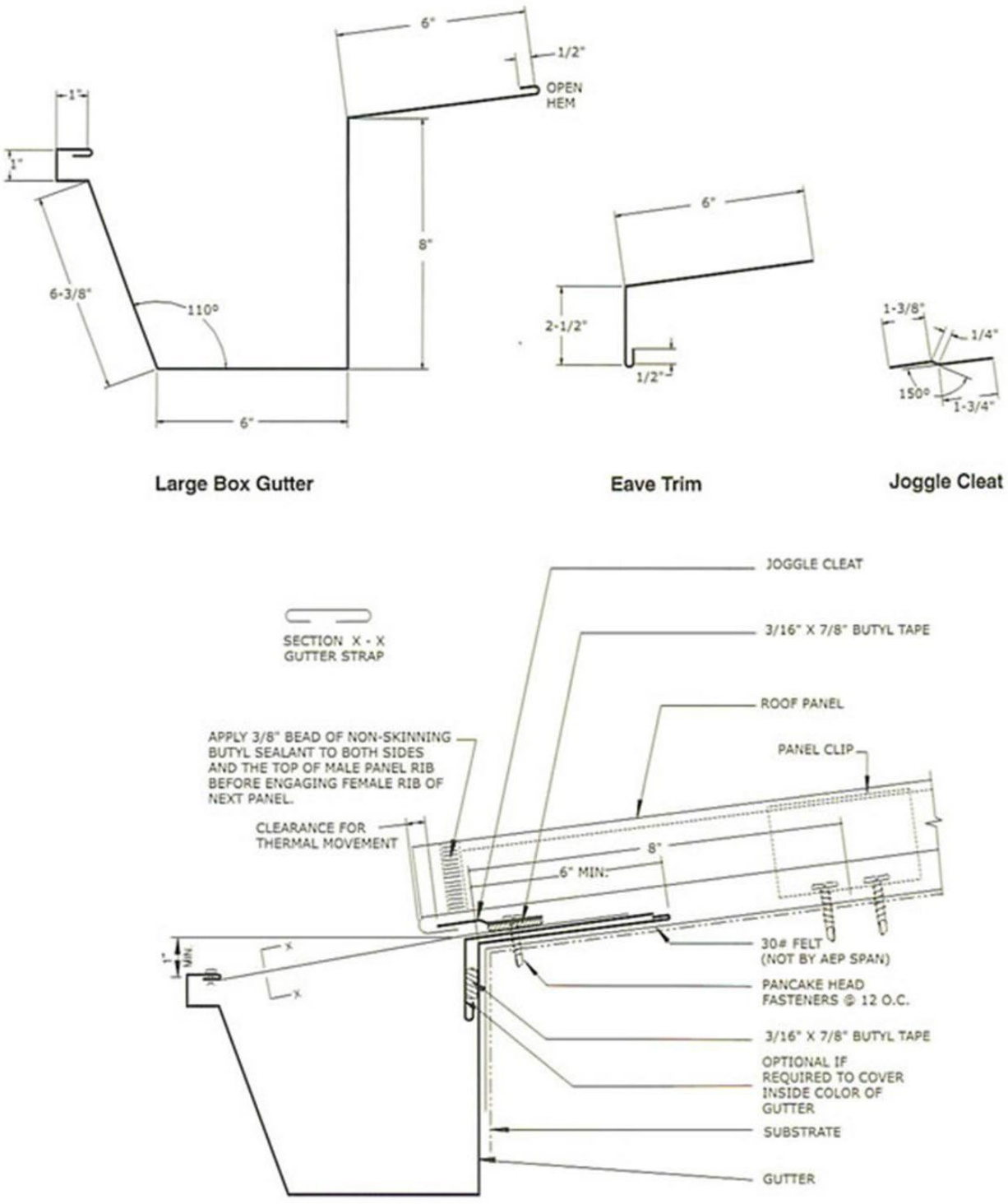
6"
1/2"
OPEN HEM
1"
1"
8"
6-3/8"
110°
6"
Large Box Gutter
6"
2-1/2"
1/2"
Eave Trim
1-3/8"
1/4"
150°
1-3/4"
Joggle Cleat
JOGGLE CLEAT
SECTION X - X
GUTTER STRAP
3/16" X 7/8" BUTYL TAPE
ROOF PANEL
APPLY 3/8" BEAD OF NON-SKINNING BUTYL SEALANT TO BOTH SIDES AND THE TOP OF MALE PANEL RIB BEFORE ENGAGING FEMALE RIB OF NEXT PANEL.
PANEL CLIP
CLEARANCE FOR THERMAL MOVEMENT
8"
6" MIN.
1" MIN.
X
X
30# FELT (NOT BY AEP SPAN)
PANCAKE HEAD FASTENERS @ 12 O.C.
3/16" X 7/8" BUTYL TAPE
OPTIONAL IF REQUIRED TO COVER INSIDE COLOR OF GUTTER
SUBSTRATE
GUTTER

Figure 17

Decks

Decks and outdoor living spaces are an important aspect of Montana living. Many homes throughout the state utilize decks and other outdoor living spaces to take full advantage of the beautiful views and climate our community has to offer. As such, residents desire to retain decks as an important aspect of homes. When choosing decking material, it is important to understand that deck safety is not just about the decking material but is a package design to include smart storage and landscaping practices. Decks are most vulnerable to ignition from direct flame impingement from adjacent combustible material such as firewood, bushes, trees, etc., and from fire brands or embers landing on the horizontal surfaces of the deck. 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 and brands.

When choosing decking surfaces there are two primary material types on the market: wood and composite or PVC. Wood is the most common product found in the construction of decks. Wood is generally easy to work with; however, it does require significant maintenance to keep it from drying out and splitting. The dry and split wood is very susceptible to capturing embers and igniting. Composite decking on the other hand is relatively maintenance free and does not rot or split, making it a much better product in terms of fire safety.

Like roofing materials, building products are tested for the surface burning characteristics and given a rating classification depending upon how well they resist ignition and spread of flame across the surface. The classification has three levels: Class A, Class B, and Class C, with Class A having the best performance at resisting flame spread. Many natural wood products inherently have a Class C rating, except for some exotic hardwoods or other products not typically selected for decking materials. Many of the composite or PVC decking materials are available with a Class B rating – some even have a Class A rating (Figure 18).

Figure 18

Many decks that ignite or burn are due to direct flame contact from ignition of combustible storage under the deck or adjacent trees and bushes. In these cases, both wood and composite decks will burn. Where decks are subject to embers and fire brands, wooden deck surfaces are more easily ignited than the composite decks, which tend to melt but not ignite.

Figure 19 shows a composite deck that was attached to a home destroyed by fire. The deck did receive damage, but for the most part was intact as the composite deck itself did not burn. In contrast, Figure 20 shows a combustible deck that was ignited due to embers/brands. Fire fighter intervention prevented further damage to the deck and structure.

Figure 19

Figure 20

While standard lumber is common, many builders and homeowners are utilizing alternative materials for the construction of their decks. Figure 21 shows a deck built with metal framing member in lieu of wood. Although not shown in the photo, this deck also has a concrete decking surface. In addition, they chose to wrap the support columns in stucco rather than leaving them exposed. Like the base of the walls, it is also important to enclose the base of any exterior columns as discussed in the next section. These areas are vulnerable to debris and ember collection inside the base of the column.

Figure 21

Base of Walls

Traditional building construction methods have the tendency to leave gaps under the lower edge of siding at the base of walls, posts, columns, etc. Figure 22 shows a close-up view, looking up from the bottom of the wall, which reveals vulnerable gaps at the base of walls. In the picture on the left, you can see the exposed combustible sheathing (green) and foam board insulation (blue). In the picture on the right, you can see the combustible wood sheathing (brown). This gap, while typically not noticeable, provides an entry point for embers and flames to enter the exterior walls of the home. As winds and embers blow up against the foundation of the home, the gap left between the siding and foundation can leave the stud wall cavity exposed. The gap provides for a point of ember intrusion into the combustible wall cavities and concealed spaces of the home. Fire can burn undetected and unimpeded in the concealed spaces for long periods of time before venting to the exterior where it is discovered. This gap needs to be protected with screening or sealed off with caulking, fire resistive foam, mortar, or similar product.

Figure 22

In Figure 23, the builder utilized metal flashing and stucco to seal the exposure where the wall connects to the foundation. Be advised that there may be a need or desire to provide suggestions for a weep or drainage to prevent moisture and condensation collection within the wall. Make sure these drains or weeps are not closed off when sealing the bottom side of the walls if moisture control is needed.

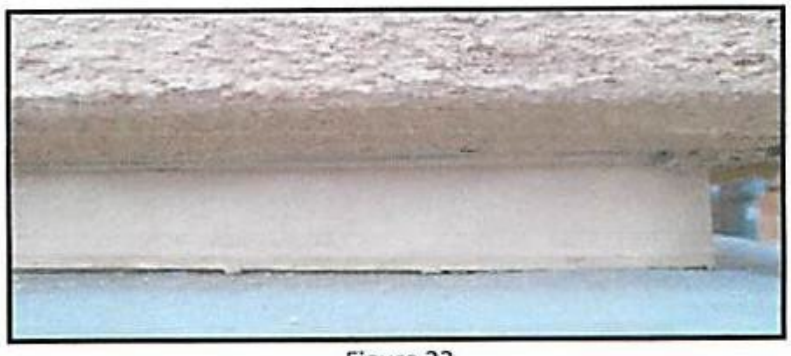

Figure 23

Chimneys

We highly recommend spark arresters be installed on existing chimneys. While spark arresters are important from a wildfire prevention standpoint, they are different from the other suggestions in this guidebook. These are not for protecting your home from wildfire but preventing a wildfire from starting due to embers from your wood burning appliances.

Spark arresters are designed to catch embers and brands that are produced during normal operation of a fireplace or wood burning appliance. Prevention of embers and brands from exiting a chimney reduces the risk of ignition outside of the home and potentially causing a wildfire event. (See Figure 24).

Figure 24

Alternative Methods and Materials

FireSafe Montana recognizes that there are many different construction methods and materials available in the construction of a home. As with everything else, technology continues to improve, and new products and construction methods are frequently introduced into the home building markets. As such, we are open to discussion and evaluation of methods or materials not specifically addressed within this document. Our goal is smart construction with ignition-resistant design that will increase a home's ability to stand alone with limited or no fire fighter intervention during a wildfire event. Nothing in this design guide is intended to prevent the use of products that have been tested and proven to provide equivalent or greater levels of protection and design than what has been called out in this guide. Consideration of alternative building products will generally require manufacturer's literature and independent product testing reports describing the flame spread characteristics of the proposed materials.

For additional information and updated lists of potentially acceptable construction materials, please visit the California Office of the State Fire Marshal, California Department of Forestry and Fire Protection web site. This site will include many of the product suggestions listed in this document. FireSafe Montana does not endorse any specific product or material, but rather looks subjectively at each product for compliance and documented testing performance when considering its use in a local application.

Fuels Management

This section of the design guide specifically addresses landscaping and natural vegetation surrounding houses, and how to apply smart landscaping design to reduce the likelihood of ignition of a home from an exposure fire. Fuels management includes selecting plant materials that have a greater resistance to wildfire in terms of susceptibility to ignition and providing adequate clearance to homes.

Plant Selection

Proper selection of plants and trees is critical when creating a defensible space around your home. However, it is not just how you landscape, but the selection of plants and materials is of equal importance. Selection of plants that are drought resistant and tend to maintain greater fuel moisture is a good start. Deciduous plants are a great choice because they generally have higher moisture content and can shed their leaves when they go dormant due to drought or during the winter months. The shedding of leaves allows the structure of the plant or tree to retain higher moisture content.

Other attributes and considerations for fire resistant landscaping include:

- Avoid plants with volatile oils and resins like pine and juniper.
- Choose plants that are native to the area and are drought tolerant for the climate.
- Choose plants with a naturally higher moisture content.
- Consider mature size and spacing.
- Select a diversity of species (as different plants are more susceptible to burning at various times of the year)

For additional information on FireWise Plant Materials, refer to Annex A in the back of this guide.

Home Ignition Zone

The home ignition zone is defined as the first 30' immediately surrounding a structure including roofline and decks. Contrary to the false impression, this area does not have to be clear cut. Fuels management is about making smart choices in selecting the plants within the home ignition zone and maintaining the existing healthy vegetation using the techniques covered in this section. There are three primary fuel layers of vegetation to be considered when evaluating the home ignition zone. These layers include ground cover, bushes, and trees. Figure 25 illustrates an overgrown lot. This image is typical of an unmitigated property. The adjacent image, Figure 26, provides an example of a well mitigated lot with plenty of clearance within the home ignition zone.

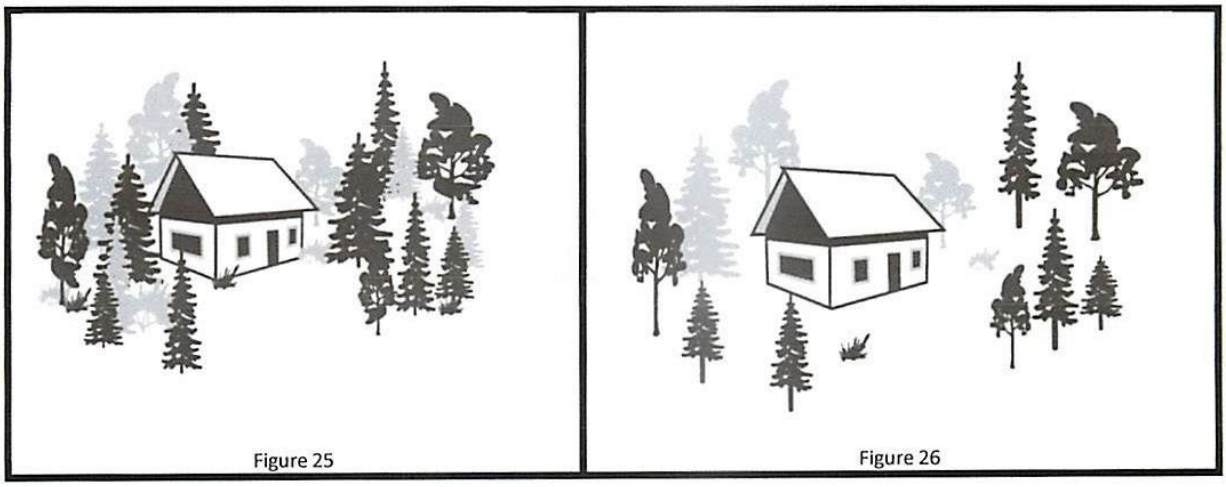

Figure 25

Figure 26

Figure 27 is a good example of the various layers of vegetation within the home ignition zone. Note the separation of fuels and the use of features such as rock walls and planting beds to create defined fuel breaks.

Figure 27

Ground Cover

Ground cover includes any materials or surfaces at grade. Native or planted grasses are the most common type of ground cover. Considerations regarding ground cover include height of the materials, clearance to structures, and fuel moisture. Ground cover is predominantly considered to be light, flashy fuels. These fuels generally don't have very high heat energy, but they do provide for very rapid fire spread when the fuel moisture is low. Keeping grass mowed to a height of less than 4" and well irrigated within proximity to the home will reduce the rate of spread as well as the intensity.

Also, of significant consideration in terms of the home ignition zone is ground cover mulch. While mulch might not seem like a big deal, combustible mulch near homes can be receptive to embers and fire brands. Avoid mulches that tend to be light weight. Denser bark or even rock and stone are a much better choice for mulch around the perimeter of the home. Rock or stone mulch should always be used when vinyl gutters are present on the home as discussed in the gutters section on page 16.

Bushes

Bushes and other low-level vegetation are those intermediate level plants that generally grow in the two- to six-foot-high range. The intermediate plants, also known as ladder fuels, become a conduit for flame transfer from ground cover to larger plants and trees. Bushes are an important consideration when evaluating the overall home ignition zone of the home. Care should be taken to select plants from the FireWise Plant Materials list from Annex A of this document.

Maintenance of bushes 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 one hundred (100) square feet. Limiting the size of and separating clumps from other vegetation is intended to break up the continuity of brush leading up to structures. By removing the debris and dead branches from the brush, the likelihood of ignition from a ground cover fire is reduced.

Trees

Trees are obviously the largest and often most sought-after vegetation within the home ignition zone. Strong, healthy trees provide many benefits to homeowners, including curb appeal, shade, wildlife habitat, and soil stabilization.

There are several factors to consider when selecting trees to plant or maintain around a home. First and foremost, select types and species of trees that are found on the FireWise Plant Materials list in Annex A of this document. Care should be taken to avoid trees such as conifers and evergreens, including pines, firs, spruces, and junipers in the safety zone. These trees have characteristics that make them prone to fire including resin and oil content, low hanging limbs, needles, thin bark, and low fuel moisture. Some pines, like Ponderosa, have thicker bark and higher limbs that make it a better choice for selecting an evergreen. Deciduous trees are always a much better choice in the home ignition zone.

The next thing to consider is the maturity and health of existing trees. A certified arborist can be a great resource in determining the overall health of trees around a home. However, some indicators of stressed or unhealthy trees include obvious signs of disease such as mistletoe as shown in Figure 28, or pest infestation such as pine beetle as indicated by the sap in Figure 29.

Figure 28

Figure 29

The biggest consideration in terms of trees within the home ignition zone is to provide plenty of clearance between trees, other vegetation, and structures. In the previous section, bushes are described as ladder fuels because they can be a conduit for flame transfer from ground cover to larger plants and trees. The most dangerous and rapid fire spread during a wildfire is known as a crown fire, which allows fire to jump from bush to bush or treetop to treetop, covering large areas of land in very short timeframes. Trees can also be a method of fire spread to structures and homes when adequate clearance is not provided as described in the following sections.

Clearance to Main Structure

The intent of 15' clearance of trees or brush is to provide spacing between the tree limbs in relation to the eaves, roofline, or deck. Figure 30 shows illustrations that compare adequate clearance to the home. The 15' clearance also accounts for several tree characteristics including mature height, shape, leaf type, moisture content, resins, and additional plant characteristics that make trees less ignition resistant. In some instances, based on property lines, the 15' clearance is not possible. In certain circumstances, trees, brush, and plant species identified as FireWise plants are allowed within 15'. See Annex A in the back of this guide.

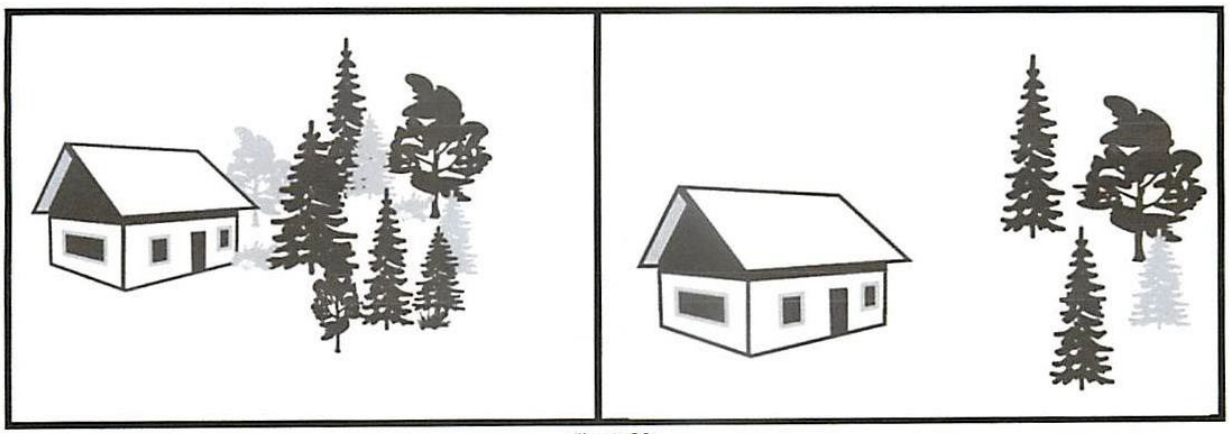

Figure 30

Figure 31 shows two examples where the 15' clearance to the main structure is not provided. In both examples provided, the homes are at significant risk of vegetation to structure ignition in the event of wildfire.

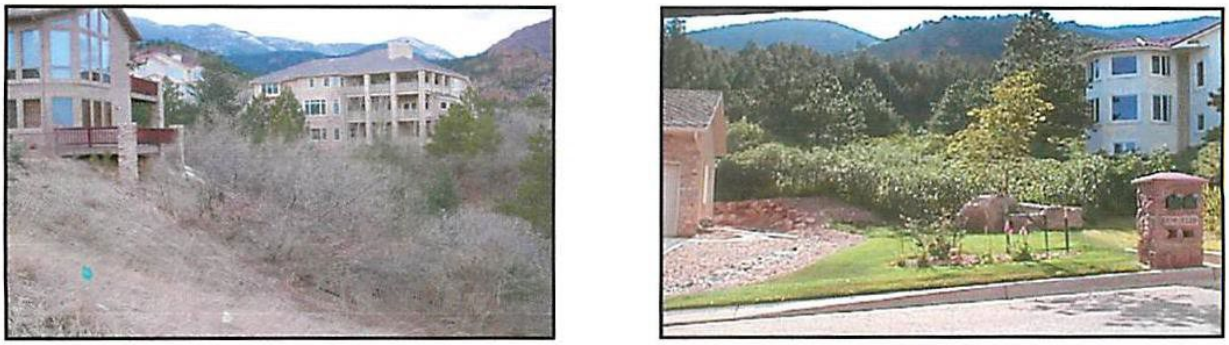

Figure 31

Pruning of Limbs

Pruning to 10’ in height is intended to remove ladder fuels and prevent fire spreading from the ground into the crowns of trees and brush. Both live and dead limbs can act as ladder fuels. The 10’ limit for pruning is intended to leave enough foliage on the tree to make enough food to survive. It is also intended to provide a limit that residents can safely prune up to, without climbing the tree or cutting overhead. While pruning is limited to 10’ the recommendation is always to maintain at least 70% of the crown to ensure good health of the tree.

Figure 32 shows an actual example of a home site before fuels mitigation. This lot is overgrown and creates a significant fire risk. Figure 33 is the same lot after fuels mitigation. This lot is now safer for the property owner and is esthetically pleasing and no longer overgrown.

Figure 32

Figure 33

Figure 34 provides a great example of how good clearance to the structure and pruning of limbs successfully protected a home from ignition. The arrow in the photo identifies where the fire burned along the ground but stopped short of the home. The scrub oak was properly pruned and limbed up to prevent the ground cover from extending into the taller plants.

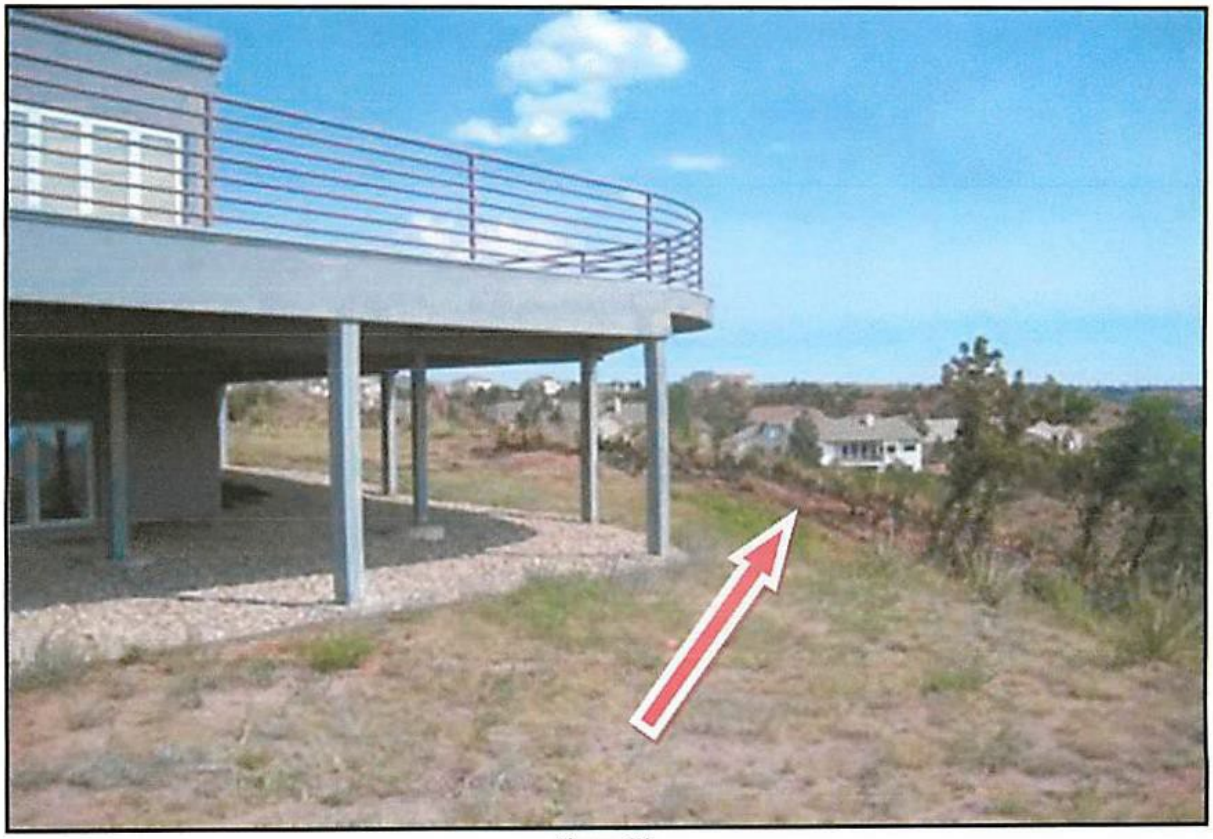

Figure 34

Clearance of Tree Branches to Structures or Appurtenances

While house plans and landscape plans note the relation of vegetation to the structure, it again does not address the size, shape, or future growth of the tree. Figure 35 represents how dense vegetation and landscaping create a means of continuity for a ground fire to spread to bushes and trees. In contrast, Figure 36 shows how good fuels management is designed to limit the spread of fire, thus keeping the fire small and manageable. Regardless of the planting location, no limbs should reach on, over, or under rooflines, decks, eaves, or chimneys (Figure 37).

Figure 35

Figure 36

Figure 37

Like building construction, good fuels management practices include a systems approach within the home ignition zone. Overall clearance to the main structure is essential in providing a buffer or fire break between combustible vegetation and the home. Pruning limbs helps to reduce the ladder fuels, which prevents ground cover fires from moving to the crowns of trees where the fire can spread much more freely. Keeping tree branches from touching or being near a home will provide protection from a crown fire and reduce the likely ignition of a home. Overlooking just one piece of the fuels management model will reduce the overall protection of the home.

Additional Tips to Reduce Your Wildfire Risk

1. Create defensible space around your home. FireSafe Montana recommends thinning out 30 feet or to your property line, whichever comes first.
2. Keep rain gutters clear of leaves and pine needles.
3. Do not store combustibles on or under decks, including firewood.
4. Rake up pine needles and leaves within 30 feet of any structure.
5. Select plant species with fire resistant characteristics.
6. Keep grass mowed to a maximum height of 4 inches.
7. Incorporate landscaping designs to break up fuel continuity (i.e. paths, rock walls, gravel mulch).
8. Keep addresses clearly marked and visible from both directions of traffic. (Fire fighters can't help you if they can't find you).
9. Prune lower branches. Removing ladder fuels will help keep the fire from getting into the crowns of the trees. Remove dead or diseased trees and brush.
10. When making home improvements or repairs, consider wildfire safety. Refer to this guide and incorporate ignition resistant design whenever possible.
11. Maintenance! You have worked hard to protect your investment; make sure you continue those efforts through regular maintenance.
12. Get involved with your HOA and participate in neighborhood chipping programs.
13. Work with your neighbors and encourage them to participate in wildfire mitigation efforts as well.
14. For more information regarding local assistance with specific wildfire threats or mitigation in your area contact FireSafe Montana at execdir@firesafemt.org or visit our website at firesafemt.org.

Summary

FireSafe Montana is here to support and encourage the citizens of Montana to do their part in keeping our communities safe against the ever-present threat of wildfire. Wildfire safety and prevention is *EVERYONE'S* responsibility, and it is up to each homeowner to take necessary steps to prepare their home against wildfire.

The information provided within this guide is an overview and is by no means all-encompassing in terms of the methods and materials available for ignition resistant construction and smart landscaping practices. We encourage you to contact FireSafe Montana if you have any questions or would like us to visit with you regarding your wildfire risk. For additional fire safety tips and information, please visit our website at firesafemt.org.

Glossary of Terms

Brands: A burning piece of wood or other burning material generally distributed by wind currents. A brand is differentiated from an ember by its larger size and higher heat energy.

Conflagration: A large, out of control and destructive fire, generally categorized by the loss of many continuous structures within a defined fire area.

Clusters: Clumps of trees and/or brush no more than one hundred (100) square feet in size and no more than fifteen (15) linear feet in any direction, separated by clear areas of ten (10) feet or more of non-combustible materials or grass mowed to not more than four (4) inches in height.

Defensible Space: An area, either natural or man-made, where material capable of allowing a fire to spread unchecked has been treated, cleared, or modified to slow the rate and intensity of an advancing wildfire and to create an area for fire suppression operations to occur.

Embers: A small piece of wood or other burning material generally distributed by wind currents. An ember is differentiated from a brand by its smaller size and lower heat energy.

Exposure Fire: A direct flame contact or radiant heat energy substantial enough to ignite vegetation and/or the adjacent structures.

Fuels Management: The act or practice of controlling flammability and reducing resistance to control wildland fuels through mechanical, chemical, biological, or guide means.

Fuel Moisture: The amount of moisture found in dead or living organic fuels (vegetation).

Ignition Resistant Construction: The use of materials and systems in the design and construction of a building or structure to safeguard or provide reasonable protection against the ignition and/or spread of fire to or from buildings or structures.

Ladder Fuels: Natural vegetation or other combustible materials that provide a conduit through direct contact or proximity to allow for a fire in smaller plants to progress vertically into taller plants and trees.

Mitigation: The intentional act of reducing the threat or severity of a fire through ignition resistant construction, creation of defensible space, and the use of FireWise plant materials.

Home Ignition Zone: The first thirty (30) feet immediately surrounding a structure including roofline and decks.

Wildfire: An uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures.

Wildland Urban Interface (WUI): A geographical area where structures and other human development meets or intermingles with wildland or vegetative fuels.

Annex A – FireWise Plant Materials

Fire-Resistant Plant Species Adapted to Montana

Groundcovers and Herbaceous Plants

COMMON NAME	GENUS AND SPECIES
Alfalfa	*Medicago sativus*
Bergenia	*Bergenia* spp.
Blanket Flower	*Gaillardia* x *grandiflora*
Bluegrass, Kentucky	*Poa pratensis*
Buffalograss	*Buchloe dactyloides*
Bugleweed	*Ajuga reptans*
Candytuft, Evergreen	*Iberis sempervirens*
Cinquefoil, Spring	*Potentilla tabernaemontani*
Columbine	*Aquilegia* spp.
Coral Bells	*Heuchera sanguinea*
Coreopsis	*Coreopsis* spp.
Cotoneaster, Rock	*Cotoneaster horizontalis*
Cotoneaster, Bearberry	*Cotoneaster dammeri*
Cottage Pink	*Dianthus plumarius*
Daisy, Shasta	*Leucanthemum* x *superbum*
Daylily	*Hemerocallis* spp.
Dusty Miller	*Artemisa stelleriana*
Fescue	*Festuca* spp.
Fescue, Blue	*Festuca ovina* var. *glauca*
Fescue, Tall	*Festuca arundinacea*
Fescue, Creeping Red	*Festuca rubra*
Flax	*Linum* spp.
Fleabane	*Erigeron* hybrids
Four O'clock	*Mirabilis* spp.
Geranium, Bloodred	*Geranium sanguineum*
Geranium	*Geranium* spp.
Ginger, Wild	*Asarum caudatum*
Hen and Chicks	*Sempervivum tectorum*
Iris	*Iris* spp.
Kinnickinnick	*Arctostaphylos uva-ursi*
Lambs Ear	*Stachys byzantina*
Lavender	*Lavandula* spp.
Lupine	*Lupinus* spp.

Fire-Resistant Plant Species Adapted to Montana

Groundcovers and Herbaceous Plants

COMMON NAME	GENUS AND SPECIES
Mahonia, Creeping	*Mahonia repens*
Mock-strawberry	*Duchesnea indica*
Myrtle, Common Periwinkle	*Vinca minor*
Ocean Spray	*Holodiscus* spp.
Orchardgrass	*Dactylis glomerata*
Poppy	*Papaver* spp.
Poppy, California	*Eschscholzia californica*
Potentilla	*Potentilla* spp.
Primrose	*Oenothera* spp.
Pussytoes	*Antennaria* spp.
Red Hot Poker	*Kniphofia uvaria*
Ryegrass	*Lolium* spp.
Sage	*Salvia* spp.
Sedum, Goldmoss	*Sedum acre*
Silver Spreader	*Artemisia caucasica*
Snow-in-Summer	*Cerastium tomentosum*
Stonecrop	*Sedum spathulifolium*
Stonecrop, Green	*Sedum album*
Strawberry, Wild	*Fragraria chiloensis*
Thrift, Common	*Armeria maritima*
Thyme, Wooly	*Thymus pseudolanuginosus*
Valerian, Red	*Centranthus ruber*
Violet, Canadian	*Viola canandensis*
Virginia Creeper	*Parthenocissus quinquefolia*
Wheatgrass, Fairway Western	*Agropyron cristatum*
Winterfat	*Eurotia lanata*
Yarrow	*Achillea* spp.
Yarrow, Common	*Achillea millefolium*
Yarrow, Fernleaf	*Achillea filipendulina*
Yarrow, Wooly	*Achillea tomentosa* var. Moonshine
Yucca	*Yucca filamentosa*

Fire-Resistant Plant Species Adapted to Montana

Shrubs

COMMON NAME	GENUS AND SPECIES
Antelope Brush	*Fendlera rupicola*
Buckthorn	*Rhamnus* spp.
Buffaloberry	*Shepherdia* spp.
Buffaloberry, Russett	*Shepherdia canadensis*
Buffaloberry, Silver	*Shepherdia argentea*
Cherry	*Prunus* spp.
Cherry, Sand	*Prunus besseyi*
Cherry, Nanking	*Prunus tomentosa*
Chokecherry	*Prunus virginiana*
Cinquefoil, Shrubby	*Potentilla fruiticosa* *Pentaphylloides floribunda*
Dogwood, Red-osier	*Cornus sericea (C. stolonifera)*
Gooseberries & Currants	*Ribes* spp.
Honeysuckle	*Lonicera* spp.
Lilac, Common	*Syringa vulgaris*
Mahogany, Mountain	*Cercocarpus* spp.
Mockorange	*Philadelphus* spp.
Plum, Native	*Prunus americana*
Raspberry	*Rubus* spp.
Rose, most members of this family	*Rosaceae*
Sumac, Skunkbush	*Rhus trilobata*

Fire-Resistant Plant Species Adapted to Montana

Trees

COMMON NAME	GENUS AND SPECIES
Alder, White	*Alnus rhombifolia*
Ash	*Fraxinus* spp.
Ash, Green	*Fraxinus pennsylvanica*
Aspen, Quaking	*Populus tremuloides*
Birch	*Betula* spp.
Cottonwood	*Populus* spp.
Hackberry	*Celtis occidentalis*
Locust, Black	*Robinia pseudoacacia*
Maple	*Acer* spp.
Maple, Boxelder	*Acer negundo*
Maple, Rocky Mountain	*Acer glabrum*
Olive, Russian	*Eleagnus angustifolia*
Poplar	*Populus* spp.
Narrowleaf Cottonwood	*Populus angustifolia*
Prunus	*Prunus* spp.

Referenced Documents

International Code Council (ICC)

-International Residential Code, 2009 Edition

-International Wildland-Urban Interface Code, 2009 Edition

-International Mechanical Code, 2009 Edition

-International Building Code, 2009 Edition

NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471

NFPA 1144 – Reducing Structure Ignition Hazards from Wildland Fire

- Insurance Institute for Business & Home Safety
- Wildfre Home Assessment & Checklist
- Protect Your Property from Wildfire – Rocky Mountain Edition
- Lessons Learned from Waldo Canyon – Fire Adapted Communities, Mitigation Assessment Team Findings

California Office of the State Fire Marshal Website:

http://osfm.fire.ca.gov/

Montana State University Extension: Fire Resistant Plants for Montana Landscapes

http://store.msuextension.org/publications/YardandGarden/MT200101AG.pdf

City of Colorado Springs Fire Department: Waldo Canyon Fire Investigations Summary memo, Nancy Gosch-Schanel, Fire Investigator

Special thanks to the City of Colorado Springs Fire Department for creating this important Ignition Resistant Design Manual.