

# APPENDIX D

## FUELS REDUCTION & STRUCTURAL HARDENING

## Appendix D

## APPENDIX D

### Table of Contents

Supplemental Documents .....	D-1
Ready, Set, Go! Action Guide.....	D-3
Before and After the Fire: Environmental Best Management Practices for Wildfire Risk Reduction and Recovery.....	D-15
Maintain a Defensible Space .....	D-57
Be Embers Aware .....	D-59
Fire Resistant Materials for Home Repair and Construction .....	D-63
Protect Your Property from Wildfire .....	D-71
Hazard Assessment Methodologies .....	D-97
Firewise Guide to Landscape and Construction.....	D-111
Trends in Wildland Fire Entrapment Fatalities...Revisited .....	D-115
Useful Links .....	D-122
Additional Resources .....	D-131





## SUPPLEMENTAL DOCUMENTS



# READY, SET, GO!

YOUR PERSONAL WILDLAND FIRE ACTION GUIDE



Photo by: Deanna Roy



# READY, SET, GO!

## Wildland Fire Action Guide

Saving Lives and Property  
through Advance Planning



2012 Version 2

### INSIDE

Wildland Fire Urban Interface	3
What is Defensible Space?	4
Making Your Home Fire Resistant	5
A Wildland Fire-Ready Home	6-7
Ready – Prepare Your Family – Checklist	8
Set – As the Fire Approaches – Checklist	9
Go – Leave Early – Checklist	10
Your Own Wildland Fire Action Guide	11
Residential Safety Checklist	12

Central Texas has been placed on the worldwide map as a wildland fire prone area with the advent of the 2011 Labor Day fires. We now share similar horrific stories of home losses and precious watersheds destroyed with areas like Colorado, California and the Mediterranean. The leadership of the Austin/Travis County area organized this Action Guide to provide you with the tips and tools you need to prepare for a wildland fire threat; have situational awareness when a fire starts; and to leave early.

The Wildland Urban Interface (WUI) is the fastest growing fire problem in the United States. Wildland fires directly threaten lives, houses, water supplies, utilities, recreation resources, cultural icons, endangered species, commerce, and transportation systems. As people continue to build houses in high-risk areas, the danger only increases.

We are committed to helping our friends and neighbors prepare for and stay safe in a wildland fire situation. Successfully preparing for a wildland fire enables you to take personal responsibility for protecting yourself, your family and your property. The Ready, Set, Go! Program works in complementary and collaborative fashion with the Firewise® Communities Program and other existing wildland fire public education efforts.

Fire is, and always has been, a natural occurrence in wildlands. Our hills, canyons and forests burned periodically long before we built homes there. Wildland fires, fueled by a build-up of dry vegetation and driven by seasonal hot dry winds, are extremely dangerous and difficult to control. Many residents have built homes and landscaped without fully understanding the impact a fire can have on them and few have adequately prepared their families for a quick evacuation.



It's not a question of if, but when the next major wildland fire will occur. Through advance planning, understanding and preparation, we can all be partners in the wildland fire solution. We hope you find the tips in the following pages helpful in creating heightened awareness and a more fire-safe environment for you, your family and firefighters.

**For additional information from local sources visit:**

<http://www.austinhsem.com>

<http://www.co.travis.tx.us>

This publication was prepared by the RSG Program with the assistance of the City of Austin and Travis County in cooperation with the International Association of Fire Chiefs; The U.S. Forest Service; U.S. Department of the Interior Bureau of Land Management; and the U.S. Fire Administration. To learn more about the Ready, Set, Go! Program and its partners, visit,

[www.wildlandfireRSG.org](http://www.wildlandfireRSG.org)

Verify compliance with rules and regulations of your local government and homeowner associations prior to modifying structures or clearing property.



## Living in the Wildland Urban Interface and the Ember Zone

Ready, Set, Go! begins with a house that firefighters can defend

## Defensible Space Works!

If you live next to a natural area, the Wildland Urban Interface, you should provide firefighters with the defensible space they need to protect your home. The buffer zone you create by removing weeds, brush and other vegetation helps keep the fire away from your home and reduces the risk from flying embers. Firewise Communities and other wildland fire preparedness education programs provide valuable guidance on property enhancements.



A home within one mile of a natural area is in the Ember Zone. Wind-driven embers can reach your home. You and your home must be prepared well before a fire occurs. Ember fires can destroy homes or neighborhoods far from the actual flame front of the wildland fire.





## What is Defensible Space?

Defensible space is the required space between a structure and the wildland area that, under normal conditions, creates a sufficient buffer to slow or halt the spread of wildfire to a structure. It protects the home from igniting due to direct flame or radiant heat. Defensible space is essential for structures to survive during wildland fire conditions. For more information about defensible space zones and preparedness techniques within each, visit the Firewise Communities' website, [www.firewise.org](http://www.firewise.org).



### ZONE ONE

Zone One extends 30 feet out from buildings, structures, decks, etc.

- Remove all dead or dying vegetation.
- Trim tree canopies regularly to keep their branches a minimum of 10 feet from structures and other trees.
- Remove leaf litter (dry leaves or duff) from yard, roof and rain gutters.
- Relocate woodpiles or other combustible materials into Zone Two.
- Remove combustible material and vegetation from around and under decks.
- Remove or prune vegetation near windows.
- Remove "ladder fuels" (low-level vegetation that allows the fire to spread from the ground to the tree canopy). Create a separation between low-level vegetation and tree branches. This can be done by reducing the height of low-level vegetation and trimming low tree branches.

### ZONE TWO

Zone Two extends 30 to 100 feet out from buildings, structures and decks. You can minimize the chance of fire jumping from plant to plant by removing dead material and thinning vegetation.

- Remove "ladder fuels."
- Cut or mow annual grass down to a maximum height of 4 inches.
- Trim tree canopies regularly to reduce continuity between branches and dense underbrush.

## What is a Hardened Home?

Construction materials and the quality of the defensible space surrounding it are what gives a home the best chance to survive a wildland fire. Embers from a wildland fire will find the weak link in your home's fire protection scheme and gain the upper hand because of a small, overlooked or seemingly inconsequential factor. However, there are measures you can take to safeguard your home from wildland fire. While you may not be able to accomplish all the measures listed below, each will increase your home's, and possibly your family's safety and survival during a wildland fire.



### ROOFS

Roofs are the most vulnerable surface where embers land because they can lodge and start a fire. Roof valleys, open ends of barrel tiles and rain gutters are all points of entry.

### EAVES

Embers can gather under open eaves and ignite exposed wood or other combustible material.

### VENTS

Embers can enter the attic or other concealed spaces and ignite combustible materials. Vents in eaves and cornices are particularly vulnerable, as are any unscreened vents.

### WALLS

Combustible siding or other combustible or overlapping materials provide surfaces or crevices for embers to nestle and ignite.

### WINDOWS and DOORS

Embers can enter gaps in doors, including garage doors. Plants or combustible storage near windows can be ignited from embers and generate heat that can break windows and/or melt combustible frames.

### BALCONIES and DECKS

Embers can collect in or on combustible surfaces or the undersides of decks and balconies, ignite the material and enter the home through walls or windows.

To harden your home even further, consider protecting your home with a residential fire sprinkler system. In addition to extinguishing a fire started by an ember that enters your home, it also protects you and your family year-round from any fire that may start in your home.



## Wildland Fire

### Home Site and Yard:

Perform a FIREWISE assessment of your home.

Landscape with fire-resistant plants that have a high moisture content and are low-growing.

Keep woodpiles, propane tanks and combustible materials away from your home and other structures such as garages, barns and sheds.

Ensure that trees are far away from power lines.

Enclose decks to prevent accumulation of leaves, needles and debris. Include metal screen with 1/8" mesh opening to prevent sparks from getting under the deck.

Trim landscaping to reduce downed and dead material.

**Roof:** Your roof is the most vulnerable part of your home because it can easily catch fire from wind-blown embers. Homes with wood-shake or shingle roofs are at high risk of being destroyed during a wildland fire.

Build your roof or re-roof with fire-resistant materials such as composition, metal or tile. Block any spaces between roof decking and covering to prevent ember intrusion.

Clear leaves and other debris from your roof and gutters.

**Vents:** Vents on homes are particularly vulnerable to flying embers.

All vent openings should be covered with 1/4-inch or smaller metal mesh. Do not use fiberglass or plastic mesh because they can melt and burn.

Attic vents in eaves or cornices should be baffled or otherwise protected to prevent ember intrusion (mesh is not enough).

**Windows:** Heat from a wildland fire can cause windows to break even before the home ignites. This allows burning embers to enter and start internal fires. Single-paned and large windows are particularly vulnerable.

Install dual-paned windows with the exterior pane of tempered glass to reduce the chance of breakage in a fire.

Limit the size and number of windows in your home that face large areas of vegetation.

**Inside:** Keep working fire extinguishers on hand.

Install smoke alarms on each level of your home and near bedrooms. Test them monthly and change the batteries twice a year.


**Address:** Make sure your address is clearly visible from the road.



**Water Supply:** Have multiple garden hoses that are long enough to reach any area of your home and other structures on your property. Have hoses on all four corners of your home to help firefighters defend your home.

If you have a pool or well, consider a pump.





**Garage:** Have a fire extinguisher and tools such as a shovel, rake, bucket and hoe available for fire emergencies.

Install a solid door with self-closing hinges between living areas and the garage. Install weather stripping around and under door to prevent ember intrusion.

Store all combustibles and flammable liquids away from ignition sources.

**Driveways and Access Roads:** Driveways should be designed to allow fire and emergency vehicles and equipment to reach your house.

Access roads should have a minimum 10-foot clearance on either side of the traveled section of the roadway and should allow for two-way traffic.

Ensure that all gates open inward and are wide enough to accommodate emergency equipment.

Trim trees and shrubs overhanging the road to a minimum of 13 1/2 feet to allow emergency vehicles to pass.

**Chimney:** Cover your chimney and stovepipe outlets with a non-flammable screen of 1/4-inch wire mesh or smaller to prevent embers from escaping and igniting a fire.

Make sure that your chimney is at least 10 feet away from any tree branches.



**Walls:** Wood products, such as boards, panels or shingles, are common siding materials. However, they are combustible and not good choices for fire-prone areas.

Build or remodel with fire-resistant building materials, such as brick, cement board, masonry, cement or stucco.

Be sure to extend materials from foundation to roof.

**Non-Combustible Boxed-In Eaves:** Box in eaves with non-combustible materials to prevent accumulation of embers.

**Rain gutters:** Screen or enclose rain gutters to prevent accumulation of plant debris.

**Non-Combustible Fencing:** Make sure to use non-combustible fencing to protect your home during a wildland fire.

If you have a wood fence attached to your house, install a metal shield between the fence and your home.

**Deck/Patio Cover:** Use heavy timber or non-flammable construction material for decks.

Enclose the underside of balconies and decks with fire-resistant materials to prevent embers from blowing underneath.

Keep your deck clear of combustible items, such as baskets, dried flower arrangements and other debris.

The decking surface must be ignition resistant if it's within 10 feet of the home.



# READY, SET, GO!

## Create Your Own Action Guide

Now that you've done everything you can to protect your house, it's time to prepare your family. Your **Wildland Fire Action Guide** must be prepared with all members of your household well in advance of a fire. Use these checklists to help you gain an awareness of the threat and to prepare your Wildland Fire Action Guide. For more information on property and home preparedness before a fire threat, review the preparedness checklist on the Firewise Communities' website, [www.firewise.org](http://www.firewise.org)

## Ready – Preparing for the Fire Threat



- ☐ Create a **Family Disaster Plan** that includes meeting locations and communication plans and rehearse it regularly. Include in your plan the evacuation of large animals such as horses.
- ☐ Register for CAPCOG's Emergency Notification System Cellular Telephone Interface: <http://wireless.capcog.org>
- ☐ Have fire extinguishers on hand and train your family how to use them.
- ☐ Ensure that your family knows where your gas, electric and water main shut-off controls are and how to use them.
- ☐ Plan several different evacuation routes.
- ☐ Designate an emergency meeting location outside the fire hazard area.
- ☐ Assemble an emergency supply kit as recommended by the American Red Cross.
- ☐ Appoint an out-of-area friend or relative as a point of contact.
- ☐ Maintain a list of emergency contact numbers posted near your phone and in your emergency supply kit.
- ☐ Keep an extra emergency supply kit in your car in case you can't get to your home because of fire.
- ☐ Have a portable radio or scanner so you can stay updated on the fire.

## Set – Situational Awareness when a Fire Starts

- ☐ Evacuate as soon as you are set!
- ☐ Alert family and neighbors.
- ☐ Dress in appropriate clothing (i.e., clothing made from natural fibers, such as cotton, and work boots). Have goggles and a dry bandana or particle mask handy.
- ☐ Ensure that you have your emergency supply kit on hand that includes all necessary items, such as a battery-powered radio, spare batteries, emergency contact numbers, and ample drinking water.
- ☐ Stay tuned to your TV or local radio stations for updates, or check the fire department website.
- ☐ Remain close to your house, drink plenty of water, and keep an eye on your family and pets until you are ready to leave.

### INSIDE CHECKLIST

- ☐ Shut all windows and doors, leaving them unlocked.
- ☐ Remove flammable window shades and curtains, and close metal shutters.
- ☐ Remove lightweight curtains.
- ☐ Move flammable furniture to the center of the room, away from windows and doors.
- ☐ Shut off gas at the meter. Turn off pilot lights.
- ☐ Leave your lights on so firefighters can see your house under smoky conditions.
- ☐ Shut off the air conditioning.



### OUTSIDE CHECKLIST

- ☐ Gather up flammable items from the exterior of the house and bring them inside (patio furniture, children's toys, door mats, etc.) or place them in your pool.
- ☐ Turn off propane tanks. Small tanks can be removed or drained.
- ☐ Don't leave sprinklers on or water running - they can waste critical water pressure.
- ☐ Leave exterior lights on.
- ☐ Back your car into the driveway. Shut doors and roll up windows.
- ☐ Have a ladder available.
- ☐ Patrol your property and extinguish all small fires until you leave.
- ☐ If there are fires that you cannot extinguish with a small amount of water or in a short period of time, call 9-1-1.
- ☐ Seal attic and ground vents with pre-cut plywood or commercial seals if time permits.

### IF YOU ARE TRAPPED: SURVIVAL TIPS

- ☐ Shelter away from outside walls.
- ☐ Bring garden hoses inside house so embers don't destroy them.
- ☐ Patrol inside your home for spot fires and extinguish them.
- ☐ Wear long sleeves and long pants made of natural fibers such as cotton.
- ☐ Stay hydrated.
- ☐ Ensure you can exit the home if it catches fire (remember if it's hot inside the house, it is four to five times hotter outside).
- ☐ Fill sinks and tubs for an emergency water supply.
- ☐ Place wet towels under doors to keep smoke and embers out.
- ☐ After the fire has passed, check your roof and extinguish any fires, sparks or embers.
- ☐ Check inside the attic for hidden embers.



# Go – Leave Early

By leaving early, you give your family the best chance of surviving a wildland fire. You also help firefighters by keeping roads clear of congestion, enabling them to move more freely and do their job in a safer environment.

## WHEN TO LEAVE

Leave early enough to avoid being caught in fire, smoke or road congestion. Don't wait to be told by authorities to leave. In an intense wildland fire, they may not have time to knock on every door. If you are advised to leave, don't hesitate! Practice being able to leave your home in 5 minutes or less.

## WHERE TO GO

Leave to a predetermined location (it should be a low-risk area, such as a well-prepared neighbor, a Red Cross shelter, motel, etc.)

## HOW TO GET THERE

Have several travel routes in case one route is blocked by the fire or by emergency vehicles, and equipment. Choose an escape route away from the fire.

## WHAT TO TAKE

Take your emergency supply kit containing your family and pet's necessary items.

## EMERGENCY SUPPLIES

The American Red Cross recommends every family have an emergency supply kit assembled long before a wildland fire or other emergency occurs. Use the checklist below to help assemble yours. For more information on emergency supplies, visit the American Red Cross website at [www.redcross.org](http://www.redcross.org).

- ☐ Three-day supply of water (one gallon per person per day).
- ☐ Non-perishable food for all family members and pets (three-day supply).
- ☐ First aid kit.
- ☐ Flashlight, battery-powered radio, and extra batteries.
- ☐ An extra set of car keys, credit cards, cash or traveler's checks.
- ☐ Sanitation supplies.
- ☐ Extra eyeglasses or contact lenses.
- ☐ Important family documents and contact numbers.
- ☐ Map marked with evacuation routes.
- ☐ Prescriptions or special medications.
- ☐ Family photos and other irreplaceable items.
- ☐ Easily carried valuables.
- ☐ Personal computers (information on hard drives and disks).
- ☐ Chargers for cell phones, laptops, etc.

Note: Keep a pair of old shoes and a flashlight handy in case of a sudden evacuation at night.



## My Personal Wildland Fire Action Guide

Write up your Wildland Fire Action Guide and post it in a location where every member of your family can see it. Rehearse it with your family.

During Red Flag/High Fire Danger days in your area, monitor your local media for information and be ready to implement your plan. Hot, dry and windy conditions create the perfect environment for a wildland fire. A list of current incidents can be found online at [www.austinhsem.com](http://www.austinhsem.com)

Important Phone Numbers:

Your Out-of-State Contact: \_\_\_\_\_ Phone: \_\_\_\_\_

Work: \_\_\_\_\_

School: \_\_\_\_\_

Other: \_\_\_\_\_

Evacuation Routes: \_\_\_\_\_

\_\_\_\_\_

Where to Go: \_\_\_\_\_

\_\_\_\_\_

Location of Emergency Supply Kit: \_\_\_\_\_

\_\_\_\_\_

Notes: \_\_\_\_\_

\_\_\_\_\_





## READY, SET, GO!

### Residential Safety Checklist Tips To Improve Family and Property Survival During A Wildland Fire

Home	Yes	No
1. Does your home have a metal, composition, or tile (or other non-combustible) roof with capped ends and covered fascia?	<input type="checkbox"/>	<input type="checkbox"/>
2. Are the rain gutters and roof free of leaves, needles and branches?	<input type="checkbox"/>	<input type="checkbox"/>
3. Are all vent openings screened with 1/8 inch (or smaller) mesh metal screen?	<input type="checkbox"/>	<input type="checkbox"/>
4. Are approved spark arrestors on chimneys?	<input type="checkbox"/>	<input type="checkbox"/>
5. Does the house have non-combustible siding material?	<input type="checkbox"/>	<input type="checkbox"/>
6. Are the eaves "boxed in" and the decks enclosed?	<input type="checkbox"/>	<input type="checkbox"/>
7. Are the windows made of at least double-paned or tempered glass?	<input type="checkbox"/>	<input type="checkbox"/>
8. Are the decks, porches and other similar areas made of non-combustible material and free of easily combustible material (e.g. plastic furniture, propane tanks)?	<input type="checkbox"/>	<input type="checkbox"/>
9. Is all firewood at least 30 feet from the house?	<input type="checkbox"/>	<input type="checkbox"/>

Defensible Space	Yes	No
1. Is dead vegetation cleared to the recommended defensible space area? (Consider adding distance due to slope of property.)	<input type="checkbox"/>	<input type="checkbox"/>
2. Is there separation between shrubs?	<input type="checkbox"/>	<input type="checkbox"/>
3. Are ladder fuels removed?	<input type="checkbox"/>	<input type="checkbox"/>
4. Is there a clean and green area extending at least 30 feet from the house?	<input type="checkbox"/>	<input type="checkbox"/>
5. Is there a non-combustible area within five feet of the house?	<input type="checkbox"/>	<input type="checkbox"/>
6. Is there separation between trees and crowns?	<input type="checkbox"/>	<input type="checkbox"/>

Emergency Access	Yes	No
1. Is the home address visible from the street?	<input type="checkbox"/>	<input type="checkbox"/>
2. Is the home address made of fire-resistant materials?	<input type="checkbox"/>	<input type="checkbox"/>
3. Are street signs present at every intersection leading to the house?	<input type="checkbox"/>	<input type="checkbox"/>
4. Are street signs made of fire-resistant materials?	<input type="checkbox"/>	<input type="checkbox"/>
5. Is flammable vegetation within 10 feet of the driveway cleared and are overhanging obstructions removed?	<input type="checkbox"/>	<input type="checkbox"/>
6. If a long driveway is present, does it have a suitable turnaround area?	<input type="checkbox"/>	<input type="checkbox"/>

Ready, Set, Go!  
www.wildlandfireRSG.org







**WILDFIRE READY**  
A U S T I N

# **BEFORE AND AFTER THE FIRE**

**Environmental Best Management Practices for  
Wildfire Risk Reduction and Recovery**





A wildfire is an incident of uncontrolled burning, normally occurring in wildlands such as grasslands, brush or woodlands, but which can sometimes spread to urban areas and consume homes, commercial structures and infrastructure. Wildfires can be extremely destructive events; however, their power is an important and necessary part of nature that is, and always has been, an essential component of many Central Texas ecosystems. Driven by natural forces like lightning and dry winds, wildfire periodically burned the hills, canyons and forests, shaping Austin's landscape long before we settled here.

Wildland fire, including prescribed fire, provides numerous environmental benefits. Fire replenishes and rejuvenates wildlands by reducing hazardous levels of brush and other vegetative fuels; controlling undesirable plant species, various plant diseases, and pest insects; and returning nutrients from plants back to the earth. After a fire, emerging vegetation uses newly-enriched soils to grow rapidly, providing ideal food sources for returning wildlife. Over the course of many centuries, native plants and animals have adapted to fire, and today, some actually depend on the effects of fire for habitat, growth and reproduction.

Wildfire management policies over the last century have focused on large-scale fire suppression. Consequently, many fire-dependent ecosystems have not been allowed to undergo the natural, cyclical fire processes that aid ecological revitalization, resulting in the accumulation of hazardous fuel in the form of fallen leaves, branches, and excessive plant overgrowth. While fire suppression is certainly appropriate when necessary to protect human life and property, applying suppression tactics across-the-map postpones the

inevitable outcome of a growing risk, and can eventually result in a high-intensity wildfire that becomes larger, spreads faster, is more difficult to control, and inflicts more damage to people and development.

As population growth and urban sprawl continue in Central Texas, residents are moving farther into natural areas to take advantage of natural beauty, privacy, recreational opportunities and affordable living. Therefore, understanding the difference between a wildfire that promotes ecological health and a wildfire that threatens human communities is essential. As noted by the Texas A&M Forest Service, eighty percent of Texas wildfires occur within two miles of a community (*2011 Texas Wildfires* 9), indicating that wildfires are not just a concern for rural homeowners. Areas where structures, subdivisions and other human development meet or intermingle with undeveloped wildland and vegetative fuels are called the wildland/urban interface. These areas usually represent the highest risk due to the close proximity of wildland fuels and the large number of human-caused ignitions. Forty-five percent of Austin's population now lives in the wildland/urban interface and many have not fully considered the potential impacts of a wildfire (Smith). Fire officials consider wildland/urban interface areas to be the fastest growing fire problem in the country.

Although wildfires are natural occurrences in many wildlands, only a small portion of fires are ignited by nature today. The Texas A&M Forest Service reports that people cause more than 95 percent of wildfires in Texas ("Mitigation"). Careless burning of household trash and brush piles, sparks produced by welding and grinding equipment, improperly discarding smoking materials, hot vehicle exhaust

systems, and arson are frequent sources of ignition. As communities continue to expand into these high-risk areas, the danger only increases.

Since natural areas are deeply valued by the community and critical to our well-being, it is important that they remain natural. Consequently, we must learn to live with wildfire by becoming fire-adapted, just as Central Texas plants and animals have. A fire-adapted community is comprised of informed and prepared residents who understand the potential for wildfire and collaboratively take action to safely co-exist with it. Wildfires can, and will occur in Central Texas; but in a fire-adapted community, they do not have to be catastrophic.

Although the risk of wildfire impacts to human life and property can't be eliminated, the probability of harm can be greatly reduced through applied knowledge, sound decision-making and responsible actions. To achieve the mutual goals of wildfire risk reduction and responsible stewardship of natural areas, Environmental Best Management Practices should be implemented **before** a wildfire occurs.

Given that fire is important to the health and integrity of many ecosystems, in most cases, no human intervention is needed after a fire. However, some wildfires can impact human development, accelerate erosion, degrade water quality, and generate waste and debris that requires special handling and disposal. In these situations, Environmental Best Management Practices employed **after** a wildfire can prevent further damage, expedite recovery, and reduce future risk.



# IN THIS GUIDEBOOK

## *BEFORE THE WILDFIRE*

### UNDERSTAND YOUR RISK, IDENTIFY RESOURCES AND KNOW YOUR LIMITATIONS

Take Responsibility.....	4
Seek Training.....	4
Understand How Fire Behavior Threatens Your Home.....	5
Collaborate with your Community.....	6
Plan Access and Escape Routes.....	7
Practice Situational Awareness.....	7
Identify Wildfire Hazards, Assess your Risk, and Plan Action Items.....	8
Stay within Your Property Boundaries.....	8
Recognize Natural Resources.....	9
Appreciate the Value of Vegetation.....	9
Preserve Critical Habitat.....	11
Observe the City of Austin Tree Protection Ordinance.....	11
Know Regulations and Permitting.....	12
Understand Prescribed Fire.....	12

### EVALUATE AND MODIFY YOUR PROPERTY

Harden the Home.....	13
Create and Maintain a Defensible Space.....	15
Account for Topography.....	17
Limit Fuel Continuity.....	17
Choose Fire-Resistant Plants that are Native or Adapted to Central Texas.....	18
Recognize Streamside Vegetation Benefits .....	19
Consider Snags and Brush Piles.....	20
Practice Proper Tree Care and Management.....	20
Prevent Oak Wilt.....	23
Avoid Using Herbicide.....	24
Dispose of Trimmings and Brush Properly.....	24
Prevent Combustion of Home Compost Piles.....	25

# BEFORE THE WILDFIRE

## UNDERSTAND YOUR RISK, IDENTIFY RESOURCES AND KNOW YOUR LIMITATIONS

Take Responsibility.....	4
Seek Training.....	4
Understand How Fire Behavior Threatens Your Home.....	5
Collaborate with your Community.....	6
Plan Access and Escape Routes.....	7
Practice Situational Awareness.....	7
Identify Wildfire Hazards, Assess your Risk, and Plan Action Items.....	8
Stay within Your Property Boundaries.....	8
Recognize Natural Resources.....	9
Appreciate the Value of Vegetation.....	9
Preserve Critical Habitat.....	11
Observe the City of Austin Tree Protection Ordinance.....	11
Know Regulations and Permitting.....	12
Understand Prescribed Fire.....	12

## EVALUATE AND MODIFY YOUR PROPERTY

Harden the Home.....	13
Create and Maintain a Defensible Space.....	15
Account for Topography.....	19
Limit Fuel Continuity.....	19
Choose Fire-Resistant Plants that are Native or Adapted to Central Texas.....	20
Recognize Streamside Vegetation Benefits .....	21
Consider Snags and Brush Piles.....	22
Practice Proper Tree Care and Management.....	22
Prevent Oak Wilt.....	23
Avoid Using Herbicide.....	24
Dispose of Trimmings and Brush Properly.....	24
Prevent Combustion of Home Compost Piles.....	25

# BEFORE THE WILDFIRE

## UNDERSTAND YOUR RISK, IDENTIFY RESOURCES AND KNOW YOUR LIMITATIONS

### *Take Responsibility*

Do not assume that emergency service providers will be able to save you and your property – you must be proactive and take responsibility for the protection of your life and property!

In a severe wildfire event, there are typically more homes that need protection than there are firefighting resources available. Some homes may be lost simply due to a lack of resources. With limited resources to protect structures, firefighters are trained to conduct structural triage to try and save as many homes as possible. Some homes just need monitoring, some can be saved easily, some will need extensive effort and some will not make it. If a home has poor access, lack of escape routes and safety zones, or no safe place to fight the fire, then firefighters may decide not to protect that home because it puts their lives at too great of a risk and consumes their limited resources. Conversely, properties that are well-prepared are typically prioritized as the first to save. There are lots of things you can do to prepare for a wildfire event – read further for more information.

### *Seek Training*

Before conducting wildfire management activities on your property, seek training. Factors that contribute to home ignitions during wildfire events are not always intuitive. It is essential to have an accurate understanding of a property's wildfire risk that is based on sound science, rather than fear alone. Do not act prematurely. Some proper training and instruction is often necessary to correctly identify and mitigate wildfire hazards on your property. Without proper education, many well-intentioned actions can actually increase fire hazards and result in environmental damage. In addition, some actions may even be illegal and could result in fines or additional costs to mitigate hazardous debris, environmental harm or other property damage. For additional educational resources, see the list of websites at the end of this publication.

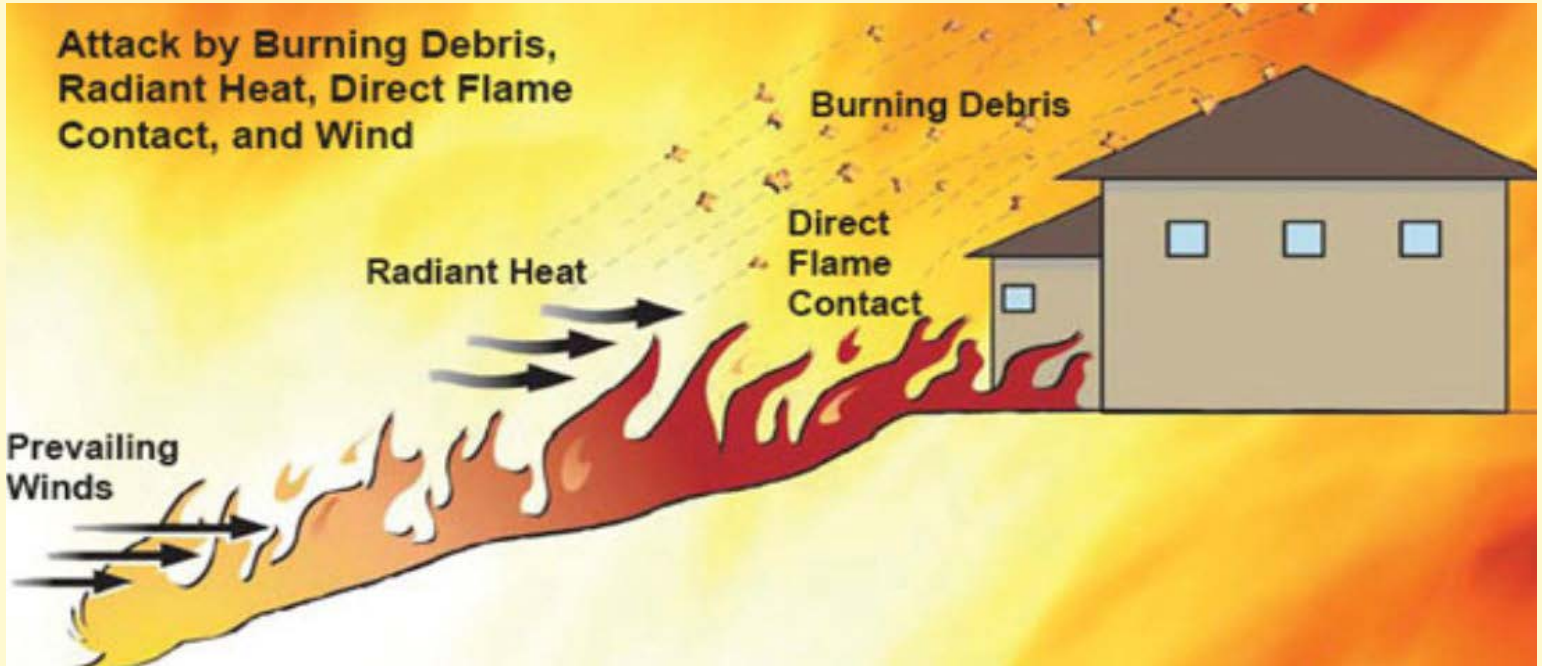


*Upon request, the City of Austin and Texas A&M Forest Service will visit your neighborhood and offer training on ways to reduce wildfire risk.*



# Understand How Fire Behavior Threatens Your Home

Wildfire can threaten structures in three ways: radiant heat, direct flame contact, and burning embers.



## Contact by Flames:

This type of threat occurs when vegetation and other fuels burning near the house produce flames that come in contact with the home and ignite it. Often it happens when fire burns through a uniform layer of vegetation right up to the house. Defensible space around the home is the most effective way to reduce this threat.



Direct flame contact occurs when vegetation, adjacent structures, or other fuels burning near the house produce flames that come in contact with the home and ignite it.

## Radiated Heat:

Radiated heat is produced by electromagnetic waves that travel outward in all directions from a flame. When a house receives enough radiated heat for a sufficient amount of time, it will ignite. Sometimes radiated heat can burst windows and allow fire to enter the house. Constructing homes with fire resistant materials is the most effective way to reduce this threat.



*Right: The vinyl siding and window frame on this home melted when exposed to radiant heat. When a structure receives enough radiated heat for sufficient time, it will ignite.*



## Flying Embers:

Embers, also known as fire brands, pose the single greatest wildfire threat to a structure. In severe fire conditions, embers can be lofted high into the air and transported more than a mile by fast moving air currents. A high-intensity fire can produce a virtual blizzard of embers. You can't control where embers land, but you can control what happens when they do. Don't give hot embers the chance to land on easily-ignitable materials and start a new fire. Wood shake roofs and accumulated leaf litter inside rain gutters are especially vulnerable to ember ignition. Also, embers can easily intrude your home through unscreened pathways, like attic vents. Removing easily-ignitable materials and restricting potential pathways for embers to enter a structure are the most effective methods to reduce this threat.



*It's the little things that count. Embers, also known as firebrands, pose the greatest threat to a home. In some fire conditions, embers can be lofted high into the air and transported more than a mile. If burning embers land in easily ignitable materials, a new fire can start.*

## Collaborate with your Community



*Neighborhoods can be much more successful at reducing wildfire risk when working together and utilizing programs like Firewise Communities.*

Action (or lack of action) on an individual property will affect the survivability of other properties nearby. By collaborating with neighbors, fire protection authorities and other community stakeholders, residents can make their own property – and their neighborhood – much safer from wildfire. Participate in a localized Community Wildfire Protection Plan to collectively identify community hazards and ways to improve wildfire preparedness. Consider pursuing recognition as a “Firewise Community” through the National Fire Protection Association’s Firewise Communities/USA® program, which encourages and acknowledges citizen involvement in reducing wildfire risk by working together. To learn more about Community Wildfire Protection Plans and the Firewise Communities/USA program, please refer to the following resources:

- NFPA Firewise Communities/USA website: <http://www.firewise.org/usa-recognition-program.aspx>
- Austin Fire Department - Firewise Program Coordinator: (512) 974-0298
- Texas A&M Forest Service - Wildland Urban Interface Specialist: (512) 339-4118



To find information about your local Austin or Travis County fire department, including where the nearest fire station is, visit the following websites:

- Travis County Emergency Service Districts and Fire Stations:  
[http://www.co.travis.tx.us/fire\\_marshall/esd.asp](http://www.co.travis.tx.us/fire_marshall/esd.asp).
- Austin Fire Department Fire Station Map:  
<http://austintexas.gov/sites/default/files/files/Fire/station-mapall.pdf>
- Fire Station Addresses:  
<http://austintexas.gov/page/index-afd-stations-addresses>

## Plan Access and Escape Routes

When propelled by strong winds, a wildfire can move as fast as 60 miles per hour! Proactive home defense measures can significantly increase a home's likelihood of survival, but these measures cannot guarantee personal safety in the face of a catastrophic fire. It is paramount to have a family disaster plan and exit strategy in place before an event that necessitates evacuation. Know the configuration of your neighborhood and identify

multiple emergency escape routes in your area. If you have concerns regarding limited entrances and exits to and from your neighborhood, contact your local fire department. When told to evacuate by authorities, leave the area immediately and choose a route that leads away from the fire. Stay alert to changes in the speed and direction of fire and smoke.



*By evacuating early, you can avoid being caught in fire, smoke or road congestion and give your family the best chance of surviving a wildfire.*

Remember that your safe way out, is the fire department's way in. Keep vegetation maintained so that driveways and private roads are clear and ready for an emergency exit by your family, and for emergency access by responders. The 2012 International Wildland Urban Interface Code (under consider-

ation for adoption in Austin) calls for an unobstructed driveway clearance of at least 12 feet wide by 13 feet 6 inches high. Keep fire hydrants clearly visible and accessible. Identify your home and neighborhood with clear and easily readable street names and numbers.

## Practice Situational Awareness

Wildfire can occur at any time throughout the year, but the risk increases during dry and windy conditions and in periods of extended drought. During "high-alert" or "red-flag" fire days, pay close attention to conditions and locations of flammable materials on your property. Take extra precautions on these days with measures such as moving straw mats and wicker patio furniture inside, sweeping leaf litter off the patio, and mowing with a manual mower or string trimmer to avoid potentially dangerous sparks and fuel leaks.



*Take extra precautions when conditions bring heightened wildfire risk.*

Register for the regional Emergency Notification System, which uses a "reverse dialing" telephone method to notify individual members of the public of critical emergency information in situations where property or human life is in danger. Citizens can link their land-line and/or cell phones to multiple Central Texas locations, including their homes, businesses, and homes of loved ones. If a public safety agency activates the system in a particular location, the system will attempt to send an emergency message to phones registered for that area. To register for this service, visit: <http://alertregistration.com/capcog/>. If you would like to receive a cell phone



*Prepare an exit strategy with multiple escape routes before emergency strikes.*





Captain Portie with the Austin Fire Department Wildfire Mitigation Division assisting homeowners by identifying hazards and assessing wildfire risk

text message when the Travis County burn ban status changes (i.e. when a burn ban has been lifted or a new ban put in place), sign up at: [http://www.co.travis.tx.us/fire\\_marshal/news/burn\\_ban\\_alerts.asp](http://www.co.travis.tx.us/fire_marshal/news/burn_ban_alerts.asp).

## *Identify Wildfire Hazards, Assess your Risk, and Plan Action Items*

Identify and prioritize the potential fire hazards of your structures, landscape, and surrounding areas before taking risk mitigation actions. You can contact your local fire department or the Texas A&M Forest Service to request a wildfire risk assessment.

Visit <http://www.Prepared.ly> to review current conditions and understand how they relate to your area's wildfire risk, schedule an on-site consultation for your home and neighborhood with local wildfire prevention experts, and stay informed and proactive about the threat of wildfires in your area by signing up for fire alert notifications. To learn more about specific wildfire risk levels in your geographic area, access the Texas Wildfire Risk Assessment Portal (TxWRAP) at <http://www.Texas-WildfireRisk.com>.

When planning actions to take in response to the hazards identified, keep in mind, structure protection efforts are generally less effective the farther they occur from the structure. A helpful strategy when evaluating your risks and prioritizing action items is to start from the ridge line of the roof and move outward.

## *Stay within Your Property Boundaries*

Your property alteration and management activities are limited to **your property** - so identify your property boundaries! Risk mitigation actions on your own property are the most effective in protecting your property from wildfire, and should always be implemented before considering potential hazards on adjacent properties. You could be liable for costs of mitigating the damage you cause to other property, in addition to other legal action for trespassing. If you have concerns about potential hazards outside of your property boundaries, contact the respective property owner to discuss the situation. Again, this is where having a localized Community Wildfire Protection Plan can help.



To discuss wildfire concerns on public land, contact the appropriate management authority. Common wildland management agencies in the Austin area include:

- City of Austin Balcones Canyonland Preserve and Water Quality Protection Lands  
Austin Water Utility, Wildland Conservation Division:  
**(512) 972-1662**
- City of Austin Parks and Natural Spaces, City of Austin Parks and Recreation Department, Park Rangers:  
**(512) 978-2600**
- City of Austin Electric Utility Easements, Austin Energy:  
**(512) 494-9400**
- City of Austin Drainage Easements, City of Austin Watershed Protection Department:  
**(512) 974-2550**
- Travis County Preserve Lands  
Travis County Natural Resources Program Manager:  
**(512) 854-7214**
- Travis County Parks  
Travis County Park Rangers:  
**(512) 263-9114**
- Balcones Canyonland National Wildlife Refuge  
United States Fish and Wildlife Service, Balcones Canyonland National Wildlife Refuge Office:  
**(512) 339-9432**
- Texas State Parks  
Texas Parks and Wildlife Department: **(512) 389-4800**
- Lower Colorado River Authority  
Parks, Recreational Areas and Natural Resource Centers  
Lower Colorado River Authority:  
**(512) 473-3200**
- The Nature Conservancy Lands and Conservation Easements  
The Nature Conservancy, Texas Field Office: **(210) 224-8774**



*Trees and other vegetation are valuable natural resources that offer a wealth of benefits.*

## *Recognize Natural Resources*

Identify important environmental resources on your property. Central Texas is a unique place with abundant natural resources. Pay special attention to water bodies such as creeks, rivers and ponds. Some natural areas may include protected “Critical Environmental Features,” such as wetlands, springs, caves, sinkholes, bluffs, and certain rock formations. Knowing what these features are and where they are located on your property will allow you to plan for their protection. Establish a buffer of natural vegetation, such as native grasses, around these critical features.

## *Appreciate the Value of Vegetation*

Austin’s urban forest is a healthy and sustainable mix of trees and other vegetation that comprise a thriving ecosystem valued, protected and cared for by the City and its citizens as an essential environmental, economic, social and community asset. In 2013, Austin ranked as one of the 10 best urban forests in the country (American Forests, “American Forests Names the 10 Best U.S. Cities for Urban Forests”). Trees offer us a multitude of benefits, many of which are discussed below.

## **Environmental Benefits**

Trees improve the environment in which we live by moderating climate, reducing erosion, treating stormwater runoff, cleansing the air, and harboring wildlife.

Vegetation moderates the sun and wind that can be extreme in our local climate. Radiant energy from the sun is absorbed or deflected by leaves on deciduous trees in the summer and only filtered by branches of deciduous trees in winter. Trees also lower air temperature by evaporating water in their leaves. The larger the tree, the greater the cooling effect. Trees in cities moderate the heat-island effect caused by pavement and buildings in commercial areas. Shade trees can make buildings up to 20 degrees cooler in the summer (“Trees and the Environment”). Wind speed and direction is also affected by trees. The more compact the foliage on the tree or group of trees, the more effective the windbreak.

Tree canopies intercept and slow the erosive forces of rainfall, sleet, and hail, providing protection for valuable topsoil. Root systems stabilize soil and further reduce erosion potential. Trees and other vegetation absorb water during a storm event and decrease the velocity of damaging runoff peaks in a watershed. Vegetation improves water quality by filtering sediment and other pollutants from stormwater before it enters creeks, rivers and aquifers.



Trees and other vegetation improve air quality by absorbing air pollutants such as carbon dioxide (a major greenhouse gas), ozone, carbon monoxide, and sulfur dioxide - and producing precious oxygen. A mature tree removes 60 to 70 times more pollution than a newly planted tree (Missouri). A two-acre stand of trees can remove a quantity of carbon dioxide that is emitted by a typical passenger vehicle, and produce enough oxygen to support 36 people ("Trees and the Environment").

Trees are critical for wildlife. As a tree moves through its life-cycle from seed, to seedling, to tree, to snag, to decaying log, to dirt, wildlife depends on it all along the way. Living trees are used by wildlife for food, shelter and reproduction sites. Many animals also use trees for resting, nesting and for places from which to hunt or capture prey. When trees mature, animals are able to enjoy delicious fruits and foraging opportunities. During times of extreme heat or precipitation, animals can seek shade and shelter under the trees without being away from their food source.

## Economic Benefits

Individual trees and shrubs have value, but the variability of species, size, condition and function makes determining their economic value difficult. The economic benefits of trees are both direct and indirect.

Direct economic benefits are usually associated with energy costs. According to the United States Department of Agriculture Forest Service, trees properly placed around buildings can reduce air conditioning needs by 30 percent and save 20-50 percent in energy used for heating. Annual energy cost reductions in U.S. homes that can be attributed to trees are said to be around two billion dollars (United States 6). As components of a well maintained landscape, trees can add value to your home. Property values of landscaped residences are 5 to 20 percent higher than those of non-landscaped homes (International).

The indirect economic benefits of trees within a community are even greater. Customers pay lower electricity bills when power companies build fewer new facilities to meet peak demands, use reduced amounts of fossil fuel in their furnaces, and use fewer measures to control air pollution. Communities can also save money if fewer facilities are needed for regional stormwater controls. To the individual, these savings may seem small, but to the community as a whole, reductions in these expenses can be substantial.

## Social and Communal Benefits

Trees and other vegetation offer a natural component in our urban landscape that beautifies our surroundings and provides a sense of serenity. The calming effect of urban forests have been documented to reduce workplace stress levels and fatigue, calm traffic, and even decrease the recovery time needed after surgery. Trees can also reduce crime. Apartment buildings with large amounts of landscaping and greenspace have statistically lower crime rates than nearby apartments without trees. Because of their potential for long life, trees are frequently planted as living memorials. We often become personally attached to trees that we, or those we love, have planted. The strong tie between Austin's citizens and trees is often evident when community residents speak out against the removal of trees for development or rally to save a particularly large or historic tree.

Even when located on a private lot, the benefits provided by trees can reach well out into the surrounding community. Likewise, large-growing trees can come in conflict with utilities, views, and structures that are beyond the bounds of the owner's property. With proper selection and maintenance, trees can enhance and function on one property without infringing on the rights and privileges of neighbors. Trees often serve several architectural and engineering func-

tions. They can offer privacy, emphasize views, screen out objectionable views, reduce glare and reflection, act as sound barriers, and direct pedestrian traffic. Trees also provide background to and soften, complement, or enhance architecture. Trees bring natural elements into urban surroundings and increase the quality of life for residents of the community.



While trees provide much prosperity, they also incur some costs. Investing in a tree's maintenance will help to return the benefits you desire. The costs associated with large tree removal and replacement can be significant. In addition, the economic and environmental benefits produced by a young replacement tree are minimal when compared to those of a mature specimen. Extending the functional lifespan of large, mature trees with routine maintenance can delay these expenses and maximize returns. An informed home owner can be responsible for many tree maintenance practices. Corrective pruning and mulching gives young trees a good start. Shade trees, however, quickly grow to a size that may require the services of a professional arborist. Arborists have the knowledge and equipment needed to prune, treat, fertilize, and otherwise maintain a large tree. To find a qualified arborist that can answer questions about tree maintenance and implement recommended treatments, visit: <http://www.treesaregood.com/find-treeservices/FindTreeCareService.aspx>.

## Preserve Critical Habitat

Some natural areas may contain habitat that supports threatened and endangered species. In Travis County, 25 animal and plant species, including the golden-cheeked warbler, black-capped vireo, texas-horned lizard, several salamanders, numerous cave-dwelling species and freshwater mussels are listed (or candidates to be listed) as threatened or endangered by state and federal authorities (Texas Parks and Wildlife). Threatened and endangered species habitat is protected by federal, state, and local regulations, **even on private property**. The Texas Parks and Wildlife Department provides management guidelines for several of the threatened and endangered species that occur in the Austin area, found at:

[https://www.tpwd.state.tx.us/hunt-wild/wild/wildlife\\_diversity/nongame/management/](https://www.tpwd.state.tx.us/hunt-wild/wild/wildlife_diversity/nongame/management/)

The Golden-cheeked Warbler could be particularly susceptible to adverse impacts resulting from poorly implemented wildfire risk reduction activities. The songbird breeds in only one location in the world: Central Texas. Habitat loss results from urban encroachment, widespread clearing of Ashe juniper as a range management practice, and other threats such as oak wilt. High quality breeding habitat for these birds is characterized by mature woodlands of Ashe juniper and a mix of oaks and other broad-leaved species with dense canopy cover. Some of this habitat can be found in western Travis County nature preserves, often extending outside preserve boundaries onto private property. The United States Fish and Wildlife Service published Best Management Practices for treating vegetation that may be associated with endangered golden-cheeked warbler habitat, available online at:

[http://www.fws.gov/southwest/es/Documents/R2ES/AUES\\_GCWA\\_FINAL\\_BMP.pdf](http://www.fws.gov/southwest/es/Documents/R2ES/AUES_GCWA_FINAL_BMP.pdf)



*Unique and diverse ecosystems in Travis County are home to many threatened and endangered species, including the Golden-cheeked Warbler (*Setophaga chrysoparia*). Poorly implemented wildfire risk reduction activities may result in adverse impacts to protected wildlife habitat.*

The guidelines aim to reduce the intensity of wildland fire while minimizing potential impacts to the bird.

For additional assistance with identifying and managing protected habitats, contact:

- Texas Parks and Wildlife Department: (512) 389-4800
- United States Fish and Wildlife Service, Austin Ecological Services Office: (512) 490-0057

## Observe the City of Austin Tree Protection Ordinance



The City of Austin's Tree Protection Ordinance regulates the removal and major pruning of large trees – those that are 19 inches and greater in diameter (measured 4.5 feet above ground surface). Most trees this size are hundreds of years old, so it is important to carefully evaluate the need to remove them and consider alternatives. Protected-size trees require a permit from the City Arborist for tree removal, pruning





*The Austin Fire Department carefully manages a prescribed burn.*

more than 25 percent of the canopy, or impacts the critical root zone (i.e. constructing a utility trench, sidewalk, driveway, irrigation lines, or foundation near the tree). Trees smaller than 19 inches in diameter are not regulated. For more information on Austin's Tree Protection Ordinance, visit the City Arborist website at: <http://austintexas.gov/departments/city-arborist>, or contact the City Arborist at: (512) 974-1876.

## *Know Regulations and Permitting*

Identify other federal, state, and local codes and regulations that may apply to your wildfire preparedness activities, including rules enforced by homeowners associations or other local governing jurisdictions. Obtain necessary permits or authorization before performing significant activities such as land grading, building a retaining wall, constructing a permanent erosion or sediment control structure, or performing work near streams, wetlands, or other protected environmental features. Be aware of the City of Austin Hill Country Roadway Ordinance, which requires properties within designated geographic corridors to preserve vegetation in a natural state on portions of the property, including along the roadway. For properties subject to this ordinance, refer to the property's

approved site development plan to determine where the protected natural areas are located before performing vegetation management activities. For additional information about permitting and other regulatory requirements in the City of Austin, contact the Development Assistance Center at: (512) 974-6370.

## *Understand Prescribed Fire*

Did you know that fire can be good for people and the land? Prescribed fire (sometimes referred to as prescribed burning, controlled burning, or good fire) is a land management tool that can be used to:

- Restore fire to the landscape, simulating natural processes;
- Reduce unnaturally high accumulations of vegetation;
- Decrease the risk and severity of unwanted wildfires in the future;
- Lessen the potential loss of life and property;
- Control many undesirable plant species, plant diseases and pest insects;

- Create and enhance wildlife habitat and increase availability of forage;
- Promote the growth of native trees, wildflowers and other plants; and
- Expose mineral-rich soil and recycle plant nutrients back to the soil.

When utilized correctly by professionals, prescribed fire is applied only after developing a written plan that identifies land management goals and specific fire use strategies to be used to safely achieve those goals. Prescribed fire plans address characteristics of the land being treated (like topography and vegetation type) and include carefully-defined parameters for temperature, humidity, wind, moisture of the vegetation, and conditions for the dispersal of smoke. The plans also specify how the fire will be applied, by whom, and what fire control people and equipment must be on-scene before the burn can commence. After the plan is complete and conditions are right, a prescribed burn can proceed under the supervision of a qualified burn manager. Low intensity fire is skillfully applied to selectively burn fuels like dead wood, brush, forest understories, and grassland. The smoke from a prescribed fire can be a nuisance, but when prescribed fire is planned and executed by professionals, smoke impacts can be greatly reduced.

Prescribed fire is usually the ideal wildland fuel treatment method. It is very compatible with environmental goals and a cost-effective alternative to more labor intensive and time



*Application of prescribed fire can result in less intense, and fewer wildfires.*

consuming methods like mechanical or hand-clearing of vegetation. The Wildland Conservation Division of the Austin Water Utility commonly uses prescribed fire on City of Austin wildlands. On Water Quality Protection Lands, where the management goal is to return the land to an oak-juniper savannah, it effectively reduces invasive plants and invigorates native grasses. On Balcones Canyonland Preserve properties, prescribed fire creates and

maintains habitat for an endangered songbird, the Black-capped vireo. City staff works closely with local fire departments and natural resource partners to ensure that adequate planning and resources are in place to conduct prescribed fires safely.

Periodic fire events have always played an integral role in many Central Texas ecosystems, and they will continue to occur. Therefore, it's not a question of

*if* the land will burn again, but *when* and under what conditions - controlled or uncontrolled? Application of prescribed fire can result in less intense, and fewer wildfires.

Residents are not allowed to conduct prescribed burns, including brush pile burns, inside Austin city limits. If you have questions about using fire as a management tool, contact your local fire department.

## EVALUATE AND MODIFY YOUR PROPERTY

### *Harden the Home*

A “hardened home” has reduced wildfire risk because it uses many non-combustible building materials and is maintained in a fire-resistant condition. The Firewise approach begins with a hardened home as the primary fire protection method, and moves outward. The farther you move away from a structure, the less effective efforts are at mitigating the wildfire risk.



*A hardened home constructed with non-combustible building materials is the best defense against falling embers, and greatly improves a home's chances of survival.*

Individuals planning a new construction or renovation project should take advantage of the opportunity and



*Falling embers from a wildfire can easily ignite leaves and dry debris collected in rain gutters.*

maximize the structure's fire-resistant qualities by incorporating the following design elements and building materials. Others who are not building a new home or planning a major renovation can still integrate many home hardening measures at no or little cost.

- Large roof surfaces are capable of catching burning embers, making them one of the most vulnerable components of a house. Wood shake roofs are especially prone to ignition and should be avoided, even when treated with a fire-retardant sealant. Embers can set a roof on fire by getting lodged between shingles or igniting collected leaf litter and debris. Use ignition-resistant, Class A-rated roofing materials such as composition, metal or tile (with bird stops) and keep roof surfaces clear of debris. Roof fea-

tures such as dormers and split-level roofs create inside corners and other nooks that are more likely to accumulate leaf litter and other ignitable material. Where possible, cover those corners with metal roof flashing.

- Embers can find their way into your attic through unscreened vents. From inside the attic, install a 1/8-inch metal screen over vent openings to create a barrier and restrict ember intrusion. Over time, 1/8-inch screening may become clogged with debris. Routine maintenance should be completed to keep the vent clean and effective.
- Eaves protect a home from rainwater, but during a wildfire event, they can be vulnerable to direct flame contact and embers



entering through soffit vents. Eaves that are boxed in with non-combustible materials can withstand flames better than open eave configurations. Install angle flashing along the roof edge and screen soffit vents to prevent embers from entering the attic area.

- Equip chimneys with a spark arrestor screen covering the opening. The screen should have openings no smaller than 3/8-inch and no larger than 1/2-inch.
- Check your gutters to ensure they are clear. Consider installing gutter guards or screening to prevent leaves and other ignitable material from building up. Maintain the roof where the gutter connects so that debris does not accumulate between the installed gutter guard and roof. Metal gutters equipped with angle flashing for edge protection are recommended.
- To increase a home's resistance to radiant heat and direct flame contact, exterior walls should be made of ignition-resistant materials. Insulated concrete forms, or ICFs, are polystyrene blocks that fit together to form a home's shell and then filled with concrete creating solid walls that can reportedly withstand fire up to four hours. Other siding materials that offer fire protection include cement siding, stucco or fire-retardant treated wood.
- Windows should be double-paned, with one of the panes made of tempered glass. This will reduce the potential for radiant heat to break the window and spread fire inside the home.
- Remove debris and other flammable material from exterior crawl spaces, including under your deck or balcony. Then screen the open area using 1/8-inch metal screen reinforced with non-combustible skirting to create a barrier for embers. Don't store firewood in these locations.
- Think about other areas where leaves and fine debris normally gather when the wind blows. During a fire, these same places are also where embers will likely collect and could start a fire.
- Keep fire from gaining a foothold on your deck by using fire-resistant, Class A-rated deck and framing materials. Pressure-treated deck boards that contain fire-retardants are an economical choice for good fire protection, but tend to leach toxins over time, degrading both the environment and the



*Wooden privacy fences can act as a wick and carry fire directly to your home.*



*Use ignition-resistant, Class A-rated roofing materials and keep roof surfaces clear of debris.*



*Non-combustible building materials and design, and the quality of defensible space surrounding the structure are key factors that give your home the best chance of surviving a wildfire.*



stability of the wood. Toxin free alternatives that offer equal or better fire protection include composite decking (made from PVC and wood fiber), and wood-and-glass boards (created by soaking lumber in liquid glass and then baking it).

- Wooden privacy fences can act like a wick and can carry fire directly to a structure. Interrupt this conduit for fire by inserting sections of fence made of noncombustible materials such as stone or wrought iron, especially for the sections of fence that attach to the home or run under eaves.
- Consider having multiple garden hoses that are long enough to reach any area of your home and any structure on your property.
- If your home is dependent on a well for water, install a backup generator so that water is still available if the electricity goes out.

For more detailed information on Firewise home construction, renovation and maintenance visit:

<http://texasforestservice.tamu.edu/uploadedFiles/Edited%202012materials%5B1%5D.pdf>

## Create and Maintain a Defensible Space

Defensible space around a home is one of the most effective fire protection tools. Defensible space is a specially designed protective buffer around a building where potential fuels (vegetation and other materials) have been modified, reduced, or cleared to:

- Produce a barrier that impedes wildfire from reaching your home,
- Prevent a house fire from spreading into a wildland or to neighboring properties,



*Effective defensible space helped save this home during the Steiner Ranch wildfire in September 2011.*

- Reduce exposure to radiant heat,
- Limit flammable materials where an ember could land and start a new fire, and
- In the event of a fire, provide maneuvering space for emergency responders to safely conduct fire suppression operations.



*With some careful planning, you can achieve a landscape that is aesthetically pleasing and helps protect your home from wildfire.*

Firewise landscape designs have a bad reputation of being unattractive; however, with some careful planning, you can achieve a landscape that is aesthetical-

ly pleasing and contains fire rather than fuels it. A common misconception is that defensible landscape design calls for the stripping of trees and plants, leaving a barren wasteland of a yard. Reduction of plant fuels is a key component, but defensible space does not require the removal of all vegetation to be effective. In fact, improper or poorly-conceived clearing can actually make the area more fire-prone. Keep in mind, defensible space does not necessarily eliminate fire, but rather changes the behavior of fire in a way that reduces flame length, fire intensity and ember production. Choosing the right plants, spacing them strategically to provide enough distance between plant groups and structures, and maintaining a healthy landscape will have a dramatic effect on fire behavior.





*This Bastrop home had an attached wooden deck surrounded by dense vegetation. These types of conditions often result in home loss during a wildfire event.*

The size and shape of your defensible space depends on many factors. Developers, homeowners, insurance providers and architects search for a specified setback distance for defensible space. What's the magic number? Through the research of multiple agencies and scientists, a value of 30 feet was determined and is still a common standard. Over time, the idea of defensible space has evolved and changed, introducing new terms like "inner and outer protection areas," "Zones 1-3," and the "home-ignition zone." These methods are an attempt to simplify complex concepts of defensible space and seek a "one-size-fits-all" answer. The result has confused many homeowners and caused them to misunderstand the true intent of defensible space. **A standard buffer distance should not be applied universally to every structure.** Homeowners and developers should be aware that standard defensible space recommendations, including those provided in this publication, require adjustments based on the structure's unique footprint, location on the topography, property size, proximity to wildlands, surrounding vegetation, and local climate. Fuels and site conditions need to be assessed beyond "standard" distances around homes to fully account for real wildfire threats in a site-specific context. In an urban setting like Austin, the size of defensible space is often limited by the property boundaries of small lots. Surrounding properties can be a significant threat if ignited by fire. Members of a fire-adaptive community must work in unison to reduce the risk of structure-to-structure burning, which can cause extensive damage to entire neighborhoods.



*A retaining wall constructed with noncombustible materials can help prevent a fire from moving up a slope, and provides key defense to homes located on steep topography.*

The landscape within a defensible space is a dynamic, constantly changing system which must be diligently maintained. The following list provides ideas on how to keep your defensible space in a fire-resistant condition.

- Be aware of the growth habits of the plants on your land and the changes that occur seasonally. Keep a watchful eye for the need to reduce fuel volumes and fuel continuity.
- Timely pruning is critical. In addition to reducing fuel volume, it also promotes healthier plants.
- Do not allow material that can serve as fire kindling to accumulate around your property. Rake and remove leaves, dead branches and other litter as it builds up.
- Remove annual, herbaceous plants after they have gone to seed or when the stems become overly dry.
- Mow or trim grasses to a low height within your defensible space. This is especially important as they cure and dry.
- When clearing and treating vegetation for fuel reduction, target plants that are undesirable (such as exotic invasive species), overgrown, considered "highly-flammable" species, dead, dying, or damaged.
- Do not store yard waste or firewood inside the defensible space.
- Be aware, when vegetation is removed to bare soil, it will eventually be replaced, often by fast-growing grasses or invasive plant species that are even more difficult to manage.
- Replant with fire-resistant natives after significant vegetation removal.



# Account for Topography

The Texas Hill Country is known for its canyons, hilltops and valleys, but these beautiful features can put structures at increased risk of wildfire. The topography around buildings is a major consideration in assessing wildfire risk exposure. Fires generally tend to burn uphill where they can produce more flaming embers that are capable of travelling longer distances, have longer flame lengths, and travel much faster and more intensely than fires moving along flat ground. Therefore, structures built on vegetated hillsides or at the edge of a ridge or bluff are at greater risk and warrant extra precautions.

- For new construction, or when making future improvements, incorporate ignition-resistant materials and design features into the building plans;
- Where possible, extend the downslope defensible space distance and implement a more aggressive vegetation management plan in that area;
- Consider building a noncombustible retaining wall downslope to bolster the effectiveness of your defensible space and prevent fire from spreading farther upslope.

## Limit Fuel Continuity

To restrict a fire's ability to travel via direct flame contact and radiant heat, plant clusters must be well-spaced with adequate horizontal and vertical separation between one another, and to structures. When adding plants to your landscape, follow the general rule, "Put the right plant in the right place." Arrange plants in small groups and islands, not in large masses.

For the area immediately around your home, practice the "fire-free three" technique: within the first three feet of structures and attachments such as decks and porches, avoid the use of flowerbeds, shrubbery and bark mulch.



*Austin's Firewise Program Coordinator evaluates a steep vegetated canyon slope and the associated risk to homes above.*

Instead, use non-flammable landscaping materials in this area, such as gravel and decorative pavers. If plants are strongly desired in this critical space, choose perennial plants with high-moisture content.



*Island landscaping allows for space between fuels and will slow the spread of fire.*

Further reduce horizontal fuel continuity inside the defensible space by identifying and correcting hazards like dry grass growing up against or leading to the foundation, or a woodpile next to the home or deck. Organic wood mulch is often used in home landscapes. If mulch becomes dry, it can be easily ignited and potentially convey fire to your home. If wood mulch is used in your defensible space, exercise caution and keep it moist to prevent possible ignition. Stop or slow the lateral movement of fire by creating fire-breaks with non-combustible features such as rock pathways and stone walls weaving through your landscape, boulderscapes, driveways, and healthy lawns.



*These fine grasses and shrubs provide continuous fuel and will allow a fire to spread uphill to the wooden deck and home.*



Break the vertical continuity between surface vegetation, tree canopies, and structures by removing “ladder fuels” in the defensible space. Ladder fuels enable fire to spread upward from low-level vegetation into tree canopies or structures. Do not plant potentially large trees and shrubs under utility lines or roof eaves, and place small trees and shrubs away from larger trees to avoid creating ladder fuels. Remove dead vegetation underneath bushes and shrubs.



Closed tree canopies can suppress highly flammable grasses and other surface fuels. Removal of intermediate ladder fuels results in a “shaded fuel break” which can be effective in slowing or stopping the spread of fire.

## *Choose Fire-Resistant Plants that are Native or Adapted to Central Texas*



Left: Plants with high moisture content, such as succulents, are generally less flammable.

There are no “fire-proof” plants. All vegetation - naturally occurring and ornamental, native and exotic - can burn during intense wildfire. But, some vegetation is more flammable than others and can greatly increase the speed with which a fire spreads.

Select native and adapted plant species for your defensible space that are high in moisture content and can be easily pruned and maintained. Plants

that are native or adapted to Central Texas are usually resilient to extreme seasonal temperatures and generally require less water to survive, making them the best-suited plants to tolerate the local climate. This may become important during extended drought when water resources are limited by watering restrictions. Additionally, many native species are fire-adapted, which means that their tops may burn off in a fire, but the roots develop to such an extent that they are typically the first

to regenerate after a fire. The robust root systems of natives also reduce the potential for property damage from post-fire erosion. For guidance on specific native and adapted plant species, refer to the City of Austin Grow Green Gardening Education Program ([www.growgreen.org](http://www.growgreen.org)) and Recommended Native and Adapted Plant Guide ([www.austintexas.gov/department/grow-green/plant-guide](http://www.austintexas.gov/department/grow-green/plant-guide)). Do not be confused when consulting the plant guide resources - not all native and adapted plants are fire-resistant.

Exotic and invasive plants can lead to property conditions that are more susceptible to fire. Exotic species that are not drought-resistant are prone to dying during a drought, thereby creating additional fuel. Invasive plant species grow and spread rapidly, creating unmanageable fuel.

General concepts to keep in mind when choosing and maintaining fire-resistant plant species include:



- A plant's moisture content is the single most important factor governing its flammability. Keep your landscape plants well-irrigated, as allowed by watering restrictions. Current information on City of Austin watering restrictions can be found at <http://www.austintexas.gov/department/water-conservation>.
- Plants with high concentrations of oil, wax, resin, terpenes, or pitch (usually indicated by leaves/needles and sap that are sticky or gummy and have a strong odor) are generally more volatile, even when well-watered. For example, conifers, cedars, junipers, holly, rosemary, yaupon holly, and agarita are considered highly flammable. If you desire to use these types of plants in your landscape, place it outside of defensible space and ensure there is adequate vertical and horizontal separation from other potential fuels.
- Fire-resistant plants do not accumulate or shed large amounts of combustible materials (litter, fine branches, twigs, needles or leaves), which burn readily when dry.
- Deciduous plants tend to be more fire resistant because their leaves have higher moisture content and their basic chemistry is less flammable. Also, when deciduous trees are dormant, there is less fuel to carry fire through their canopies.
- Plants with an open and loose branch/stem configuration have a lower volume of total biomass that could potentially become fuel.
- Plants that grow slowly and require less pruning will make it easier to maintain your landscape in a fire-resistant condition.
- In some cases, there is a strong correlation between drought tolerance and fire resistance.

- During periods of extreme drought and irrigation restrictions, prioritize the plants you wish to save. Provide supplemental water to those nearest your home first.

## *Recognize Streamside Vegetation Benefits*

Although it may seem counterintuitive, some types of vegetation – particularly riparian woodlands along creeks, streams, and rivers – have low ignition potential. Riparian vegetation can inhibit ignition, diminish fire intensity, and halt or slow the spread of fire by:

- Reducing wind and air temperature;
- Maintaining higher soil moisture and humidity; and

- Suppressing the growth of natural grasses and other fine surface fuels - the primary carriers of wildfire in Central Texas.

In addition to wildfire suppression, riparian vegetation offers a wealth of other environmental benefits including stabilizing creek banks and reducing erosion, filtering and sequestering pollutants, purifying water, creating shade, regulating water temperature, and providing excellent wildlife habitat.

When coupled with Firewise strategies around the home, preservation of riparian vegetation serves the mutually beneficial long-term goals of increased environmental integrity and reduced threat of property damage by wildfire.



*Riparian vegetation can inhibit ignition, diminish fire intensity, and stop or slow the spread of fire, along with a wealth of other environmental benefits.*



## Consider Snags and Brush Piles

Although the removal of dead and dying vegetation is important in your defensible space, understand that the presence of this material in the environment benefits wildlife and soil. By some estimates, the removal of dead organic material results in a loss of habitat for up to one-fifth of the animals in the ecosystem! Standing dead trees (also known as “snags”), logs, brush piles, downed woody debris, and stacks of firewood provide wildlife with protection from predators, shelter from inclement weather, a source of habitat, and feeding places. Snags occurring along streams and shorelines may eventually fall into the water, adding important woody debris to aquatic habitat. Decaying logs retain moisture and nutrients that aid in new plant growth and support wildlife such as soil organisms (earthworms, beetles and other insects). These fuel sources usually do not pose a significant hazard when located outside of the defensible space and away from structures, roadways, and other commonly occupied areas.



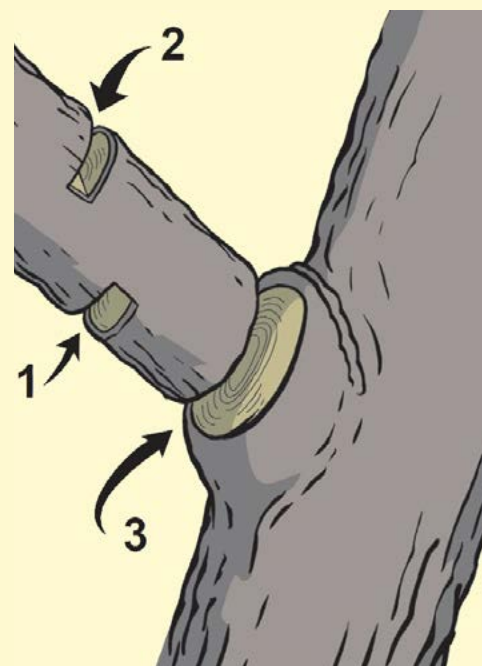
The Red-bellied woodpecker (*Melanerpes carolinus*), a prevalent cavity-dweller in Central Texas, uses a snag.

## Practice Proper Tree Care and Management

Excessively dense tree canopies can facilitate crown fire spread and produce large quantities of flaming embers. Additionally, continuous trees canopies in close proximity to homes can carry fire to the structure.

Remove dead tree limbs, branches making contact with roofing and siding, and branches overhanging structures and decks. Trim the lower branches of trees to at least six feet above the ground. Prune trees to decrease canopy density while maintaining canopy closure. Shade provided by closed tree canopies reduces the potential for fire by limiting ignition-prone surface fuels (such as dry grass), reducing air temperatures, and maintaining higher humidity.

Right: If a large limb is to be removed, its weight should first be reduced. This is done by making an undercut about 12 to 18 inches from the limb's point of attachment. Make a second cut from the top, directly above or a few inches farther out on the limb. Doing so removes the limb, leaving the 12- to 18-inch stub. Remove the stub by cutting back to the branch collar. This technique reduces the possibility of tearing the bark.



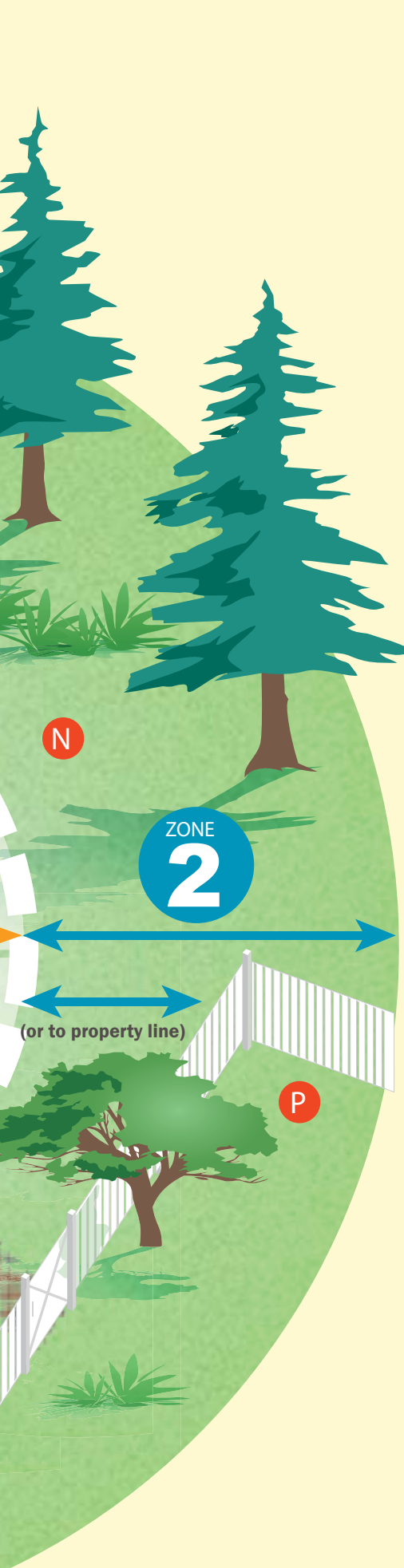
Practice proper tree pruning techniques. To learn how much of a tree should be pruned, and where cuts should be made, visit <http://www.treesaregood.com/>.

If desired, trees that are near the home can be preserved by incorporating them into the footprint of the home





## Zone One (Lean, Clean, Green Zone)

- 
- A** A Firewise property starts with the structure and moves outward. A home constructed with fire resistant building materials should always be considered the primary method of protecting the structure from fire.
  - B** Water lawn, plants, and trees regularly (as allowed by watering restrictions) to ensure that they are healthy, especially during fire season. Mow the lawn regularly.
  - C** Remove dead, dying, or dry vegetation, leaf litter, and other debris from yard, roof surfaces, gutters, and other locations where it accumulates.
  - D** If you have big beautiful shade trees you want to keep, you can incorporate them into your home's footprint. Then, defensible space will extend around your home and those chosen trees. Prune trees so the lowest limbs are at least 6 feet from the ground, and limbs have adequate clearance from structures.
  - E** Eliminate ladder fuels and accumulations of woody debris. Remove dense understory layers and thin tree canopies. Prune trees so the lowest limbs are at least 6 feet from the ground.
  - F** Plants in Zone 1 should be carefully spaced, mostly low-growing, and low in resins, oils and waxes that burn easily.
  - G** Within the first 3 feet of the home, use nonflammable landscaping materials, such as rock and pavers. If plants are desired in this space, choose perennial plants with high-moisture content.
  - H** Add protection with "fuel breaks," such as driveways, gravel walkways and healthy lawns.
  - I** Consider using nonflammable material for fencing, at least for the sections of fence that connect to your home.
  - J** Clearly mark septic tank locations. The weight of fire trucks can collapse them, immobilize the truck, and endanger personnel.
  - K** Identify your home and neighborhood with clear and easily readable street names and numbers.

## Zone Two (Reduced Fuel Zone)

- L** This area should be thinned out as well, though less space between potential fuels is needed than in Zone 1.
- M** Create separation between low-level vegetation and tree branches by removing ladder fuels, reducing the height of low-level vegetation, and/or trimming low tree branches.
- N** Don't allow grass and other surface fuels to become overgrown in Zone 2. Typically, surface vegetation in this area should be maintained at a height no greater than 4 inches.
- O** Locate any propane tanks, firewood stacks, brush piles, and snags in Zone 2, at least 30 feet from the home.
- P** Collaborate with your neighbors for a more effective, community-based approach to wildfire protection.
- Q** Provide adequate emergency vehicle access by maintaining a driveway clearance of at least 12 feet wide by 13 feet 6 inches high.
- R** Preserve natural vegetation along creeks, streams, and rivers. The higher moisture content of riparian corridors reduces fire intensity and can serve as a fire break.

and redefining defensible space zones accordingly. Then, defensible space setbacks will extend around your home and those chosen trees. While this is a gratifying option that may allow valued trees to be kept, diligent maintenance becomes even more critical. Ensure there is no pathway for potential fire to reach the incorporated trees and your home, and tree litter is routinely removed from roof surfaces, gutters, and other areas where it accumulates.

If you're concerned by a tree on an adjacent property that has limbs extending over your property line, contact the respective property owner. This is a civil issue and tree limbs should never be arbitrarily cut at the property line without regard for proper tree pruning techniques and tree health.

Pruning large trees can be dangerous. If pruning involves working above the ground or using power equipment, it is best to hire a professional arborist. An arborist can provide the services of a trained crew to improve the health, appearance, and safety of your trees with the necessary safety equipment and liability insurance. To find a tree care service professional, visit: <http://www.treesaregood.com/find-treeservices/FindTreeCareService.aspx>. Seek those with experience in vegetation management for wildfire risk reduction.

## Prevent Oak Wilt

Austin is losing one of its most treasured assets - the beautiful live oak and red oak trees that form a shady, green canopy over the city. These oak trees are being threatened by oak wilt, a contagious tree disease caused by a fungus.

Over the past twenty years, Austin has lost more than 10,000 oaks to the incurable disease, many of which had existed in our landscape for a century or more ("Oak Wilt Suppression"). For both, individuals and the City as a whole, the deaths of such majestic trees are felt by reduced property val-

ues, increased utility bills, and a sense of devastation.

The fungus infects the vascular system of a tree, which contains vessels that transport moisture throughout the tree. The vessels of an infected tree effectively become blocked by the fungal infection, and cannot transport adequate moisture to sustain a healthy or living tree. In most cases, the end result is tree mortality.

Trees infected with oak wilt can spread the disease to surrounding oaks via their interconnected root systems. When that happens, the only way to stop further spread is by digging trenches to break the root connections. The deadly fungus can also be spread by insects, which strike primarily from February through June. Sap-feeding beetles are attracted to oak wound sap and the sweet-smelling spore mats produced by infected red oaks. The disease is spread when those insects fly from an infected tree to feed on a healthy red oak or a live oak with a fresh wound.

You don't want to manage oak wilt - that means you have it, and it is very difficult to stop. Preventing oak wilt is the key. While caring for your trees, protect live oaks and red oaks from transmission of oak wilt fungus by adhering to the following guidelines:

- Avoid pruning or wounding oaks during the spring (February 1 through June 30).
- Always seal fresh wounds on oaks, including pruning cuts and stumps, with wound dressing or latex paint immediately, at all times of the year. A wound is created any time bark is removed and wood is exposed. That can happen with the simplest of tasks - pruning limbs, clearing brush, tree removal, or even pushing a lawn mower over a bare tree root.
- Clean all pruning tools with 10 percent bleach solution between trees.



*Left: Leaves on diseased live oaks often develop yellow veins that eventually turn brown, a symptom called veinal necrosis. Most live oaks defoliate and die in 1-6 months.*

*Right: Foliar symptoms of oak wilt on red oaks are less distinct. In early spring, young leaves simply wilt, turning pale green and brown, usually remaining attached for a period of time. Mature leaves develop dark green water soaking symptoms or turn pale green or bronze, starting at the leaf margins and progressing inward. This can begin on one branch and quickly engulf the entire tree. Red oaks generally die within 3-6 weeks.*



*Bottom: Oak wilt fungal mat exposed.*



- Consider consulting with a professional if you suspect that you have infected trees on your property. Oaks that are confirmed to be diseased should be destroyed.
- Debris from diseased oaks should be immediately chipped, burned or buried.

To learn more about oak wilt please refer to: <http://texasoakwilt.org>.

## *Avoid Using Herbicides*

When removing vegetation for wildfire preparedness, avoid the use of chemical herbicides and opt for more environmentally-friendly, manual removal methods. Herbicides negatively impact the water quality of our local streams and aquifers. Chemicals used in popular herbicides are showing up in groundwater and surface water monitoring sites across Austin. When herbicide use is determined to be necessary, always follow manufacturer's instructions.

## *Dispose of Trimmings and Brush Properly*

Mounds of tree branches and debris are the inevitable result of vegetation management activities. Before you start cutting, figure out what you are going to do with your slash. Once cut, this material can present an even greater fire hazard and should be disposed of promptly and appropriately. Consider coordinating with your neighbors so that trimmings can be disposed of collectively during a community clean up event. If you must store slash on your property temporarily, locate piles away from structures, outside of the defensible space. Do not illegally burn or dump vegetation waste. Disposing of yard waste over your fence, a seemingly innocent act, is usually illegal dumping and can create a fire hazard. Never place brush or clippings in a water channel (wet or dry, natural or manmade), cave, sinkhole or other environmental feature.



*Austin Resource Recovery collects large brush from residential customers twice a year. Plan your vegetation management activities accordingly.*

Some disposal options for your yard trimmings and brush include:

- **Outdoor Burning:**  
If you are interested in using fire as a management tool, contact your local fire department first. Open burning of brush or other waste on private property is not allowed in the City of Austin. For Travis County residents outside the corporate boundaries of a municipality, on-site burning of trees, brush, grass, leaves, branch trimmings, or other plant growth, by the owner of the property or other person authorized by the owner, is allowed during certain times of year, when a burn ban is not in effect and when the material is generated only from that property. Such burning is subject to the Texas Outdoor Burning Rule and structures containing sensitive receptors must not be negatively affected by the burn. For more information on the Texas Outdoor Burning Rule, visit:

[http://www.tceq.texas.gov/publications/rg/rg-049.html/at\\_download/file](http://www.tceq.texas.gov/publications/rg/rg-049.html/at_download/file).

Before burning, notify and obtain permission from:

- Neighbors (“sensitive receptors”),
- Local fire department, Travis County Fire Marshal: (512) 854-4621, and
- Texas Commission on Environmental Quality Regional Office: (512) 339-2929

When burning slash, follow these basic rules:

- Always make sure your burn pile is completely burned or put out before dark.
- Have fire suppression tools on hand such as garden hoses, shovels and rakes.
- Make sure that the area is completely clear around and above the burn pile. Check for overhanging tree limbs and utilities.
- Do not burn garbage with vegetative material.
- Someone should be pres-



ent to monitor the fire. Never leave a burn pile unattended.

- Do not burn on windy or excessively dry days.
- Rake all material together.
- Keep your piles small and manageable!

- **Recycle On-site:**

Rent or hire the services of a chipper and turn your clippings into mulch for use on site in your landscape beds, as protective ground cover on your property, or in your compost mix. Perhaps your neighbors or homeowners association will share the cost. Keep in mind that organic mulch can be flammable too, so don't place it immediately around structures or let it become too dry, and use cautiously within your defensible space.

- **Recycle by Third-party:**

For residents inside Austin city limits, Austin Resource Recovery provides weekly yard trimmings collection (grass clippings, leaves and small branches or limbs that are no longer than 5 feet and no thicker than 3 inches in diameter), and twice-per-year large brush collection. Trimmings and brush collected by Austin Resource Recovery are composted and turned into Dillo Dirt. For more information, including your curbside collection schedule, visit: <http://www.austintexas.gov/department/residential-curb-side-collection-schedule>.

Additionally, many local recycling and composting companies will accept your yard trimmings for a small fee.

- **Private Waste Hauler Disposal:**

If you hire the services of a private waste hauler, be sure the waste is disposed of legally. The City of Austin licenses private waste haulers. If an unlicensed contractor illegally dumps your waste, you may face a maximum fine of \$2,000 and one year in

jail. To protect yourself from this liability, consider opting for the services of a licensed organic material hauler and ask them for a receipt verifying where it will be discarded. A list of licensed haulers can be found online at: <http://www.austintexas.gov/department/austin-private-waste-hauler-licensing>.

- **Landfill:**

You can haul vegetative waste to a Type IV or Type I Municipal Solid Waste landfill and pay the disposal fee. Several of these landfills are located around Austin:

- Austin Community Landfill  
9900 Giles Road, Austin  
(512) 272-4329
- Texas Disposal Systems  
Landfill  
3016 FM 1327, Buda  
(512) 421-1363
- IESI Travis County Landfill  
9600 FM 812, Austin  
(512) 243-6300



*Dumping vegetation waste over your fence is illegal and can present an extreme fire hazard.*

## *Prevent Combustion of Home Compost Piles*

During dry, hot, or windy weather conditions, carefully monitor compost piles which can potentially combust. Compost piles heat up when microorganisms, such as bacteria and fungi, reproduce and break down organic material at a rapid pace. If materials in a very large compost pile are relatively dry, the pile may self-heat to a temperature high enough to spontaneously combust.

To reduce fire risks associated with compost piles, follow these safety measures during hot summer months.

- Compost piles should be no larger than 1 cubic yard.
- Turn piles weekly during high temperatures.
- Keep piles moist.
- A compost thermometer may be used but is not essential. If a thermometer is used, turn the pile when internal temperatures reach 160 degrees Fahrenheit.



*Very large compost piles may self-heat and spontaneously combust.*



# AFTER THE WILDFIRE

## EVALUATE POST-FIRE CONDITIONS AND IMMEDIATE NEEDS

### *Identify Immediate Threats and Develop a Recovery Plan*

Once authorities have determined that it is safe to return to your property, evaluate post-fire conditions to identify immediate threats to people, structures or the environment. This evaluation will assist you in developing a recovery plan. Recovery plan components may include the following:

- Identify and mitigate safety hazards, such as damaged trees and structures.
- Assess and remediate pollutant releases to the environment and other adverse impacts to natural resources.
- Characterize, segregate and determine proper disposal methods for debris and waste.
- Clean-up and dispose of ash, soot, fire-retardant and debris.
- Design and implement erosion and sedimentation controls and revegetate, where needed.
- Repair damaged drainage structures to reduce impacts from potential post-fire flooding.
- Restore wildlife habitat.



*Evaluate post-fire conditions to identify immediate threats to people, structures and the environment.*

### *Realize the Potential for Contamination*

Some items impacted by fire can pose a threat of contaminant release to the environment, such as chemicals or fuel in aboveground storage tanks or other containers. If a spill of unmanageable volume or a material of concern is found, call the City of Austin 24-Hour Pollution Hotline at (512) 974-2550. If the spill poses a threat to public health and safety, call 9-1-1 first.

In addition to obvious pollutants like containers of chemicals, building materials can also contribute pollutants. For example, burned pressure-treated lumber can be a source of toxic metals like arsenic, and burned PVC materials may release chemicals like dioxins. Treat ash and debris resulting from burned structures as a contaminated waste (as

opposed to ash resulting from burned vegetation). Exercise extra caution and wear appropriate protective equipment when removing ash and debris from burned structures. Older buildings in particular may contain hazards such as asbestos and lead. If you suspect that asbestos-containing building materials or lead-based paints were damaged during the fire, contact an industrial hygiene professional.



*Chemicals, petroleum products and building materials can pollute the environment following a wildfire.*



## *Assess Impacts to Natural Resources*

Identify specific environmental resources impacted by the fire. Contact the City of Austin Watershed Protection Department or your local jurisdiction for recommendations on restoration of lands in or near sensitive natural features such as creeks, rivers, ponds, lakes, wetlands, springs, or groundwater recharge features.

## *Follow Regulatory Requirements*

Be aware of code limitations and obtain necessary permits before cutting down trees, performing major land-grading activities, building a retaining wall, constructing a permanent erosion or sediment control structure, or performing work in a riparian area, wetland, stream, or other natural area. Contact your local jurisdiction with questions regarding permitting. Before performing excavation activities, locate your underground utility lines for free by calling (800) 545-6005.

## *Consider Obtaining Professional Assessments*

Acquire professional damage assessments for the private and public utilities that are connected to your home such as gas lines, wastewater lines, septic systems, water wells, irrigation systems, storm drain inlets and culverts. Utility infrastructure, such as PVC piping, may have melted or otherwise been destroyed in the fire or by firefighting operations. Repairs may be necessary to stop contaminant releases or to reestablish proper drainage for stormwater management. You may also want to consider hiring a professional to assess the natural resources on your property.



*Creeks and other natural features are susceptible to damage when post-fire stormwater runoff transports ash, debris and pollutants.*



*Land management professionals can determine if treatments are necessary to restore natural areas.*



# Clean-Up Ash and Soot

Clean wildfire ash and soot from decks, porches, sidewalks, and around your home. Direct the ash and soot from burned vegetation (not burned structures) to landscaped areas. Light applications of ash can be beneficial to your landscape by acting as a nutrient-rich fertilizer and providing a seed bed for revegetation. If your property does not have suitable landscape to accept ash at the surface, alternative disposal options are available:

- **Bury the ash in a pit or trench on your property. Be sure to:**
  - Call (800) 545-6005 to confirm locations of underground utilities before excavating,
  - Find an area away from planned or likely future structures, and
  - Bury only ash from your own property.
- **Take the ash to a landfill. Be sure to:**
  - Contain and cover the ash so it will not disperse during transport,
  - Clean up any ash that does disperse, and
  - Keep the disposal receipt from the landfill.

If any of your building materials are chemically-treated (i.e. pressure-treated lumber), the ash can contain toxic constituents and will likely require special disposal through a hazardous waste disposal service company. Contact the City of Austin Watershed Protection Department for a list of local hazardous waste disposal companies.



*A Texas Forest Service C-130 airplane drops red-tinted fire retardant near homes in Oak Hill during the 2011 Pinnacle Fire.*



*Ash from chemically-treated building materials, such as pressure treated lumber, can be toxic and require special disposal.*

Never direct ash or soot towards a water course, including curb gutters, storm drains, creeks and lakes, where it can degrade water quality. Do not use clean-up methods that can cause ash to become airborne and create respiratory hazards. Wear protective gear, including long sleeves, eye protection, and a respirator when handling ash and soot.

If you are concerned about the ash, soot or debris on your property, call the Texas Commission on Environmental Quality Debris Hotline at: (800) 687-7057.

## Clean-Up Fire Retardant

Usually seen on the evening news as red cloud being sprayed out of an airplane, fire retardants have been widely used since the late 1950s and are extremely helpful in suppressing wildfire.

There are three classes of fire retardants and clean-up methods vary accordingly:

- Long-term retardants are usually applied with a rotary or fixed-winged aircraft. They are 85 percent water, with 10 percent fertilizer and 5 percent coloring, usually iron oxide. The retardant is dyed for higher visibility over the drop zone. Long-term retardants can usually be removed with plain water but if dried, may require the use of a power washer. The iron oxide coloring can penetrate some materials and be difficult to remove, requiring additional solvents. The average pH of a long-term, aerially applied retardant is 5.5 to 7.5. Because of this and the high concentrations of nutri-

ents that make up the products, landscape plants coated with fire retardant should be washed as soon as possible to prevent chemical burns to foliage.

- Foams are typically applied with ground equipment. Foams are mostly uncolored, concentrated dish detergents and are 99 percent water, 1 percent surfactant, foaming agents, corrosion agents and dispersants. They can be removed by thoroughly rinsing the area with water.
- Gels also are typically applied from the ground. They consist of 95 percent to 98 percent water and 2 percent to 5 percent thickeners and stabilizers. They come in two forms that can be identified by color:
  - Orange or clear gels, which can be removed by rinsing with water or citric acid, and
  - Blue gels, which must be treated as an oil-based clean-up.



*Although most fire retardants are not considered toxic, do not rinse the retardant off your property or into a storm drain. Recover cleaning wastewater with a sponge, mop, or pump so that it can be properly disposed to the sanitary sewer system.*

Do not allow fire retardants or cleaning agents to enter a watercourse, including curb gutters, storm drains, creeks, and lakes. Retardants can have adverse impacts on water quality and ultimately on fish and other aquatic life. Create a berm downslope from cleaning activities to capture wastewater

before it leaves your property. Wastewater can be recovered with a pump or wet-vacuum, and properly disposed to the sanitary sewer system.

At no time should chlorine bleach, or bleach-based products be used to clean up any type of retardant, as this could produce harmful and explosive gases. As retardant products are mostly water, they will eventually evaporate. The remaining ingredients can cause eye irritation and cuts, scratches, or chapped skin to sting. Wear protective gear, including long sleeves, eye protection and a respirator when cleaning fire retardant. Clean-up of interior spaces should be done by professionals trained in fire restoration work.

Although modern retardants are not considered toxic, it is a good idea to avoid making puddles when cleaning so that pets and wildlife do not ingest this material. Pets should be shampooed to remove any material that is on them, although the main effect is just a temporary drying of skin.

## *Perform Post-Fire Tree Risk Assessments and Treatments*

Safety is the primary concern during post-fire tree assessment and care. Standing dead trees, particularly fire-damaged trees, are dangerous and unpredictable. If they fall, they can cause serious damage and even death. While it is possible for property owners to perform assessments and remedial work themselves, it is also important to recognize your limits. Strongly consider hiring the services of a certified, experienced and insured arborist to safely assess tree conditions and risks, and complete any consequent pruning or removal. Whoever does the work should wear appropriate protective equipment and avoid climbing into trees or working on large trees from a ladder.



*Greg Creacy of the Texas Parks and Wildlife Department evaluates impacts to the Lost Pines following the 2011 Bastrop Complex Wildfire.*

The initial step is to identify and remove standing trees that present a safety hazard. Property owners are liable for any losses or damages that are the result of a tree or limb falling from their land. Questionable trees near structures, overhead electrical lines, roadways, paths, or other commonly occupied areas should be assessed and removed promptly if compromised. In the City of Austin, protected-size trees (19 inches and greater in diameter, measured 4½ feet above ground surface) that are dead or otherwise hazardous still require a permit from the City Arborist before removing the tree or pruning more than 25 percent of its canopy.

Don't assume that damaged and scorched trees are completely dead. Many native plants are adapted to wildfire and can survive severe burns. Healthy deciduous trees, such as native oaks, can be resilient after being burned and may produce new leaves and stems, as well as sprouts at the base of the tree. Evergreen trees may also survive, if more than 10 percent of their foliage is still green (Skelly 2). Young trees can sustain a lot of damage and still recover. Prune severely burned limbs and defer the decision on whether to remove the entire tree until the following growing season, when you can better assess the health of the tree.

Resist the urge to remove all dead or burned vegetation. Fire-damaged trees that are located far from normal human activity usually do not necessitate





*Standing trees impacted by wildfire can present a serious safety hazard when located near human activity. A certified arborist can safely assess tree conditions and risks.*

tree removal. Leaving some standing dead trees in low risk areas can be beneficial to the environment by adding structure to the ground, giving wildlife and insects habitat, and returning valuable nutrients to the ground when they eventually do fall.

every few feet with a shovel so that it will not blow or wash away. Severely burned soils, especially those high in organic matter, may take months or over a year to absorb water without additional corrective measures.

## *Evaluate Soils and Irrigate Survivor Trees*

Sometimes after a fire, soils can become water-repellant (hydrophobic). First, determine if the soil will absorb water. To test for hydrophobic soils, pour a cup of water on the soil. If the soil does not absorb it and the water beads up on the surface, scrape off the top inch or two of soil and try again. If the water still will not penetrate the top couple of inches of soil, rake the ground to loosen the impermeable layer. Mulch the area with a thin layer of weed-free straw after raking to help it absorb water. Twenty percent of the soil should show through the straw when finished. It may be necessary to lightly push the straw into the soil (crimp)



*High intensity fire can make some soils repel water, or hydrophobic.*

When water will soak into the soil, start irrigating your trees (as local watering restrictions allow). The goal is to soak the entire area under the dripline (from the trunk to the branch tips) and a few feet past the dripline, to a depth of 12 inches to 15 inches. Water-absorbing roots are in the top 12 inches to 15 inches of soil. It is not necessary to water more deeply.

A soaker hose that slowly releases water into the soil works well. Place the hose in a circle a few feet away from the tree trunk. After watering for an hour, check the depth of water penetration by digging a small hole in the soil. After it has soaked the necessary 12 inches to 15 inches, move the hose out another two to three feet and water that area. Continue to move the soaker hose outward until the dripline and two to three feet outside the dripline have been watered.

If the trees are irrigated by a drip system, it may have to be expanded to wet a larger area. A few emitters will not be enough to water the entire area under a big tree.

Where sprinklers are used, make sure they provide full coverage under the tree and out past the dripline a few feet. Manage the sprinklers with an on/off/on schedule to prevent runoff and soil erosion and to wet the soil slowly, but thoroughly.

Check trees weekly and water when the soil dries to six inches deep, not only in the summer, but also through the fall and winter, unless there is sufficient precipitation to maintain adequate soil moisture. It is critical to water slowly to allow water to soak in and avoid runoff.

# Characterize, Segregate, and Choose Proper Disposal Methods for Wastes

During cleanup and recovery efforts, large volumes of various types of debris may need to be disposed. Different types of waste will require different methods of disposal and will therefore need to be segregated accordingly. Refer to the following table for waste segregation categories and corresponding disposal options.

Although most materials are not recyclable if damaged by fire, much of the metal, brick and other debris might be. Before you haul anything to a third party recycling center, call to find out:

- Which materials are accepted.
- Whether fire-damaged materials are accepted.
- Whether they charge a fee for recycling. (This usually depends on the material and its condition. If the material is valuable enough, they might pay you for it).

Contact your local jurisdiction for guidance on disposal of household hazardous waste items. For Austin residents, these items can normally be disposed

<i>Waste Type</i>	<i>Examples</i>	<i>Disposal Options</i>
Vegetation	Yard waste, trees, brush	<ul style="list-style-type: none"> <li>• Recycle/compost on-site</li> <li>• Recycle by third party</li> <li>• Haul to Type IV or Type I Municipal Solid Waste Landfill</li> </ul>
Clean Lumber	Lumber that is not painted, stained, or chemically treated	<ul style="list-style-type: none"> <li>• Recycle on-site</li> <li>• Recycle by third party</li> <li>• Haul to Type IV or Type I Municipal Solid Waste Landfill</li> </ul>
Animal carcasses	Deceased pets, livestock, wildlife	<ul style="list-style-type: none"> <li>• In the City of Austin, call 3-1-1 for collection by Austin Resource Recovery</li> <li>• Burial on-site (contact TCEQ for guidance on burial location requirements)</li> <li>• Haul to Type I Municipal Solid Waste Landfill</li> </ul>
Household / Commercial Waste	Paper, cardboard, plastic, clothes, food	<ul style="list-style-type: none"> <li>• Haul to Type I Municipal Solid Waste Landfill</li> <li>• Recycle by third party</li> </ul>
White goods	Refrigerators, stoves, washers and dryers	<ul style="list-style-type: none"> <li>• Recycle by third party</li> <li>• Haul to Type I Municipal Solid Waste Landfill</li> </ul>
Construction / demolition waste	Painted/stained/treated wood, sheet rock, roof shingles	<ul style="list-style-type: none"> <li>• Haul to Type IV or Type I Municipal Solid Waste Landfill</li> <li>• Recycle by third party</li> </ul>
Household hazardous waste	Cleaning products, paints, solvents, pesticides, automotive products, compressed gas cylinders, batteries, air conditioners, electronics	<ul style="list-style-type: none"> <li>• Residential hazardous waste can be taken to the City of Austin Household Hazardous Waste Facility (see more information below)</li> <li>• If available, dispose of at a hazardous waste collection event</li> <li>• Most of these wastes can be disposed of at a Type I Municipal Solid Waste Landfill</li> </ul>



of at the City of Austin Household Hazardous Waste Facility. For more information on the City's Household Hazardous Waste facility, including location, business hours, and items accepted, visit their website at: <http://www.austintexas.gov/hhw>.

For large wildfire events, your local jurisdiction may schedule special waste pick-ups. Contact your local environmental jurisdiction for event-specific waste disposal guidance.

Consider employing the services of a trained professional for significant exposure risks. If drums or other containers of unknown wastes are identified, call the City of Austin 24-Hour Pollution Hotline at (512) 974-2550 for guidance.



*Different types of waste may require different methods of disposal and need to be segregated accordingly.*

For additional waste disposal guidelines, contact the Texas Commission on Environmental Quality at (512) 339-2929.

## *Determine the Need for Soil Erosion and Sedimentation Control*

Erosion and sedimentation can have devastating impacts on the environment - polluting surface waters and aquatic habitats with excess amounts of fine-grained soil particles. It strips nutrient-rich topsoil from the land which diminishes productivity and hinders reestablishment of natural vegetation. Practical measures prop-



*After a wildfire there is potential for severe soil erosion and accelerated water runoff due to the lack of vegetation and ground cover to stabilize the soil.*

erty owners can take to mitigate soil erosion are:

- Include erosion control planning in your debris-removal and land restoration activities. Consider hiring experienced and certified contractors who can develop and implement a successful plan for controlling erosion and restoring permanent vegetation.
- Protect sensitive areas by paying special attention to steep or barren slopes, severely burned areas, erodible soils, and areas directly adjacent to streams, wetlands or other water bodies.
- Where practical, preserve existing vegetation whether burned or unburned. The roots of vegetation hold the soil together. It is especially important to protect vegetation alongside surface waters.
- Minimize soil disturbance by limiting activity in areas with exposed soils. Avoid using heavy machinery during recovery efforts. Control impacts from livestock by deferring grazing in burned areas until plant growth has reestablished.

## *Establish Erosion and Sedimentation Controls*

Identify locations where water and burn debris are likely to flow through your property and consider some of the following erosion and sedimentation controls:

- **Reseeding** may help restore your landscape if existing vegetation has been badly damaged. However, in many cases, the preexisting vegetation may re-sprout and recover with normal rainfall.
- **Hydraulic mulching** is a method that uses a slurry of shredded wood or paper fiber with a binder that helps decrease runoff and increase water infiltration. Seed can be included in the slurry for revegetation.
- A layer of **wood mulch** can reduce runoff and protect soil from erosion. Chipping some of the burned vegetation on your property is a good way to create wood mulch for erosion control while using some of the fire debris onsite.
- **Mulch socks** are biodegradable, photodegradable, or recyclable mesh tubes, usually 12 to 18 inches in diameter, filled with



mulch. They are typically used to intercept, settle, and filter runoff flows on slopes.

- **Erosion control blankets** reduce erosion in critical areas such as slopes and channels, and assist in the establishment of vegetation.
- **Silt fencing** helps intercept and detain sediment as it is transported from exposed soil areas.
- **Contour log terraces** can utilize large trees on the property that have been burned or cut down after the fire and serve as a barrier to runoff from heavy rainstorms.
- **Water bars** are installed across dirt roads and trails to redirect water and reduce erosion.

Do not install erosion and sedimentation controls that contain flammable materials, such as wood mulch, mulch socks and silt fencing, until the fire is completely out and there is no risk of re-igniting the fire.

Improper application of erosion and sedimentation control techniques can make conditions worse. For detailed information on how to correctly design and install erosion and sedimentation controls, refer to the City of Austin Environmental Criteria Manual, Section 1.4.0 located online at <http://www.austintech.amlegal.com/nxt/gateway.dll/Texas/enviro/section1-waterqualitymanagement>



Reseeding



Hydraulic mulching



Wood mulch



Mulch socks



Erosion control blankets



Silt fencing



Contour log terraces



Water bars



# PLAN AND IMPLEMENT LONG-TERM RECOVERY

## *Evaluate Revegetation Needs*

Not all burned areas require reseed-ing. Local plant species have evolved several mechanisms to survive wild-fire. Some will re-sprout, some will grow new leaves and others have fire resistant seeds that sprout after a fire. Some woody plants survive fire by having thick, protective bark or dormant buds below the soil surface. Most woody plants re-sprout if top growth is killed. Once top growth is lost, dormant basal buds begin growing. The success of unassisted vegetation recovery after a fire is dependent upon a number of factors, including:

- Types of plants and their adaptation to fire,
- Fire intensity,
- Precipitation before and after the fire,
- Soil type,
- Prior grazing history,
- Prior fire history,
- Season of the fire, and
- Management after the fire.

When determining the need for revegetation, take into account the severity of the burn and the abundance of undesirable plants that were on the land before it burned. In general, more severe burns and higher pre-burn populations of undesirable plants increase the need for revegetation. Examine the burned soil and residual ash material. If white ash is present, then resident seed from pre-existing native plants may no longer exist. White ash is an indicator that the fire burned very hot and any resident seed bank in the soil was likely killed during the fire in these areas. Also consider slope steepness, proximity to drainage ways, and overall land management objectives. Steep slopes should be stabilized quickly to control erosion. Vegetation in drain-



*Shortly after this photo was taken, native grass and wildflower seed was applied by hydraulic mulch at the 2011 Oak Hill fire site to quickly stabilize slopes and protect a detention pond.*

age ways will help reduce erosion and filter sediment from post-burn runoff. Re-seeding these areas with native grasses and/or re-planting with native plants may be a good idea.

## *Support New Plant Growth*

Encourage good germination and establishment of desirable plants when revegetating burned areas of your property. Additional steps to bolster success of preferred plants are advised.

- If there is no ash layer, prepare a seedbed before and after broadcast seeding.
- Use drought-resistant plant stock and locally-collected seed that is native or adapted to Central Texas. Do not choose invasive plants or grasses, such as annual ryegrass. For guidance, refer to the City of Austin Grow Green

gardening education program ([www.growgreen.org](http://www.growgreen.org)) and recommended native and adapted plant guide ([www.austintexas.gov/department/grow-green/plant-guide](http://www.austintexas.gov/department/grow-green/plant-guide)).

- Explore ways to reduce irrigation needs. Consider reducing the size of your turf areas with wildscape or xeriscape plants. Revegetate turf areas in full sun locations with alternatives to St. Augustine grass, such as Buffalo, Bermuda, or Zoysia.
- To improve the soil structure and contribute to a healthy nitrogen cycle, add nitrogen-fixing legumes (plants in the Fabaceae/pea family), such as Texas Mountain Laurel, Redbud, Honey Mesquite and Bluebonnets.
- Increase seeding rates to improve competition with undesirable plants.



- After the fire is completely out and there is no risk of re-igniting the fire, provide a thin protective mulch cover, such as native chipped wood, to protect soil and seeds from erosion, conserve moisture, and moderate soil temperatures. Too thick of a mulch layer will prohibit vegetation growth.
- Manually remove emerging undesirable plants to the extent possible.
- Defer livestock grazing until vegetation has been established, usually after two growing seasons.
- For additional recommendations on revegetating land after a wildfire, contact the City of Austin Watershed Protection Department or your local environmental jurisdiction.

## Manage Invasive Plants



*Invasive tumbled mustard (*Sisymbrium altissimum*) emerges after a wildfire.*

Quickly develop a management plan for invasive plants within burned and adjacent areas. Wildfires can expose ground surfaces and create conditions that favor the establishment of invasive plant species. While many native and desirable plants survive fires, their ability to reestablish, thrive and reseed is reduced by the presence of invasive species that aggressively compete for

water, light, and soil nutrients. The key is to support the reestablishment of desirable plants and healthy plant communities. For detailed guidance on invasive species management, refer to the City of Austin Invasive Plants Management website:

<http://www.AustinTexas.gov.Invasive>.

## Support Wildlife Recovery

Understandably, many people fear that fire will harm wild animals. But animals' senses are often far stronger than we can imagine. Before it ever comes to a race to safety, animals in the wild are almost always aware of a fire growing nearby. Even small flames crackling and popping through dry grass in calm winds are easily seen, smelled, and heard from great distances. So escape from a wildfire is easy for most individual animals who are able to avoid direct harm by moving away or burrowing underground, and species as a whole are well-adapted to fire as a natural part of their ecosystem. In fact, many wildlife species depend on fire for their survival, and thrive after a fire event. The grasses, seedlings, shrubs, and trees that re-establish burned areas provide

an ideal environment for many small seed-eating mammals and birds. This abundance of small prey attracts other wildlife like foxes, bobcats and hawks.

You can support post-fire recovery of general wildlife populations by working to enhance wildlife habitat on your property. Take steps to turn your backyard, balcony, or patch of grass into a habitat for wildlife.

- Provide natural food sources for wildlife by planting native vegetation. Native grasses, shrubs and trees provide the foliage, nectar, pollen, berries, seeds and nuts that many species of wildlife require to succeed. Avoid providing supplemental food via animal feeders. Supplemental food will hold animals in habitats that cannot naturally support them, and populations will exceed carrying capacity. Excessive animal populations that stay in a burned area will quickly eat any new plant regrowth, slowing or even stopping the natural land healing process.
- Supply clean water for wildlife year-round. Water sources may include natural features such as ponds, lakes, rivers, springs, and wetlands; or human-made



*Most wildlife can instinctively sense when fire is near, and will flee or take refuge to avoid harm.*



features such as bird baths, installed ponds, rain gardens, or watering troughs. Provide “ladders” into and out of above-ground watering troughs using stacked rocks or wire-mesh. This allows small animals and birds to access the water, and a way out if they fall in. Do not let your supplemental water sources turn into a mosquito-breeding ground - change the water a few times each week during warm weather.

- Create cover for wildlife to provide places to safely reproduce and raise its young. Native vegetation, shrubs, thickets, and brush piles provide great shelter. Even some of the badly burned or dead trees can be left in place as they can provide value to lots of different animals. Birds like flickers, kestrels, and chickadees use tree cavities for nesting and perching, while woodpeckers thrive on the insects that inhabit fire-killed trees.
- If the fire-impacted area is known to include endangered species habitat, contact the Texas Parks and Wildlife Department for information on how you can limit further impacts and perhaps assist with the recovery of that special habitat.

## Evaluate Stormwater Ponds

Wildfire can affect a stormwater pond's ability to properly function. If you are aware of a stormwater pond that was burned, filled with sediment and burned debris or otherwise impacted by fire, contact the City of Austin Watershed Protection Department by calling (512) 974-2550 and determine what steps need to be taken to restore function to the pond.

## Monitor Land Recovery and Let Nature Take Its Course



*Monitoring the environmental recovery at the 2011 Oak Hill fire site finds many native grasses, shrubs, and trees beginning to reestablish shortly after the fire.*

Periodically monitor and evaluate the burned area to determine the adequacy of your land recovery management practices and make adjustments as necessary. If appropriate, consider allowing the area to recover naturally. In some natural areas, inaction may be the best solution for environmental recovery. Doing nothing allows the land to heal naturally over time, as it did once before.



*Many native plants are fire-adapted, and thrive after a wildfire.*



# PHONE NUMBERS

Capital Area Master Naturalists	(512) 863-8250
City of Austin - 24-Hour Pollution Hotline	(512) 974-2550
City of Austin - Austin Energy	(512) 494-9400
City of Austin - Austin Fire Department	(512) 974-0130
City of Austin - Austin Fire Department, Firewise Program Coordinator	(512) 974-0298
City of Austin - Austin Water Utility, Wildland Conservation Division	(512) 972-1690
City of Austin - City Arborist	(512) 974-1876
City of Austin - Development Assistance Center	(512) 974-6370
City of Austin - General Information	3-1-1
City of Austin - Household Hazardous Waste	(512) 974-4343
City of Austin - Parks and Recreation Department, Park Rangers	(512) 978-2600
City of Austin - Watershed Protection Department	(512) 974-2550
City of Austin/Travis County - Office of Homeland Security and Emergency Management	(512) 974-0450
Lower Colorado River Authority	(512) 473-3200
The Nature Conservancy, Austin Office	(512) 623-7240
Texas A&M Forest Service - Austin Area Wildland Urban Interface Specialist	(512) 339-4118
Texas Commission on Environmental Quality - Debris Hotline	(800) 687-7057
Texas Commission on Environmental Quality - Regional Office	(512) 339-2929
Texas Parks and Wildlife Department	(512) 389-4800
Travis County - Fire Marshal	(512) 854-4621
Travis County - Natural Resources Program Manager	(512) 854-7214
Travis County - Park Rangers	(512) 263-9114
Underground Utility Locating	(800) 545-6005
United States Fish and Wildlife Service - Austin Ecological Services Office	(512) 490-0057
United States Fish and Wildlife Service - Balcones Canyonland National Wildlife Refuge	(512) 339-9432

For a list of local erosion control supply companies, contact the City of Austin Watershed Protection Department.



# WEBSITES

## LOCAL RESOURCES

- Capital Area Council of Governments - Emergency Notification System Registration (Reverse 9-1-1)  
<http://alertregistration.com/capcog/>
- Capital Area Master Naturalists  
<http://www.txmn.org/capital/>
- City of Austin - Austin Energy Tree Pruning Program  
<https://my.austinenergy.com/wps/portal/ae/residential/Residential-Services/tree-pruning>
- City of Austin - Austin Fire Department, Wildfire Division  
<http://austintexas.gov/department/wildfire-division>
- City of Austin - Austin Resource Recovery, Curbside Collection Schedule  
<http://austintexas.gov/department/Residential-Curbside-Collection-Schedule>
- City of Austin - City Arborist and Tree Permitting  
<http://austintexas.gov/department/city-arborist>
- City of Austin - Environmental Best Management Practices for Wildfire Risk Reduction and Recovery  
<http://www.austintexas.gov/WildfireEnviroBMPs>
- City of Austin - Erosion and Sedimentation Control Criteria  
[http://www.austintech.amlegal.com/nxt/gateway.dll/Texas/environ/section1-waterqualitymanagement?f=templates\\$fn=default.htm\\$3.0\\$vid=amlegal:austin\\_environment\\$anc=JD\\_1.4.0](http://www.austintech.amlegal.com/nxt/gateway.dll/Texas/environ/section1-waterqualitymanagement?f=templates$fn=default.htm$3.0$vid=amlegal:austin_environment$anc=JD_1.4.0)
- City of Austin - Grow Green  
[www.growgreen.org](http://www.growgreen.org)
- City of Austin - Homeland Security and Emergency Management  
<http://www.austintexas.gov/department/homeland-security-and-emergency-management>
- City of Austin - Household Hazardous Waste  
<http://www.austintexas.gov/HHW>
- City of Austin - Invasive Plants Management  
<http://www.austintexas.gov/Invasive>
- City of Austin - Licensed Private Waste Haulers  
<http://www.austintexas.gov/department/austin-private-waste-hauler-licensing>
- City of Austin - Prescribed Burns on City Wildlands  
<http://www.austintexas.gov/rxfire>
- City of Austin - Water Conservation  
<http://www.austintexas.gov/department/water-conservation>
- Prepared.ly - Stay Informed and Proactive about the Ongoing Threat of Wildfires  
<http://www.prepared.ly>
- Ready, Set, Go! - Localized Personal Wildland Fire Action Guide  
[http://www.co.travis.tx.us/fire\\_marshall/pdf\\_files/ReadySetGoTexasBooklet.pdf](http://www.co.travis.tx.us/fire_marshall/pdf_files/ReadySetGoTexasBooklet.pdf)
- Travis County - Fire Station Map and Department Information  
[http://www.co.travis.tx.us/fire\\_marshall/esd.asp](http://www.co.travis.tx.us/fire_marshall/esd.asp)
- Travis County - Cell Phone Text Notification of Burn Ban Status Changes  
[http://www.co.travis.tx.us/fire\\_marshall/news/burn\\_ban\\_alerts.asp](http://www.co.travis.tx.us/fire_marshall/news/burn_ban_alerts.asp)

## STATE RESOURCES

- Oak Wilt Information and Prevention Guidelines  
<http://texasoakwilt.org>
- Texas A&M AgriLife Extension Service - Wildfire Information Network  
[http://www.extension.org/surviving\\_wildfire](http://www.extension.org/surviving_wildfire)
- Texas A&M AgriLife Extension Service - Extension Disaster Education Network - Fires and Wildfires  
<http://texashelp.tamu.edu/004-natural/fires.php>
- Texas A&M Forest Service - Daily Fire Danger and Advisory Maps  
<http://texasforestservice.tamu.edu/main/article.aspx?id=1991>
- Texas A&M Forest Service - Disaster Resources  
<http://texasforestservice.tamu.edu/main/article.aspx?id=14767>
- Texas A&M Forest Service - Firewise Home Construction, Renovation and Maintenance  
<http://texasforestservice.tamu.edu/uploadedFiles/Edited%202012materials%5B1%5D.pdf>

Texas A&M Forest Service - Protect Your Home

<http://texasforests.service.tamu.edu/main/article.aspx?id=15378>

Texas A&M Forest Service - Wildfire Preparedness Home Page

<http://texasforests.service.tamu.edu/main/article.aspx?id=8512>

Texas Commission on Environmental Quality - Interpreting the TCEQ Outdoor Burning Rule

[http://www.tceq.texas.gov/publications/rg/rg-049.html/at\\_download/file](http://www.tceq.texas.gov/publications/rg/rg-049.html/at_download/file)

Texas Commission on Environmental Quality - Managing Debris from Texas Wildfires

<http://www.tceq.texas.gov/assets/public/response/drought/managing-wildfire-debris.pdf>

Texas Commission on Environmental Quality - Protect Your Health and the Environment Following a Wildfire

<http://www.tceq.texas.gov/response/smoke/wildfires>

Texas Parks and Wildlife Department - Threatened/Endangered Species Management Guidelines

[https://www.tpwd.state.tx.us/huntwild/wild/wildlife\\_diversity/nongame/management/](https://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/nongame/management/)

Texas Wildfire Risk Assessment Portal

<http://www.TexasWildfireRisk.com>

## **NATIONAL / INTERNATIONAL RESOURCES**

FEMA Wildfire Preparedness and Recovery Information

<http://www.ready.gov/wildfires>

Fire-Adapted Communities

<http://www.FireAdapted.org>

Firewise Communities/USA Recognition Program

<http://www.FireWise.org>

Firewise Tips and Tools for Homeowners

<http://www.firewise.org/wildfire-preparedness/be-firewise/home-and-landscape.aspx>

Invasive Plant Management after Fire

[http://www.weedcenter.org/textbook/9\\_sheley\\_etal\\_fire.html](http://www.weedcenter.org/textbook/9_sheley_etal_fire.html)

Ready, Set, Go! - International Program Homepage

<http://wildlandfirersg.org/>

Reducing Wildfire Risk While Achieving Other Landscaping Goals

[http://www.interfacesouth.org/products/fact\\_sheets/fire-in-the-interface-fact-sheets/reducing-wildfire-risk-while-achieving-other-landscaping-goals/index\\_html](http://www.interfacesouth.org/products/fact_sheets/fire-in-the-interface-fact-sheets/reducing-wildfire-risk-while-achieving-other-landscaping-goals/index_html)

Selecting and Maintaining Firewise Plants for Landscaping

[http://www.interfacesouth.org/products/fact\\_sheets/fire-in-the-interface-fact-sheets/selecting-and-maintaining-firewise-plants-for-landscaping/index\\_html](http://www.interfacesouth.org/products/fact_sheets/fire-in-the-interface-fact-sheets/selecting-and-maintaining-firewise-plants-for-landscaping/index_html)

Proper Tree Care Guidelines and Tree Care Service Providers

<http://www.treesaregood.com>

U.S. Department of Agriculture - Natural Resources Conservation Service - Wildfire Protection and Restoration

<http://www.nrcs.usda.gov/wps/portal/nrcs/detail/?ss=16&navtype=SUBNAVIGATION&cid=stelprdb1044051&navid=120160320120000&pnavid=120160320000000&position=Not%20Yet%20Determined.Html&ttype=detail&pname=Wildfire%20Protection%20and%20Restoration%20|%20NRCS>

U.S. Fish and Wildlife Service - Fire Management Homepage

<http://www.fws.gov/fire/>

U.S. Fish and Wildlife Service - Fuel Treatments in Golden-Cheeked Warbler Habitat

[http://www.fws.gov/southwest/es/Documents/R2ES/AUES\\_GCWA\\_FINAL\\_BMP.pdf](http://www.fws.gov/southwest/es/Documents/R2ES/AUES_GCWA_FINAL_BMP.pdf)

U.S. Forest Service - Fire and Aviation Management Homepage

<http://www.fs.fed.us/fire/>



# WORKS CITED

- "403.2.1 Wildland-Urban Interface Area Requirements, Access, Driveways, Dimensions." *2012 International Wildland-Urban Interface Code*. Country Club Hills, IL: International Code Council, 2011. 15. Print.
- American Forests. *American Forests Names the 10 Best U.S. Cities for Urban Forests*. American Forests. 5 Feb. 2013. Web. 19 July 2013.
- International Society of Arboriculture. *The Value of Trees. Trees Are Good*. International Society of Arboriculture. Web. 07 Aug. 2013.
- Missouri. Department of Conservation. *Right Tree in the Right Place*. Missouri Department of Conservation, Jan. 2010. Web. 7 Aug. 2013.
- "Mitigation." *Texas A&M Forest Service*. Texas A&M Forest Service. Web. 06 Aug. 2013.
- "Oak Wilt Suppression." *Oak Wilt Suppression*. City of Austin. Web. 6 Aug. 2013.
- Skelly, JoAnne. "Taking Care of Residential Trees after Wildfire." *University of Nevada Cooperative Extension*. University of Nevada Cooperative Extension. Web. 6 Aug. 2013.
- Smith, Jordan. "Wildfire Prevention Waiting for Ignition." *The Austin Chronicle*. The Austin Chronicle, 31 Aug. 2012. Web. 1 Aug. 2013.
- Texas. Texas A&M Forest Service. Fire Prevention & Mitigation Program. *2011 Texas Wildfires, Common Denominators of Home Destruction*. By Justice Jones, April Saginor, and Brad Smith. *Texas A&M Forest Service, Forest Resource Protection, Mitigation, Wildfire Preparedness*. Texas A&M Forest Service. Web. 1 Aug. 2013.
- Texas. Texas Parks and Wildlife. Wildlife Diversity Program. *Rare, Threatened, and Endangered Species of Texas*. Texas Parks and Wildlife Department, 2 Oct. 2012. Web. 6 Aug. 2013.
- "Trees and the Environment." *Trees Are Good*. International Society of Arboriculture. Web. 7 Aug. 2013.
- United States. United States Department of Agriculture. Forest Service. *Sustaining America's Urban Trees and Forests*. By David J. Nowak, Eric J. Greenfield, Susan M. Stein, Paula B. Randler, Sara J. Comas, Mary A. Carr, and Ralph J. Alig. June 2010. Web. 7 Aug. 2013.



*This public education guidebook is a product of the City of Austin / Travis County Joint Wildfire Task Force.*

*The City of Austin Watershed Protection Department led development of the guidebook with assistance from: Austin Fire Department, Austin Water Utility Wildlands Conservation Division, Austin Planning and Development Review Department, Austin Parks and Recreation Department, Austin Homeland Security and Emergency Management, Austin Energy, Travis County, the City of Lakeway, local Emergency Service Districts, and the Texas A&M Forest Service.*

***First Edition, April 2014***

**[www.AustinTexas.gov/WildfireEnviroBMPs](http://www.AustinTexas.gov/WildfireEnviroBMPs)**



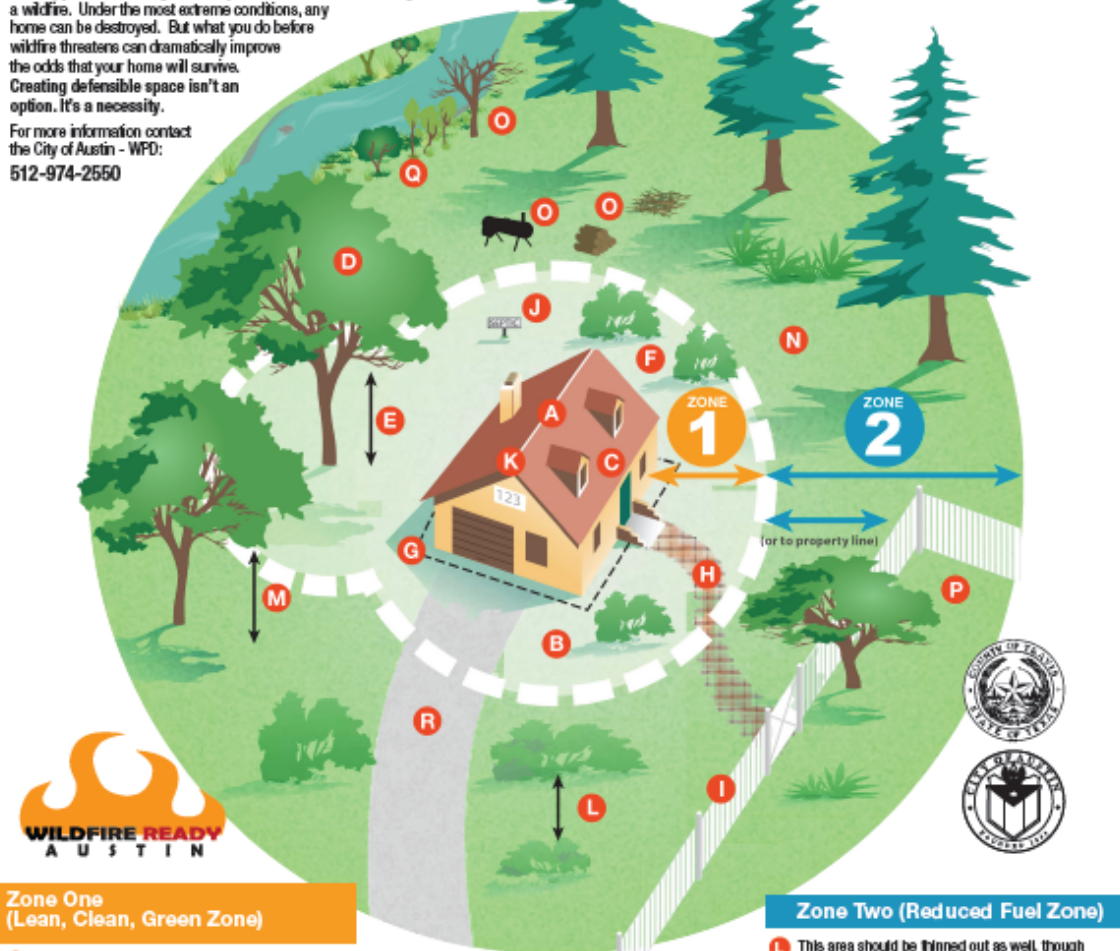
Defensible space is the area around a structure that creates a buffer intended to stop or slow the spread of flames, reduce exposure to radiant heat, limit flammable materials where an ember could land and start a fire, and in the event of a fire, provide space for emergency responders to safely conduct fire suppression operations. This area must be diligently managed in order to maintain it in a fire-resistant condition. **Homes with effective defensible space are much more likely to survive a wildfire.**

The size and shape of your defensible space depends on the home's location and property boundaries, topography, surrounding vegetation, and other factors. Consider the zone approach: Zone 1 serves as a critical buffer immediately around the home, including attached decks, garages, and trees next to the house that you wish to incorporate. Ideally, Zone 1 extends at least 30 feet from the perimeter of the home, or to your property boundaries if you have a small lot. Zone 2 is a secondary buffer and extends out from Zone 1, usually an additional 70 feet or to property lines. When structures are located on a steep hill or at the edge of a ridge or bluff, increase the downslope Zone 2 distance up to 200 feet from the home. If your property boundaries do not allow for a Zone 2, then Zone 1 will extend to your property line. Property management activities are always limited to your property boundaries.

Nothing you can do will guarantee your home will make it through a wildfire. Under the most extreme conditions, any home can be destroyed. But what you do before wildfire threatens can dramatically improve the odds that your home will survive. Creating defensible space isn't an option. It's a necessity.

For more information contact the City of Austin - WFD:  
512-974-2550

# MAINTAIN a DEFENSIBLE SPACE



## Zone One (Lean, Clean, Green Zone)

- A** A Firewise® property starts with the structure and moves outward. A home constructed with fire resistant building materials should always be considered the primary method of protecting the structure from fire.
- B** Water lawn, plants, and trees regularly (as allowed by watering restrictions) to ensure that they are healthy, especially during fire season. Mow the lawn regularly.
- C** Remove dead, dying, or dry vegetation, leaf litter, and other debris from yard, roof surfaces, gutters, and other locations where it accumulates.
- D** If you have big beautiful shade trees you want to keep, you can incorporate them into your home's footprint. Then, defensible space will extend around your home and those chosen trees. Prune trees so the lowest limbs are at least 6 feet from the ground, and limbs have adequate clearance from structures.
- E** Eliminate ladder fuels and accumulations of woody debris. Remove dense understorey layers and thin tree canopies. Prune trees so the lowest limbs are at least 6 feet from the ground.
- F** Plants in Zone 1 should be carefully spaced, mostly low-growing, and low in resins, oils and waxes that burn easily.

- G** Within the first 3 feet of the home, use nonflammable landscaping materials, such as rock and pavers. If plants are desired in this space, choose perennial plants with high-moisture content.
- H** Add protection with "fuel breaks," such as driveways, gravel walkways and healthy lawns.
- I** Consider using nonflammable material for fencing, at least for the sections of fence that connect to your home.
- J** Clearly mark septic tank locations. The weight of fire trucks can collapse them, immobilize the truck, and endanger personnel.
- K** Identify your home and neighborhood with clear and easily readable street names and numbers.

## Zone Two (Reduced Fuel Zone)

- L** This area should be thinned out as well, though less space between potential fuels is needed than in Zone 1.
- M** Create separation between low-level vegetation and tree branches by removing ladder fuels, reducing the height of low-level vegetation, and/or trimming low tree branches.
- N** Don't allow grass and other surface fuels to become overgrown in Zone 2. Typically, surface vegetation in this area should be maintained at a height no greater than 4 inches.
- O** Locate any propane tanks, firewood stacks, brush piles, and snags in Zone 2, at least 30 feet from the home.
- P** Collaborate with your neighbors for a more effective, community-based approach to wildfire protection.
- Q** Preserve natural vegetation along creeks, streams, and rivers. The higher moisture content of riparian corridors reduces fire intensity and can serve as a fire break.
- R** Provide adequate emergency vehicle access by maintaining a driveway clearance of at least 20 feet wide by 13 feet 6 inches high, with pullouts every 400 feet.

Original graphic provided by CAL FIRE





# Be Embers Aware

IT'S THE LITTLE THINGS THAT COUNT



Overhanging branches can drop embers onto a roof.

**“** *You don't have to live in a concrete block home with stainless steel doors and a metal deck all the way around it. You just have to to remember – it's the little things that count.* **”**

Jack Cohen,  
Research Physical Scientist,  
U.S. Forest Service

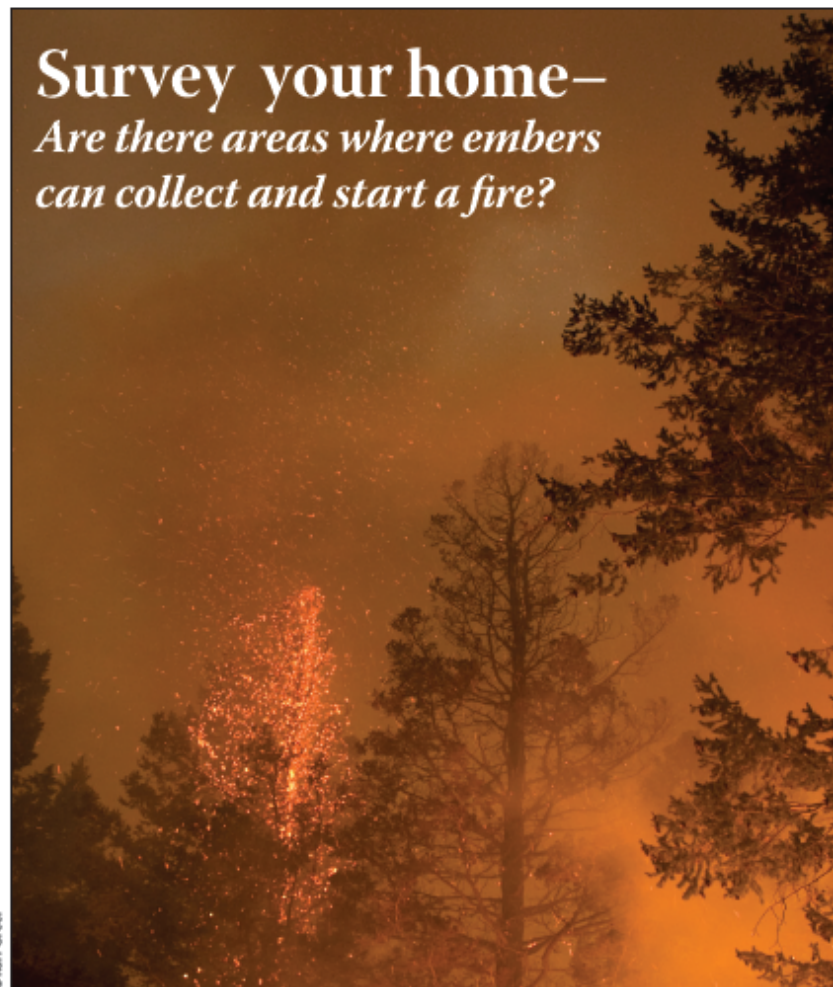
**T E X A S**  
**FOREST SERVICE**  
The Texas A&M University System

## *What is the greatest threat to homes?*

Embers, also known as firebrands, pose the greatest threat to a home. These fiery little pieces of wood shoot off from the main fire and get carried to other areas by fast-moving air currents.

A high-intensity fire can produce a virtual blizzard of embers. Some can travel more than a mile before landing. They can get into the smallest places and easily start a fire that can burn down an entire home.

**Survey your home—**  
*Are there areas where embers can collect and start a fire?*



©Karl Greer

# Be Embers Aware

## AROUND YOUR HOME



*Debris can build up in corners, providing fuel for embers. Photo by Institute for Business and Home Safety Research Center.*



*Embers from flames can find their way into your attic through unscreened vents. Photo by Institute for Business and Home Safety Research Center.*



*Inside corners can harbor embers.*



*This photo shows damage to a wooden deck from embers.*

Dormers, split-level roofs and lots of nooks and crannies create the perfect nest for burning embers. Pay particular attention to any and all inside corners. Wherever possible, cover those corners. Metal flashing is very effective.

Check your gutters to ensure they are clear. Consider adding gutter guards or screening to prevent buildup of pine needles, leaves and other flammable debris.

Vents provide the perfect opening for embers. Add a one-eighth-inch metal screen over the vent opening to create a barrier.

Think about where leaves or trash accumulate when the wind blows. These are the areas where embers will collect and start a fire.

Scout out openings like exterior crawl spaces or the critter zone under wooden porches and decks. Remove any flammable debris that you find underneath, such as leaves and pine needles. Then screen the open area using one-eighth-inch metal mesh to create a barrier for embers.

Visualize if there is anything that can burn easily. Look for the little things: Dry grass growing up against or leading to the foundation, dead vegetation underneath bushes and shrubs, a woodpile next to the home or on the deck, patio furniture cushions, etc.



# Be Embers Aware

## AROUND YOUR YARD AND PROPERTY

Landscaping can serve as a fuel break by limiting flammable vegetation and materials surrounding the home where an ember could land and start a fire. Consider the entire “home ignition zone,” which extends up to 200 feet from the home. Your property does not have to be bare of vegetation to be Firewise.

### **ZONE 1** 30 feet adjacent to the home

This area should be well-irrigated and free from fuels that may ignite your home, such as dry vegetation, clutter and debris.

- Plants in this area should be limited to carefully spaced plantings that are low-growing and free of resins, oils and waxes that burn easily. (Diagram 1)
- Mow the lawn regularly. Prune all trees so the lowest limbs are at least 6 to 10 feet from the ground.
- Space flammable conifer trees 30 feet between crowns to reduce the risk of crown fire.
- Within 5 feet of the home, use nonflammable landscaping materials, such as rock, pavers and perennials with high-moisture content. (Diagram 2)
- Remove dead vegetation, such as leaves and pine needles, from gutters, under your deck and within 10 feet of your home.
- Firewood stacks and propane tanks should not be located in this area. Keep them at least 30 feet from the home. (Diagram 3)
- Water plants and trees regularly to ensure that they are healthy and green, especially during fire season.

### **ZONE 2** 30 to 100 feet from the home.

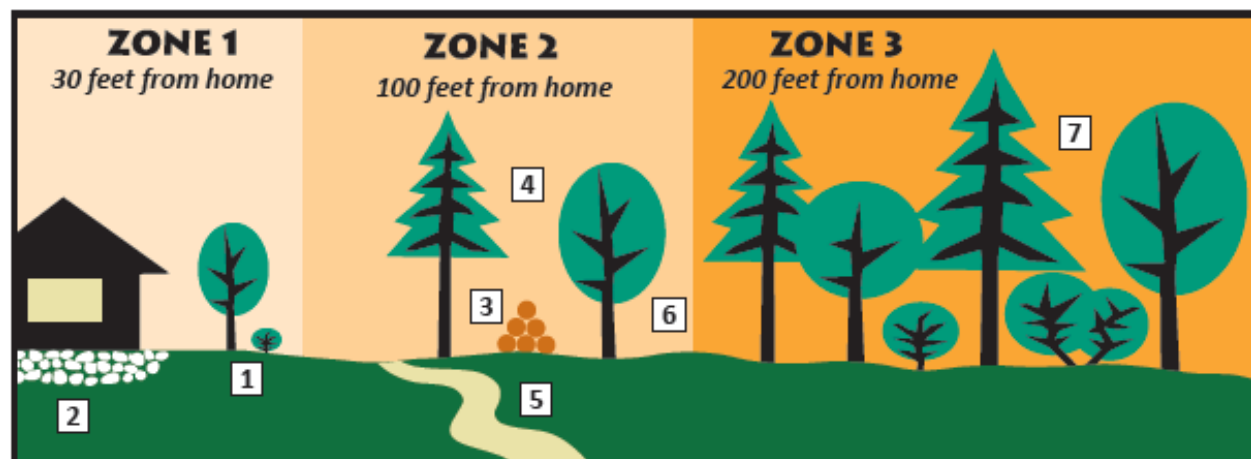
Plants in this zone should be low-growing, well irrigated and less flammable.

- Leave 30 feet between clusters of two to three trees, or 20 feet between individual trees. (Diagram 4)
- Encourage a mixture of deciduous and coniferous trees. Most deciduous trees do not support high-intensity fires.
- Give yourself added protection with “fuel breaks,” such as driveways, gravel walkways and lawns. (Diagram 5)
- Prune trees so branches and leaves are at least 6 to 10 feet above the ground. (Diagram 6)

### **ZONE 3** 100 to 200 feet from the home

This area should be thinned out as well, though less space is required than in Zone 2.

- Remove heavy accumulation of woody debris.
- Thin trees to remove smaller conifers.
- Reduce the density of tall trees so canopies are not touching. (Diagram 7)



# Be Embers Aware

I CAN MAKE MY HOME FIREWISE BY...



Embers destroyed this trampoline.



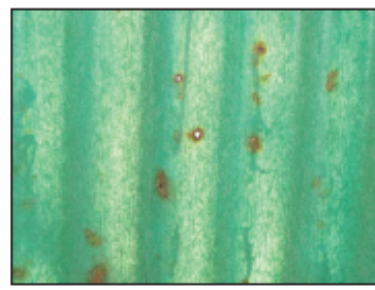
Embers landing on this wood could set your deck on fire.



Embers landed on this window.



Embers could ignite these needles.



Embers damaged this roof.

Inspect your home where embers may land or hide. Remove the debris and make the area Firewise. Communities are safer when they work together. To learn more about becoming a Firewise Community, visit [www.firewise.org](http://www.firewise.org).

- |  |   |
|--|---|
| <input type="checkbox"/> Gutters                                     | <input type="checkbox"/> Dormers                                      |
| <input type="checkbox"/> Vents                                       | <input type="checkbox"/> Deck and porch                               |
| <input type="checkbox"/> Nooks and crannies                          | <input type="checkbox"/> Exterior crawl spaces                        |
| <input type="checkbox"/> Roof, especially split-level                | <input type="checkbox"/> Patio furniture cushions                     |
| <input type="checkbox"/> Inside corners of home (porches and insets) | <input type="checkbox"/> Critter zones under wooden porch and deck    |
| <input type="checkbox"/> Dry grass against or leading to foundation  | <input type="checkbox"/> Dead vegetation underneath bushes and shrubs |
| <input type="checkbox"/> Wood pile next to home or deck              |   |

Learn more about protecting your home at property at [www.texasfirewise.org](http://www.texasfirewise.org)

To learn more, request one of these brochures.

- Plan and Prepare: Is Your Home Ready?
- Fire Resistant Landscaping
- Fire Resistant Materials for Home Repair and Construction
- Vegetation Management in the Wildland Urban Interface



**TEXAS**  
FOREST SERVICE  
The Texas A&M University System



Some of the photos in this publication came from IBHS Research Center studies. Learn more at [www.disastersafety.org](http://www.disastersafety.org).

This institution is an equal opportunity provider. The work upon which this publication is based was funded in whole or in part through a grant awarded by the Southern Region, State and Private Forestry, U.S. Forest Service.





# Fire Resistant Materials

## FOR HOME REPAIR AND CONSTRUCTION



**“** *You don’t have to live in a concrete block home with stainless steel doors and a metal deck all the way around it. You just have to remember – it’s the little things that count.* **”**

Jack Cohen,  
Research Physical Scientist,  
U.S. Forest Service

**T E X A S**  
**FOREST SERVICE**  
The Texas A&M University System

A home located within the Wildland Urban Interface (WUI) may be at risk in the event of a wildfire. Lands and communities adjacent to and surrounded by wildlands are part of the WUI. However, there are precautions that a homeowner can take to reduce a home’s risk. It begins by learning what parts of your home might burn if exposed to direct flame contact, radiant heat or embers.

Several sections of a home are vulnerable to a wildfire because of their size or placement. For example, the roof is a large surface, capable of catching burning embers. The embers may get lodged between the shingles or ignite leaf or pine litter on a roof. Other sections that are vulnerable to wildfires are windows, decks, fencing, vents and eaves.

“Hardening a home” is a term used to describe the retrofitting process that reduces a home’s risk to wildfire. This involves using non-combustible building materials and keeping the area around your home free of debris. The following pages will describe each section and offer alternative building materials that will reduce a home’s risk to wildfire.



*Firewise construction and landscaping helped protect this home from wildfire.*

# Roof and Gutters



*Leaves and needles burning along roof edge with dormer. Photo by Institute for Business and Safety Research Center.*



*The pine needles on this roof burned, but the Class A roof did not. Photo by Institute for Business and Safety Research Center.*

The roof is one of the most vulnerable areas of a home. It is a large surface that is capable of catching embers during a wildfire. A roof also can collect dead vegetation such as pine needles and leaf litter, which will readily ignite. So the maintenance of a roof is as important as the materials used to construct it.

The roof can be ignited along the surface and the edge where gutters are connected. In both cases the most likely cause will be embers landing and debris igniting. The flame then can penetrate the roofing materials and allow the fire to spread to the attic. A homeowner can prevent this by keeping combustible fuels cleared from the roof and using ignition-resistant roofing materials.

## Recommended materials:

- Metal
- Tile (with bird stops)
- Class A shingles

A Class A rating is based on how long a building material burns before it ignites. The manner in which a building material is assembled and layered affects the time to ignition. Class A takes two to four hours; Class B takes one hour; Class C takes 20 minutes.

## Recommended actions:

The homeowner should keep the roof and gutters clear of debris. Keep tree limbs cut back and off the roof.

During a wildfire, vinyl gutters do not resist heat like metal gutters. The primary concern is at the roof edge. There may be an opening between the roof decking and fascia board (behind the gutter). Angle flashing should be placed over this exposure to keep embers out. Debris in the gutter can ignite and fire can spread to the eave. Vinyl gutters can melt and detach, leaving this area exposed.

## Recommended materials:

- Metal gutters
- Gutter guards
- Angle flashing for edge protection

## Recommended actions:

Install gutter guards to keep debris from accumulating. Maintain the roof where the gutter connects to make sure debris does not accumulate between the guard and roof.



*This vinyl gutter melted from heat, exposing the wood and roof edge to embers and direct flame. Photo by Institute for Business and Safety Research Center.*



# Eaves and Soffits

There are typically two types of home eaves:

1. Open eaves
2. Boxed-in eaves (with soffit vents)

The primary function of the eave is to protect the home from rainwater. However, during wildfire events this section is vulnerable to embers and direct flame contact. The goal is to prevent embers entering the attic through vents. The vents should have screening attached to stop embers from passing through.

Direct flames also can spread to the eaves and ignite any combustible materials. Open eaves are especially vulnerable to direct flame contact. If a homeowner uses a boxed-in eave, they should use non-combustible materials.

Angle flashing also should be used, as discussed in the roof section of this guide.



*Direct flame on siding burns into the eaves and roof. Photo by Institute for Business and Safety Research Center.*

## Recommended materials:

- Metal
- Cement board
- Stucco

## Recommended actions:

Box in eaves with non-combustible material.



*Without roof edge flashing, embers can enter into the attic. Photo by Institute for Business and Safety Research Center.*



*With roof edge flashing, fewer embers enter the attic area. Photo by Institute for Business and Safety Research Center.*

# Exterior Walls



*This photo shows the difference between combustible siding (left) and fiber cement siding (right) when exposed to the same direct flame source. Photo by Institute for Business and Safety Research Center.*

The exterior walls of a home will need to be resistant to radiant heat and direct flame contact. For homes with vinyl siding, the radiant heat from a wildfire may become intense enough to melt the siding. This could possibly expose crevices in a home and allow embers to enter.

If the siding is exposed to direct flame contact long enough, it could possibly ignite. Homes are at a higher risk of direct flame contact if they have combustible siding and are surrounded by dense vegetation.

**Recommended materials:**

- Cement board
- Masonry
- Stucco

**Recommended actions:**

Use non-combustible siding and make sure there are no crevices or holes that could potentially catch embers.



*The vinyl siding and window frame on this home melted when exposed to radiant heat.*



*When this vinyl siding melted, it exposed other combustible materials.*



# Windows

The windows of a home are vulnerable to radiant heat and direct contact with flames. Plants placed below a window could potentially ignite and release significant heat, causing a window to break. After the glass has broken, the interior of the home will be exposed to embers.

The window's wooden framing can ignite, allowing a wildfire to spread to the interior of a home. Vinyl framing can melt, exposing the interior, allowing embers and direct flame to travel through.

The best preventative maintenance a homeowner can do is to arrange the landscaping in a way that limits vegetation (shrubs, plants and tall grasses) near a window. Creating space between plants and a home will help prevent direct flame contact. Reducing the vegetation near a home will decrease the amount of flammable fuel, which will reduce the radiant heat.

Window screens also play a vital role during a wildfire. They will absorb and redirect radiant heat, allowing the glass to absorb less. If the glass breaks, screens may also prevent embers from entering.



*Radiant heat melted the interior blinds.*

## Recommended materials:

- Tempered-glass window
- Double-pane window
- Metal framing or aluminum coverings for wood or vinyl

## Recommended actions:

- Install double-pane windows or tempered-glass windows and use a metal framing.
- Use a fiberglass or metal screen.



*Although this glass cracked from radiant heat, the second pane provided an extra barrier that kept flames from entering.*

*Metal frames are less likely to melt. Frames that melt or burn allow the window panel to fall out, letting embers and flames into the home.*

*Tempered glass also is recommended because it deflects more heat than non-tempered glass.*

*Photo by Institute for Business and Safety Research Center.*

# Vents



Screening helped capture these embers and prevent their entry into the attic. Photo by Institute for Business and Safety Research Center.



This screen prevented embers from entering. Photo by Institute for Business and Safety Research Center.

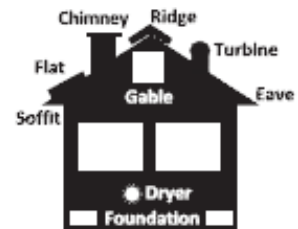


Combustible material like this mulch, near skirting or siding, leaves the home unprotected, even with screening in place. Photo by Institute for Business and Safety Research Center.

There are several different types of vents for a home. These vents play a vital role by supplying openings for air to flow through. However, these vents can allow embers to enter a home during a wildfire.

Types of vents Include:

Soffit	Gable
Flat	Eave
Chimney	Foundation
Ridge	Dryer
Turbine	



These vents should all be non-combustible with 1/8-inch screening. This will prevent the vent from melting and exposing the interior of a home. The 1/8-inch screening protects the home from embers.

However, using a 1/8-inch screen may reduce the amount of air flow designed for an area; this should be considered when installing a vent. Also, 1/8-inch screening may become clogged with debris. Regular maintenance should be completed to keep the vent clean.

**Recommended materials:**

- 1/8-inch metal screen
- 1/8-inch fiberglass screen

**Recommended actions:**

- Install 1/8-inch screening
- Clean vents to keep them free of debris, allowing them to keep embers out while allowing air flow for ventilation.



Vents can clog. This vent was painted over, reducing its effectiveness in providing ventilation. Photo by Institute for Business and Safety Research Center.



# Decks, Fencing & Skirting

## Decks and fencing

Decks and privacy fencing are common attachments that are vulnerable to wildfire. A wildfire can ignite and spread along a fence line, ultimately spreading to the home itself. Once a wildfire begins to burn fencing near the home, it will release embers into the eaves, possibly allowing direct flame contact. A deck will create the same type of embers and direct flame contact, but most likely will produce greater radiant heat.

The goal is to build these attachments with non-combustible material or to separate the section adjacent to the home using fire-resistant materials. This will create a buffer between the home and combustible materials. This also will separate the home from direct flame due to the wooden attachment.

### Recommended materials:

- Brick/masonry
- Cement board
- Metal
- Composite decking material

### Recommended actions:

- Clear vegetation from underneath the deck.
- Spread gravel or other non-combustible material under the deck.
- Screen in the bottom of the deck with metal 1/8-inch screening.



*Materials under this deck could easily catch the home on fire.*



*This home escaped the flames when firefighters knocked down the burning fence that would have led flames to the home. Notice the burn marks on the fence.*



*The flammable skirting under this deck, along with mulch, could easily lead flames to the deck and home.*

## Skirting

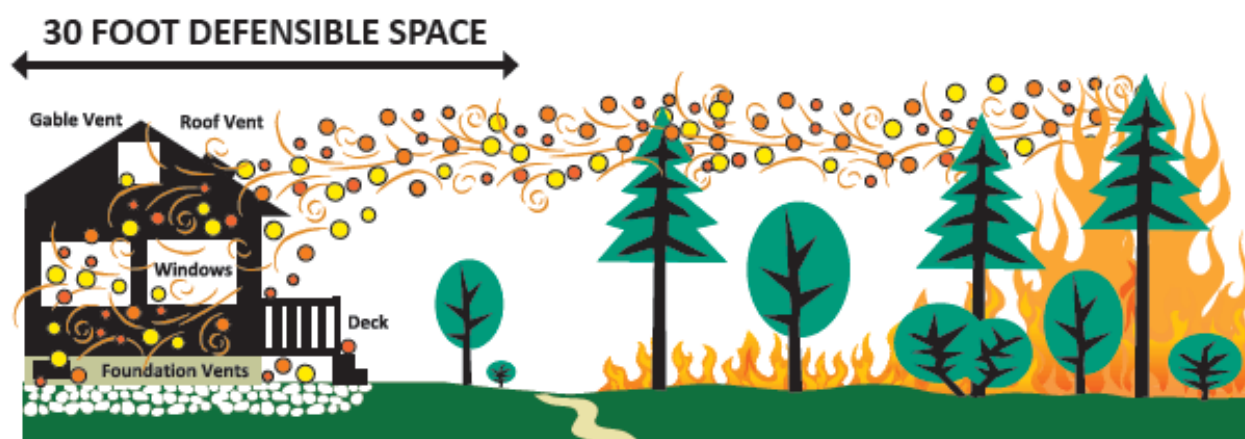
Foundations should be enclosed with skirting. Exposed foundations will allow embers to travel underneath the home and possibly ignite flammable material. However, the wrong type of skirting can be vulnerable to radiant heat and direct flame contact. If a combustible skirting ignites or melts, embers and flame could get in.

### Recommended materials:

- Masonry
- Cement board
- Metal

# Construction Checklist

- |   |  |
|---|--|
| <input type="checkbox"/> Create 30 feet of defensible space             | <input type="checkbox"/> Install window screens (fiberglass or metal)  |
| <input type="checkbox"/> Use non-combustible roofing materials          | <input type="checkbox"/> Use metal window frames or aluminum coverings |
| <input type="checkbox"/> Install guards on metal gutters                | <input type="checkbox"/> Clear underneath deck of any vegetation       |
| <input type="checkbox"/> Keep roof clean of debris                      | <input type="checkbox"/> Screen the underside of deck                  |
| <input type="checkbox"/> Box in eaves with non-combustible material     | <input type="checkbox"/> Use non-combustible decking material          |
| <input type="checkbox"/> Screen all vents with 1/8-inch screening       | <input type="checkbox"/> Create buffer between fencing and home        |
| <input type="checkbox"/> Use non-combustible material for siding        | <input type="checkbox"/> Use non-combustible skirting                  |
| <input type="checkbox"/> Install double-pane and tempered-glass windows |  |



Without creating defensible space, retrofitting a home will not significantly reduce risk. The 30 feet of defensible space reduces the amount of hazardous vegetation, keeps the yard green and healthy, and creates a buffer between the home and the wildland environment. Defensible space combined with the use of non-combustible construction materials gives a home a better chance of surviving a wildfire.

If you want more information on protecting your home and property, request one of these brochures.

- Plan and Prepare: Is Your Home Ready?
- Be Embers Aware
- Firewise Landscaping
- Vegetation Management in the Wildland Urban Interface



**T E X A S**  
**FOREST SERVICE**  
 The Texas A&M University System



Texas Forest Service is an equal opportunity provider. The work upon which this publication is based was funded in whole or in part through a grant awarded by the Southern Region, State and Private Forestry, U.S. Forest Service.



Some of the photos in this publication came from Institute for Business and Home Safety Research Center studies. Learn more at [www.disastersafety.org](http://www.disastersafety.org).



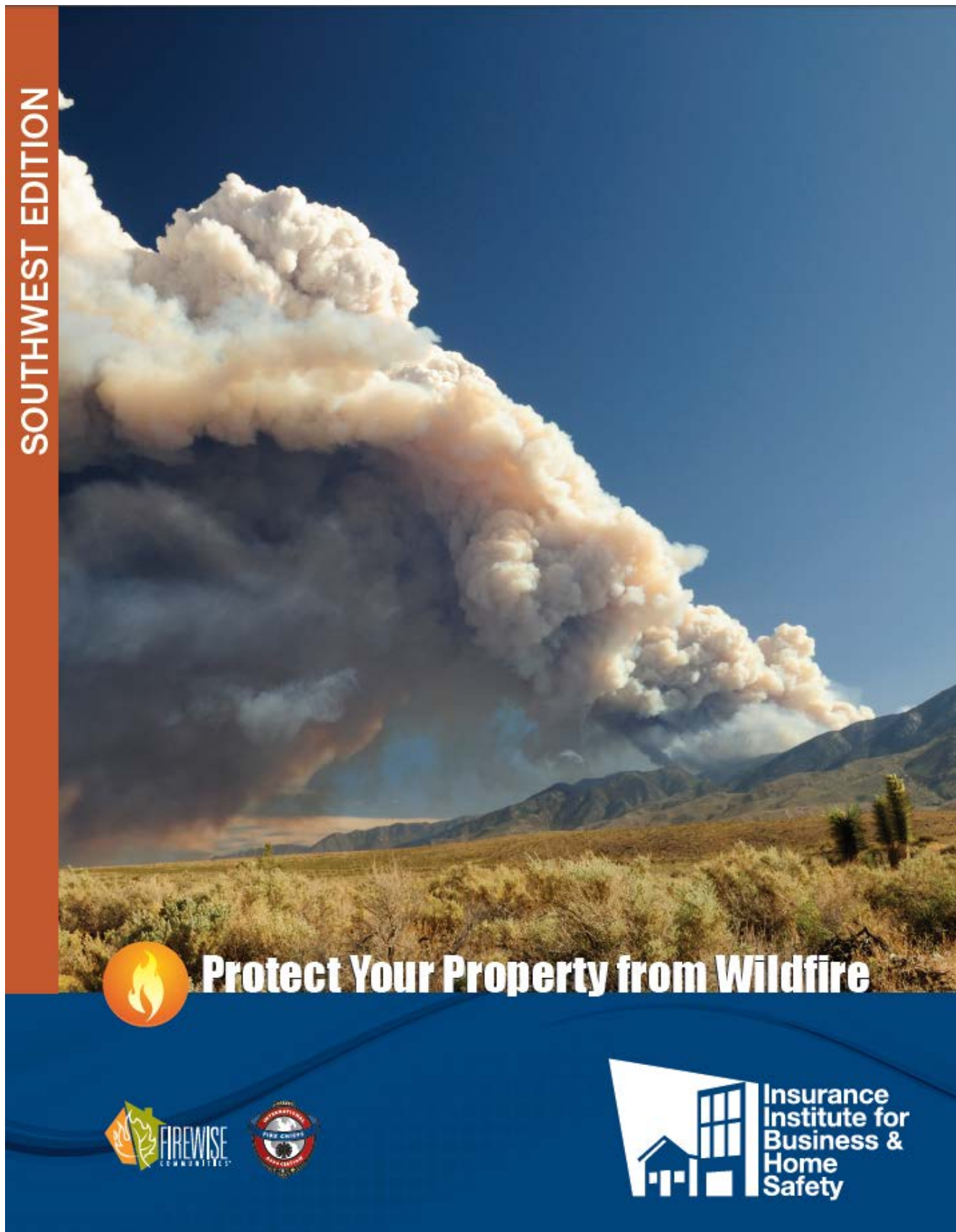
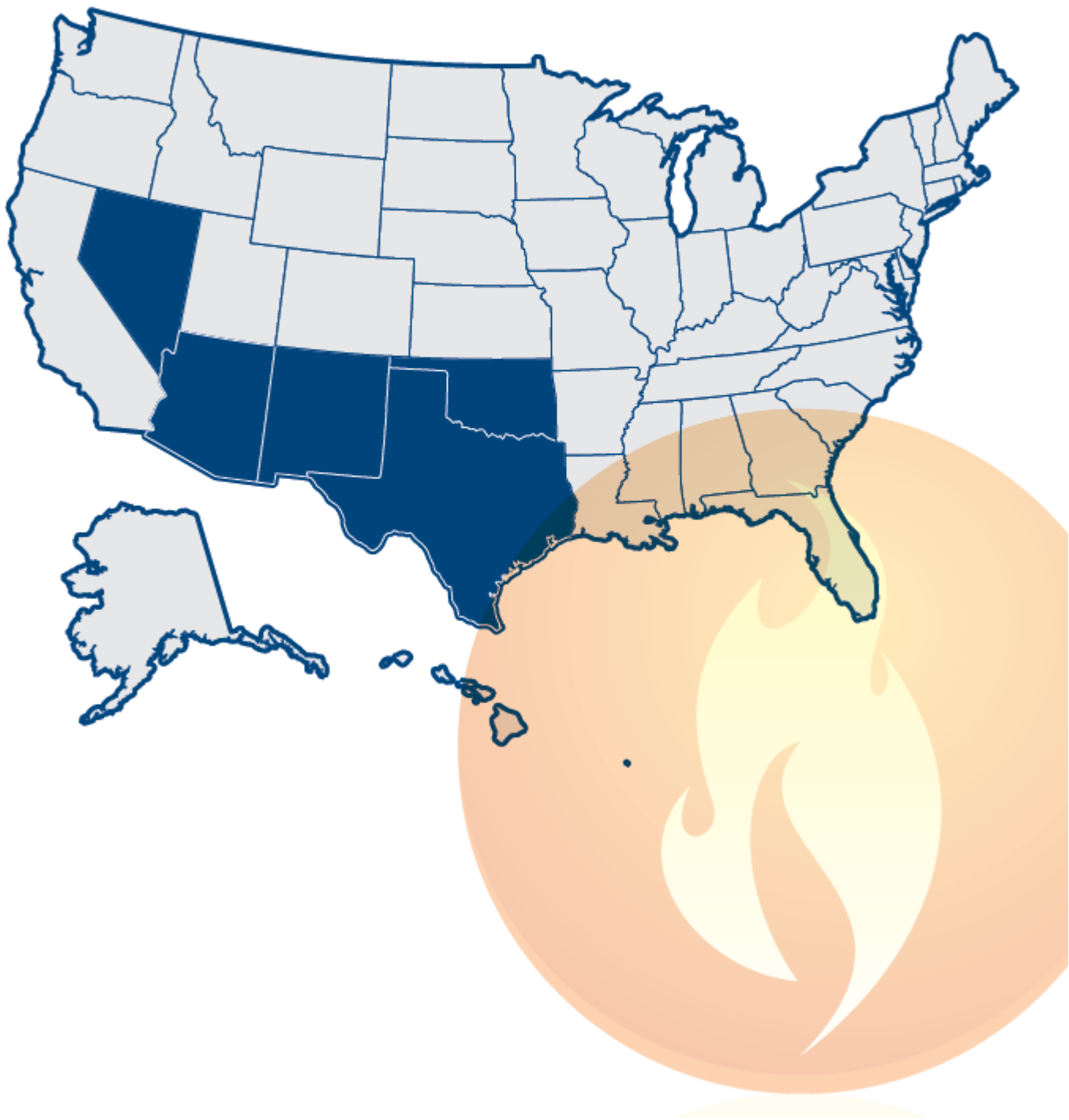


Table of contents

3	Introduction
4	Southwest Retrofit Guide
15	Property Assessment Checklist







## YOU CAN MAKE A DIFFERENCE

Prolonged drought conditions combined with hot, dry winds that commonly blow through the mountains and across the plains have left Arizona, Nevada, New Mexico, Oklahoma and Texas particularly vulnerable to wildfire conditions. As these areas are threatened by larger and more destructive fires, property owners are looking for solutions to reduce their risk of damage. This guide was created for the Southwest and takes into account local building styles and construction materials, common topographical characteristics and weather patterns, and other risk factors identified by fire science research. While wildfire protection begins with the individual, this research proves that a community-wide approach to fire protection is the most effective, so please share this guide with friends and neighbors. If something combustible is located within a 100-foot perimeter of your home or business, it could potentially put your property at risk. Everyone benefits from a wildfire-adaptive community.

Wildfire research has shown that individuals and families can protect their properties against wildfires by addressing three clear sources of vulnerability: the home or business itself, the landscaping near a building and the general vegetation in the area surrounding the building. Each of these sources can be dealt with through maintenance, structural improvements, and vegetation control. Many of these projects are affordable and can be done in a weekend. Some of the projects have an additional financial benefit: they can help improve the energy efficiency of your home or business.

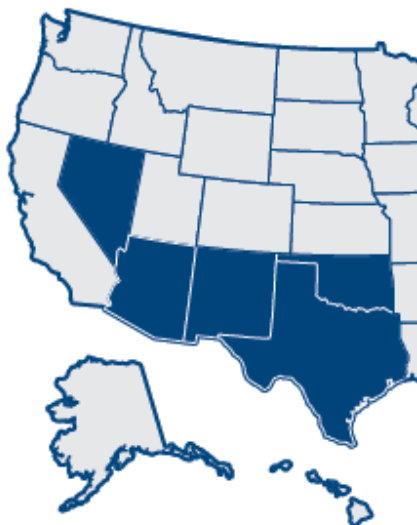
### UNDERSTANDING EFFECTIVE WILDFIRE PROTECTION

Wildfires are called wild for a reason – they are often uncontrollable. What is controllable, however, is the preparation you can undertake to protect your home or business from damage and losses when a wildfire threatens. Ultimately, the difference between survival and destruction is whether some part of the building catches on fire.

There are two primary areas of concern when it comes to limiting ignition from exposure to a wildfire. First, a number of features, materials and design details of the structure itself can make it vulnerable to a wildfire. Second, the surrounding wildlands and vegetation near your home or business can provide a pathway for an approaching wildfire to get close enough to for flames touch the structure, radiant energy (like standing in front of a camp fire) to preheat or ignite your structure, or embers from a fire a mile away may fall onto the structure and cause it to catch fire.

### MANAGING YOUR HOME OR BUSINESS:

The most vulnerable part of your structure is the roof. If you have a flammable roof, almost anything else you do will be of little consequence in reducing the chances the structure will burn when a wildfire approaches. Other key risk factors include vents that can allow embers to enter the attic; fences and decks that can ignite and bring a fire right up to the building; single-pane windows that can shatter and allow flames and embers inside, and debris that collects in gutters and in various locations along the roof and wall lines. This guide



provides ideas for reducing the ignition risks by making improvements to your home or business.

## MANAGING VEGETATION AND FUEL SOURCES AROUND YOUR HOME OR BUSINESS

Fire officials recommend a vegetation management zone around your structure of at least 100 feet or more, depending on the type of vegetation in wildland areas adjacent to the structure and the slope of the land around it. The actions you take to modify the vegetation in this area are intended to reduce the severity of the fire. This also reduces the chances that flames will come into direct contact with any part of the structure or radiant energy from the high-intensity flames will be sufficient to break the glass in windows or cause other surfaces to catch on fire. Regardless of the size of the land surrounding a home or business, the goal is the same: to reduce the amount of fuel that can bring a wildfire dangerously close to your door. This zone, which is widely referred to as "defensible space," creates a safer area for firefighters to try to keep the wildfire at bay and help stop the flames from actually reaching your home or business.

## IMPROVING YOUR STRUCTURE'S WILDFIRE RESISTANCE

You probably already have a list of property improvement projects, both large and small. Maybe you need a new roof, want to replace old windows or doors with new energy-efficient models, or need to rebuild a deck or porch. As your first step, review your list to see if it includes projects in any of the following building-related sections. If so, by slightly modifying your project plans, you may be able to simultaneously improve the condition of your home or business, add to its value and reduce your risk of wildfire damage. You also may decide to add new projects to the list, ones that can both provide vital protection against wildfire and, in some cases, save money on energy bills.

## ROOF

### WHAT YOU SHOULD KNOW

Replacing a roof is a major project, but it also yields major benefits. The roof should be your first priority. Research has shown that combustible roof coverings are the greatest threat to a structure during a wildfire. Roof combustibility is described by a UL (Underwriter's Laboratory) rating system – with a Class "A" being the least combustible based on ember tests. Roof shape also plays an important role. Take a careful look at your roof. If you have a lot of ridges and valleys, or roof segments that intersect with the walls of the structure, you have a complex roof. This makes your structure more vulnerable to wildfires even if you have a Class "A" roof because vegetative debris readily accumulates in these intersection areas and so can burning embers. When the resulting fire is next to combustible siding or a dormer window it can cause the structure to catch fire.

### WHAT YOU SHOULD DO

Always keep your roof clean of debris.

It can be difficult to tell whether you have a Class "A" fire-rated roof, unless it's made of an obviously noncombustible material, such as tile. If you are not sure about your roof, schedule a professional roof inspection to find out. If you



Dormers





replace your roof, choose a Class "A" rated roof, and completely remove the old covering.

Regardless of the specific Class "A" roofing material that you choose, inspect it regularly, maintain it when necessary, and replace it when needed.

Here are some things to keep in mind when choosing a Class "A" roof covering:

- Many roof coverings have a Class "A" rating based only on the top/external part of the roof that you can see. Some common examples include asphalt composition fiberglass shingles, steel, and clay or concrete tiles. Asphalt composition shingles also can use organic fibers instead of fiberglass, which would result in a Class "C" fire rating.
- Other roof coverings obtain their Class "A" rating because additional materials are used in the roof assembly to enhance fire resistance. The assembly is the underneath part of the roof that you can see. These coverings are considered "Class 'A' by assembly." Examples include aluminum, and some newer composite roofs made from recycled plastic and rubber materials, which require other layers of noncombustible materials to achieve a Class "A" rating. Wood shakes also are now available with pressure-impregnated, exterior-rated, fire-retardant chemicals that provide a Class "B" fire rating, and a "Class 'A' by assembly."
- It is important to note that most roofing products and assemblies are tested with new materials when they receive their rating. One exception is wood shakes, which are subjected to a natural weathering protocol prior to roof fire testing. One important thing to note is that over time as the products weather, both wood shake and shingle roofs may become more vulnerable to fire.

## EAVES, SOFFITS, AND ATTIC AND CRAWLSPACE OPENINGS

### WHAT YOU SHOULD KNOW

Researchers have learned from post-fire surveys of buildings damaged and destroyed by wildfires that attic/roof and foundation vents are entry points for embers and flames. Among the most vulnerable are vents in the eave and soffit areas, but there also are risks associated with the most common type of eave, known as open (or exposed) eave construction, which does not have vents. You have this type of construction if you can see the rafter tails from your roof framing on the exterior underside of your roof. If not properly installed, there can be gaps where the blocking and rafter tails intersect; as a result, wind-blown embers could become lodged here and ignite.

### WHAT YOU SHOULD DO

If you have vented openings into your attic or crawl space, check for screening. At a minimum, these vents should be covered with 1/8-inch metal mesh screens (usually the finest mesh allowed by the building code). Post-fire surveys have shown that embers large enough to cause ignitions can pass through 1/4- and even 1/8-inch mesh screening, so whereas screening will help, it won't be the



Wood Shake



Asphalt Shingles



Barrel Tile/Complex roof

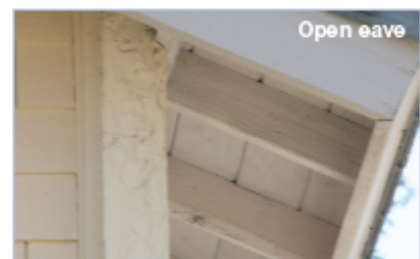
Wood shake roofs are now available with chemical treatments that provide a Class "B" fire rating.

Asphalt shingles are available with Class "A" fire ratings, but also may use organic fibers that can result in a Class "C" rating with less fire resistance.

Tile roofs must be kept clear of debris and the ends blocked to avoid allowing embers to override the Class "A" fire rating abilities.



Boxed eave



Open eave



perfect answer. Also, keep in mind that while a finer mesh screen will offer better protection against embers, it also requires more maintenance to be kept free of debris. It is important to keep air flowing freely to help manage the moisture in your attic.

Property owners in every area vulnerable to wildfire can benefit from new vents being designed as a result of stricter building codes in California. Although these vents may not be required in your state, they are designed to offer enhanced protection by reducing the chance embers will enter your space. These products are currently in the testing and acceptance phase. Find a list of accepted vents at: <http://osfm.fire.ca.gov/> Scroll down to the section titled Building Code Chapter 7A Wildfire Protection Information & CBC Chapter 7A Task Force.

If you have open eaves (i.e., you can see the exposed rafters in the eave of your home or business), you can enclose the underside of the roof overhang to help keep embers from lodging there. To do this, fasten sheathing made from a noncombustible or fire-resistant material to the underside of the rafter tails. This enclosure can follow the slope of the roof, and is sometimes referred to as boxing-in the eave. This can also be accomplished by extending the material from the roof edge horizontally to the exterior wall, thereby making a soffit eave. If you have a vented attic, don't forget to add soffit vents as part of your project – position the vents close to the roof edge, not the exterior wall.

## TILE AND OTHER NONCOMBUSTIBLE ROOF COVERINGS WITH GAPS ALONG THE EDGES

### WHAT YOU SHOULD KNOW

Some roofing materials have a gap at the ridge and edge of the roof. The most common example is a clay barrel tile roof covering, but it also occurs in some metal roofs (mainly shingle style) and other cement roof coverings. The gaps can allow birds and rodents to get into the opening and build nests. The small bits of vegetation used for nesting material are highly combustible, and easily ignited by wind-blown embers. The flames can then quickly spread to the structural members that support your roof and bypass any protection offered by Class A fire-rated roof covering materials.

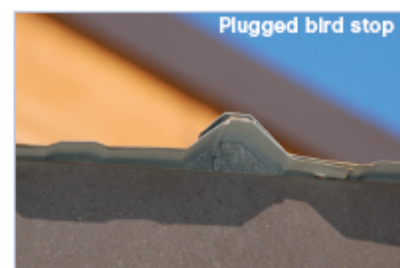
### WHAT YOU SHOULD DO

Use a form of protection called a bird stop to seal the open edges of the roof covering. Bird stops are a manufactured shield that can be purchased from roofing supply stores and are typically provided by the manufacturer of the roof covering. The bird stop is inserted into the opening at the edge of the roof. You can also use a mortar mix to plug the ends. The mortar mix would be the best option for openings at the ridge of the roof. Remember, the idea is to keep fuel sources (such as nesting materials, and wind-blown debris) and embers from getting under the roof covering.

Don't forget to inspect the ridge (peak) of your roof. A flat tile roof may not have a gap at the roof edge, but it could have openings at the ridge. These openings also need to be closed.



Bird stop (missing)



Plugged bird stop



## GUTTERS

### WHAT YOU SHOULD KNOW

Wind-blown vegetative debris and overhanging trees can lead to the accumulation of leaves and needles on the roof and in gutters. Once dry, this debris can be readily ignited by embers from a wildfire. Debris accumulated in gutters and at roof-to-wall intersections are both particularly vulnerable to ignition by wind-blown embers.

Even if you have a Class "A" fire-resistant roof covering, such as tile, concrete or asphalt composition shingles, the roof edge, and in the case of a multistory structure or one with dormers, the exterior siding adjacent to the roof, will be exposed to flames from the ignited vegetative debris.

Many check lists suggest replacing vinyl gutters with metal gutters. Debris in any gutter will be readily ignited by embers. Depending somewhat on the amount of accumulated debris, a vinyl gutter will likely quickly detach from the fascia due to deformation from the heat or flames and fall to the ground. The debris will burn out on the ground, potentially igniting any other vegetation or combustible siding. The metal gutter will remain attached to the fascia, and the ignited debris will burn out there, continuing to expose the edge of the roof. The most 'fire safe' solution is to minimize the build-up of debris in the gutter.

### WHAT YOU SHOULD DO

Remove tree branches that overhang the roof and remove any dead vegetation, including branches, within your defensible space, the zone where you are actively managing your vegetation. This should be part of your routine defensible space maintenance. Do this at least once each year, at a time best suited for the health of the tree or plant.

Clean gutters and roof areas where debris collects. Inspect these areas at least twice a year. Remove accumulated leaves, pine needles and any other combustible debris.

Covering your gutters with screens or other cover devices can minimize the build-up of debris in the gutter. Remember that even gutters with screens should be inspected to make sure covers are still in place and performing properly. Some screens and cover devices will keep debris out of the gutter, but allow it to accumulate on the roof, behind the device. If ignited, this amount of debris won't be a problem for a Class "A" roof but can increase your vulnerability if you don't have a Class "A" roof. Even if you have a Class "A" roof, debris should still be removed on a regular basis to reduce ember generation and exposure to other building components.





## WINDOWS AND DOORS

### WHAT YOU SHOULD KNOW

The doors and windows of any structure should be able to resist wind-blown embers and protect against radiant heat and flame exposures. Depending on the type of glass, a window that is exposed to flames may break after only 1 to 3 minutes of exposure to intense heat or flames. When windows break from exposure to heat and/or flames, embers and flames can get inside the structure. Testing has shown that single-pane windows are highly vulnerable to breaking when exposed to wildfire conditions. Fortunately, dual-pane windows provide better protection; this protection is even greater when tempered glass is used. Remember, even dual-pane, tempered glass windows will not protect your home or business if they are left open. So, close all windows before you evacuate during a wildfire.

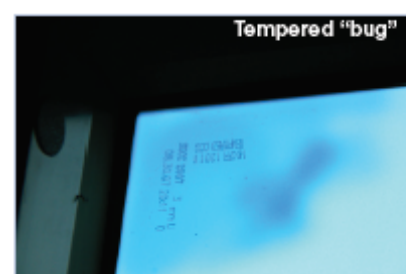
Glass in windows breaks because of extreme temperature differences that develop between the exposed glass, and the glass protected by the window framing material, when exposed to the heat from a wildfire (or the heat from your neighbor's property that has ignited). Cracks develop at the edge of the glass. Because larger windows have more edge, large windows are more vulnerable to breaking than smaller ones. Studies have shown that the glass is the most vulnerable part of the window (i.e., the glass is more vulnerable than the frame).

### WHAT YOU SHOULD DO

Determine what kind of windows are in your building. Single-pane windows are more common in older buildings, while dual-pane windows are more frequently found in newer construction. Dual-pane windows have two sheets of glass that are separated by airspace. To find out if your dual-pane windows contain tempered glass, look for an etching (called a bug) in the corner.

You should replace your single-pane windows with dual-pane windows that have at least one pane of tempered glass (if only one pane of the dual-pane window is tempered, it would be best to have the tempered pane on the outside). Dual-pane windows without tempered glass don't protect as well in wildfire conditions. Current energy code requirements usually require dual-pane windows, so changing your single-pane window to dual-pane will help with both fire-resistance and energy efficiency.

If you cannot afford to replace your windows but have managed the fuels close to your property, including vegetation, mulch and yard structures, a less expensive alternative is to make shutters out of ½-inch plywood. Cut them to size and label them for each window so they can be installed quickly when wildfire threatens. Take the time to pre-install the anchorage hardware and prepare your shutter materials in advance. The ½-inch plywood will provide an extra measure of protection from radiant heat or the impact of wind-blown embers.



The outer pane of this dual-pane window broke during a 2007 wildfire. Having the dual-pane window was one reason why this home survived.

Tempered glass in a window will have a marking etched on one of the corners, similar to that shown here.



## DECKS, PORCHES AND PATIOS

### WHAT YOU SHOULD KNOW

Decks, patios and porches are important because they often are attached to the house or business and are next to windows, sliding glass doors, and possibly combustible siding. Consider the construction material used to build the deck, patio or porch, along with the types of items that are on and beneath it. This includes vegetation leading up to the structure, which can act as a wick and move the fire through to the building materials, igniting it and other items stored underneath or nearby. This is particularly important for decks when the house or business is sited on a sloped lot. Depending on the type and condition of the vegetation, flame lengths on a slope can reach more than 30 feet, so even an elevated deck can be vulnerable.

It is common knowledge that wood deck boards are combustible. There is sometimes a misunderstanding regarding the combustibility of wood-plastic composite decking products. These products also are combustible; some manufacturers are now incorporating fire retardant chemicals into their products, and fire performance information for many decking products is now available online at the manufacturer Web site. Wood decking that has been treated with an exterior fire retardant also is available.

Some checklists and guides suggest attaching a metal flashing strip, approximately 18 inches tall, between the top of the deck, patio or porch and the exterior (combustible) siding. The purpose of the flashing strip is to provide protection from ember exposure, both the embers themselves and the flaming exposure that could occur if accumulated debris at the point where the house or business intersects with the deck, patio or porch were ignited by the embers. This is a good idea, as long as the flashing is tucked in behind the siding where the top of flashing terminates so water cannot seep between the flashing and the siding.

### WHAT YOU SHOULD DO

Enclosing your elevated deck, patio or porch can help reduce the risk of damage from wildfire. These can be enclosed vertically by applying an exterior siding product around the edge of the deck, patio or porch or horizontally by applying an exterior panelized product to the bottom of the support joists.

To determine if enclosing your deck, patio or porch would be beneficial, consider whether you store combustible materials underneath it, or if your vegetation management plan is inadequate, particularly in the 0- to 30-foot zone. If you can avoid storing combustible materials underneath and if you create and maintain your vegetation management plan, enclosure will not significantly increase the protection of your house or business from wildfire.

If you choose to enclose your deck, patio or porch make sure you provide sufficient ventilation or other means for water to drain out. The building code requirement for a crawlspace is one square foot of venting for each 150 square feet of floor area. You should have at least this much ventilation and maybe more if you are in a particularly wet area. If you do not allow the structural



**Use noncombustible materials when building a deck. Never store flammable materials on top of or beneath the deck.**

support members and boards to dry out, fungal decay will become the biggest threat to your deck, patio or porch.

Enclosing your deck, patio or porch will not reduce the risk of the top being exposed to embers. For that, the best protection is to keep the surface clear of leaves, pine needles and other vegetative debris. If your house or business is supported by a column and beam system, and it doesn't have skirting around the perimeter, add a skirting of an ignition-resistant material. Remember to provide vents on all sides to ensure proper ventilation.

Learn more about how to choose wildfire-resistant decking materials at: [http://www.fire.ca.gov/fire\\_prevention/fire\\_prevention\\_wildland.php](http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland.php).

## SIDING

### WHAT YOU SHOULD KNOW

Siding can be vulnerable for two reasons. First, if ignited, combustible siding can provide a path for flames to reach other vulnerable components of your structure, such as windows and the eave area. Second, if penetrated, a horizontal or vertical lap joint can provide access for flames to enter the building. Penetration at lap joints is more likely with combustible siding products, but can occur in noncombustible siding products as well.

Large logs used to side homes will resist ignition better than smaller members typically used for wood siding products. The most vulnerable part of a log wall is the space between joints, but this risk is minimized if the space is filled with "chinking" that provides protection from flame penetration. Wood siding with a more complicated lap joint, such as tongue-and-groove or shiplap, offers better resistance from flame penetration into the stud cavity.

Vinyl siding will deform and fall off the wall at relatively low radiant energy or flame exposure during a fire. In these cases, protection of your home will depend on the performance of the underlying sheathing material.

Noncombustible siding, including fiber cement, traditional 'three-coat' stucco, and brick, will provide the best protection. Wood siding that has been treated with an exterior-rated fire retardant chemical will also improve the performance of siding against wildfire exposure.

### WHAT YOU SHOULD DO

If you have combustible siding, consider incorporating a noncombustible zone next to your home or business. In order to best resist fire penetration at lap joints, plain lap joints should be avoided, or exterior-type fire retardant treated siding should be used. If you have a chinked-style log structure, inspect the chinking for cracks and missing pieces. Repair and replace with fire-resistant chinking.

Replacing siding is expensive and there are other, less expensive items already discussed in this guide that will provide more protection.







## FENCES

### WHAT YOU SHOULD KNOW

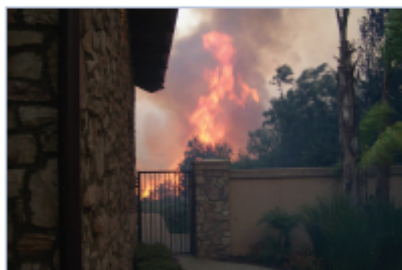
Fences can be a wildfire hazard, particularly if they connect directly to the structure. The bottom of fences collect debris that, when combined with combustible fencing materials, become a fuel source that can act as a wick to carry fire directly to the building.

Some checklists recommend inserting a metal shield where the fence connects to the exterior (combustible) siding. How effective this will be will depend on the size of the metal. Also, depending on how it is attached, over time it could also result in other moisture-related problems with the siding. Find more in the following section.

### WHAT YOU SHOULD DO

New fences should be entirely constructed of noncombustible or other fire-resistant materials. A wood frame with steel mesh infill is another option that will provide adequate protection. Existing wood fences that are attached to the structure should be retrofitted so the fence ends with a noncombustible material like masonry or metal, or with a larger wood member (i.e., heavy timber) to keep fire from spreading. A common technique is to use a metal gate that is attached to the fence on one side and to the exterior siding on the other side.

It is important not to store firewood or other combustible materials against the fence, and to regularly remove debris and dead vegetation at the bottom of the fence.



Use metal gates and noncombustible materials when installing or replacing a fence.

## CHIMNEYS AND BURN BARRELS AND OPEN DEBRIS BURNING

### WHAT YOU SHOULD KNOW

Spark arrestors are required to prevent large embers from escaping through your chimney. Think of it as a community-wide approach to wildfire protection – you protect your neighbors and they protect you by having a chimney spark arrestor.

The spark arrestor concept also applies to burning debris and garbage in an open barrel. Embers generated during burning can result in ignitions in adjacent woodlands. Fire also can escape when doing debris burning in open piles.

### WHAT YOU SHOULD DO

Install a spark arrestor that has ½-inch mesh. These are available at lumber yards, hardware stores or fireplace specialty stores.

In the case of burning in barrels, a heavy metal screen with ½-inch mesh should be placed on top of the barrel. Debris also should be cleared from the area immediately surrounding the barrel. Care should always be taken when conducting open backyard debris burns to stop fire from escaping into the

wildland. State and local ordinances may require a permit for open burning. Contact your local fire department for information.

Follow these guidelines for safe debris burning:

- Clear a safe zone that is wide enough to prevent the escape of fire.
- Keep a supply of water and a rake or shovel readily accessible.
- Stay with the fire until it is completely out and never leave a fire unattended.
- Burn only when the wind is calm and the humidity level is high.
- Extinguish fire completely if conditions become windy.
- Keep brush piles small to allow quick control of the fire if necessary.
- Locate brush piles an adequate distance from structures and utilities.
- Obey all outdoor burning laws including forest fire laws, air pollution, open burning regulations, and local ordinances.
- Understand that you are liable for damages and cleanup if the fire escapes.

## CREATING DEFENSIBLE OR DEFENSIVE SPACE

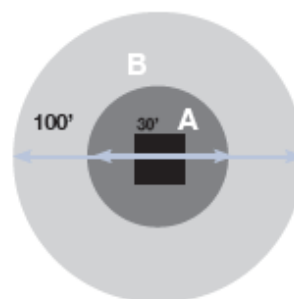
### IDENTIFYING FUEL MANAGEMENT ZONES

The zone closest to your home or business extends outward at least 30 feet (or to the property line). This zone will require the most thinning and (horizontal) separation of trees and other vegetation and removal of items that could cause a very intense, close fire. The objective of the thinning and separation in this zone is to reduce the chance that vegetation will provide flames a direct path to your home or business. The other kinds of items to be removed include wood structures, boats, RV's and other combustible items that could create a very intense fire.

The next zone extends from 30 feet to approximately 100 feet (or to the property line). If your home or business is located on a steeper slope (more than 1-foot drop for every 5 feet you move away from the structure), then this zone should be increased. Trees and other vegetation here should be maintained and dead plant materials and tree branches should be removed. The objective of the work in this zone is to slow down and reduce the energy of the wildfire.

If you are in a forested area, there is a risk that a wildfire could spread to the tops of the trees. By making modifications in the 30 to 100 foot zone such as increasing the separation between trees and vegetation and eliminating tree branches located close to the ground, you can help drive the wildfire back to the ground. These improvements also will help to reduce the chance that a fire will climb back up into the crown of the tree. Once created, it's critical to maintain these improvements.

Because of the importance of the area closest to your home or business, some experts suggest an additional zone that extends from 10 to 15 feet from the building. In high risk areas such as chaparral, this extra attention needs to be extended throughout the full 30 foot zone. Pay particular attention to the types of vegetation and mulch you select for this area. Whatever types of plant materials are chosen, they must be carefully maintained. There are products on the market such as noncombustible mulches, including rock, gravel, and noncombustible hardscape features such as brick and concrete walkways



Defensible space involves two zones extending out from a home or business.





and surfacing that will reduce your wildfire exposure. Choosing low-growing, irrigated herbaceous plant materials is another good option.

### THE AREA CLOSEST TO YOUR STRUCTURE (0 TO 30-FEET)

Take stock of what surrounds you. Consider the plants but look beyond them to other items that could increase the risk that your building will catch on fire. People frequently forget to look beyond the plants.

## PLANTS

### WHAT YOU SHOULD KNOW

Close to the building, plants can become a major fire hazard. Plants adjacent to combustible siding, as well as plants under or next to windows or the interior corners present the greatest hazard. Embers from a wildfire can reach the building from a mile or more away, and can become trapped in corners, igniting nearby plants and exposing siding and the roof overhang to flames.

### WHAT YOU SHOULD DO

Remove dead vegetation close to the home or business, paying attention to material on and underneath plants. Mulch can help keep the ground moist and reduce the need for watering, but it also can become a fire hazard. Avoid using wood, bark and rubber mulch products, particularly small pieces of bark. Consider rock mulch or other noncombustible materials. For plants, shorten the height, remove branches that are close to the ground, prune to reduce the amount of material in the plant, and remove dead material.



Palm trees act as torches once ignited.

### BETTER VEGETATION CHOICES FOR YOUR AREA

Choose fire-resistant plants. Learn more about choosing plants, and community-based programs by visiting the links at [DisasterSafety.org/megafires](https://DisasterSafety.org/megafires) or directly at:

#### Arizona

<http://ag.arizona.edu/pubs/garden/az1153.pdf>

#### New Mexico

[http://www.co.santa-fe.nm.us/resident/documents/WuI\\_plantlist.pdf](http://www.co.santa-fe.nm.us/resident/documents/WuI_plantlist.pdf)

#### Oklahoma

<http://www.forestry.ok.gov/firewise-plant-list>

#### Nevada

<http://www.unce.unr.edu/publications/files/ho/2001/fs0133.pdf>

#### East Texas

<http://www.circleoaks.org/fire/Firewise%20Recommended%20Plants.pdf>



## YARD STRUCTURES

### WHAT YOU SHOULD KNOW

Arbors, pergolas or trellises, combustible fencing, playground equipment, gazebos and other structures located close to your home or business will increase its vulnerability to wildfire. Wind-blown embers can accumulate in or on such structures and ignite them. Depending on how close the items are to vegetation or your structure, they might be ignited by direct contact with flames. Trellises and pergolas are especially susceptible, since they are often made of wood, are covered with vegetation, and attached or adjacent to the structure.

### WHAT YOU SHOULD DO

Consider removing arbors or pergolas made from combustible materials. Structures made from metal and other noncombustible materials would be acceptable choices. Wood arbors and pergolas can be more resistant to fire if they are made with exterior-rated, fire retardant lumber, or larger dimension material. If you go this route, you should also use the heartwood of a naturally durable species (such as cypress or cedar). Consider mixing materials: the supporting structural members could be large timbers and the smaller members could be noncombustible. Don't forget to remove dead vegetation on these structures. Keep all yard structures free of accumulated debris. Any structures, such as a child's play set or gazebo, built from combustible materials, should be relocated at least 30 feet away from the structure.

## OUTBUILDINGS, FUEL TANKS AND FLAMMABLE PERSONAL PROPERTY

### WHAT YOU SHOULD KNOW

All buildings on the property face the same types of risks when it comes to wildfire. Once ignited, buildings will act just like a large plant, bringing flames closer to the main structure, potentially resulting in ignition. If ignited, outbuildings will burn much longer than a typical plant, resulting in a longer fire exposure for your home or business. They will also generate their own embers. Boats, RV's and other personal property can also burn very intensely. They should be protected inside a building or parked at least 30 feet from the structure.

If fire comes too close to exterior liquefied petroleum (LP) tanks, a leak can develop at the valve, and the tank can explode. So, it's important to locate propane tanks at least 30 feet from your structure, and create a 10 to 15 foot 'defensible space' around your tank.



Wooden playground equipment can be a fire risk if located too close to a home or business.



Locate propane tanks at least 30 feet from a home or business and create defensible space around the tank.





### WHAT YOU SHOULD DO

Relocate combustible outbuildings at least 30 feet away. Other options would be to create defensible space around the outbuilding, just as you did with your home or business, or incorporate noncombustible or fire-resistant materials into the building.

If necessary, relocate your propane tanks so that it is at least 30 feet from the structure. Create a noncombustible zone within 10 feet of the tank. Another option is to enclose the tank. If enclosure is used, it should be made of noncombustible materials (i.e., fiber cement siding, stucco, or metal.)

## FIREWOOD, LEFTOVER MATERIALS AND COMBUSTIBLE MULCH

### WHAT YOU SHOULD KNOW

It may seem obvious, but firewood, combustible mulch, or other combustible materials located too close to a home or business can be factors in spreading wildfire. Mulch offers several beneficial attributes to the soil, including weed and erosion control and water retention. Balancing the benefits of mulch with the potential risk from spreading fire to the building must be carefully considered.

The ease with which combustible mulches ignite, and the rate fire will spread, will depend on the characteristics of the particular mulch, but they will all burn. Mulches that are smaller, or have 'fine fuel' components (for example, the 'hairy bark' or needle mulches), will ignite and spread fire more quickly. Studies have shown that composted mulches perform better than other combustible mulches, but this material exhibits smoldering combustion. Learn more by reading the University of Arizona Cooperative Extension Service's study "Comparing the Ignitability of Mulch Materials for a Firewise Landscape." The link is available at [DisasterSafety.org/megafire](https://disastersafety.org/megafire).

### WHAT YOU SHOULD DO

Move firewood and leftover building materials, and items such as wheelbarrows containing these materials, as far away from your building as possible. Firewood piles should be located at least 30 feet from any structure. Consider using noncombustible mulches in the area immediately adjacent to your home or business.





## ASSESSING AND MANAGING SURROUNDINGS BEYOND 30-FEET:

### VEGETATION MANAGEMENT

#### WHAT YOU SHOULD KNOW

If your home or business faces a wildland and you own or can get access and permission to modify the vegetation in the area between 30-feet and 100-feet, your goal is to reduce the intensity of the fire in this area and make sure that it at most is a ground fire.

#### WHAT YOU SHOULD DO

You should regularly remove any dead brush from this extended fuel modification area and thin out trees, including removing branches close to the ground so that a crown fire cannot be supported and a fire on the ground will not climb up into the tree canopy.

### IMPORTANCE OF TOPOGRAPHY

#### WHAT YOU SHOULD KNOW

Southern California is known for its canyons, hilltops and valleys, but these beautiful features also can put your house or business at increased risk of wildfire. The topography around your house or business, which includes the slope of the land and the direction the structure faces, is a major consideration in assessing the risk exposure to wildfire. Wildfires burn up a slope faster and more intensely than along flat ground. A steeper slope will result in a faster moving fire, with longer flame lengths.

#### WHAT YOU SHOULD DO

Determine the slope of your structure. Select a mark on the slope and walk 10 paces downhill. If your head is below the mark you have a steep slope.

If your house or business is mid-slope or at the top of a steep slope, but set back less than 15 feet for a single-story and 30 feet for a two-story house, take additional precautions. These include being more aggressive with your vegetation modification and maintenance plan and more aware of the materials used to build the house, deck or any outbuildings. You will also want to push the fuel modification area beyond the 100-foot length if at all possible. A target for the extended fuel modification area would be between 150 and 200 feet.

Consider increasing the protection of your house or business by constructing a noncombustible retaining wall to help increase the set back. When making future improvements incorporate ignition-resistant features and materials into the house or business and surrounding landscape.







## IMPORTANCE OF ENVIRONMENTAL CONDITIONS

---

### WHAT YOU SHOULD KNOW

Higher wind speeds are frequently associated with fast moving wildfires. Strong winds blowing a fire toward your house or business will have the same effect as being located on a slope; the fire will move faster and burn more intensely, blowing embers in front of the fire. The flame lengths also will be longer.

### WHAT YOU SHOULD DO

If your house or business is located on the side of a development that faces into the prevailing strong wind direction or on a side that is parallel to the prevailing strong wind direction, consider pushing the fuel modification area beyond the 100-foot length if at all possible. A target for the extended fuel modification area would be between 150 and 200 feet.

## DEFENSIVE ACTIONS

---

### WHAT YOU SHOULD KNOW

Some states, including northern Minnesota, have been given grants from the Federal Emergency Management Agency (FEMA) for the installation of exterior roof-mounted fire sprinklers. The use of exterior sprinklers is considered a defensive action and a primary use is to help limit the spread of the fire to the home or business. The sprinklers would be turned on prior to evacuation.

Using exterior sprinklers can help to reduce the chances of a home or business being damaged by a wildfire, but like all other actions that can be taken, it requires planning and the system must be maintained. It must also be treated as one component of a fire safe plan and it does not eliminate the need for other actions recommended in this guide.

### WHAT YOU SHOULD DO

If you are considering an external sprinkler system, check with your local fire department. They may have plans, and other suggestions. In order to maximize the effectiveness of exterior sprinklers, they should be on a stand-alone, independent water system (i.e., tank, pool, or lake) and must be attached to a pressurized delivery system or use a generator for needed pumps.

Separate water and power supplies will reduce the reliance on municipal power sources, which could be affected by the wildfire, and water sources that could be needed by firefighters to protect other properties.

YOUR HOME OR BUSINESS	REQUIRED ACTION OR RETROFIT	RELATIVE COST
<b>ROOF COVERING</b> - Your roof, both in terms of its covering and design, is the most vulnerable part of your home or business when considering exposure to wildfire.		
1. Do you have a non-combustible or Class "A" roof?	A professional roof inspection can help determine this. If not, replace your roof covering with a Class "A" fire-rated covering. Many styles are available.	\$\$\$\$
2. Do you have a tile or metal roof? If yes, are the gaps between covering and roof sheathing, which can occur at the edge and ridge, filled with either a bird stop or other material to seal the openings?  Are there other roof openings?	Install bird stops.  Plug any roof openings that are not functioning as vents.	\$-\$
3. Do you have combustible siding where a lower level roof meets and on the upper level roof or wall?	Replace siding with a more fire-resistant material.	\$\$-\$\$\$\$
4. Has vegetative debris accumulated on your roof?	Ember accumulation at the roof-wall intersection increases the risk of fire exposure, particularly if combustible siding is present. The problem is exacerbated with a buildup of debris. Routinely remove debris from the roof. Consider hiring a professional to help with this task.	FREE
<b>VENTS</b> are vulnerable to wind-blown embers and flames from nearby vegetation, combustible siding that has ignited or if combustible materials are stored nearby that could potentially catch on fire. Maintaining appropriate defensible space will help minimize wildfire risks.		
1. Are your vents covered with 1/8-inch mesh metal screens?	There are many types of new vents on the market that are designed to reduce the risks of wind-blown embers getting inside. Consider installing new vents; availability and styles will vary by region. A less expensive alternative is to attach a minimum of 1/8-inch mesh metal screens over existing vents.	\$
2. If your vents are not covered with metal screens, have you attached 1/8-inch mesh metal screens and have you prepared vent covers that can be easily installed when a wildfire is approaching?	Attach screens and/or prepare covers. Attaching a solid cover would provide additional assurance that large embers would be kept out of the attic or crawlspace. Since the primary purpose is to prevent embers from getting inside your vents, 1/2-inch plywood could be used. Keep the areas around the vents clear of vegetation and other combustible materials. Install covers before evacuation and remove them upon your return. Use caution when installing and removing covers over vents on higher floors.	\$





3. Are you planning to replace vents?	Several ember-resistant vents were recently accepted for use under the strict new California Building Code. These are a good idea for any home or business owner in any wildfire-prone state. Find a list of accepted vents at: <a href="http://osfm.fire.ca.gov/">http://osfm.fire.ca.gov/</a>	\$\$
<b>GUTTERS - Debris can collect in gutters and become fuel for falling embers during a wildfire. It's then possible for the fire to burn into the attic space.</b>		
1. Has vegetative debris accumulated in your gutters?	Clean out your gutters on a regular basis. Use caution when doing this or consider hiring a professional to complete the task.	FREE
2. Have you installed gutter cover devices that are available to help keep your gutters clear of debris?	Consider installing a gutter cover device to help manage debris buildup. A number of designs and devices are available. Devices can result in the accumulation of debris on the roof area behind the gutter, so maintenance is still required.	\$\$-\$\$\$
<b>EAVES - Eaves are vulnerable to flame and ember exposures and can provide a way for a wildfire to get into your attic.</b>		
1. Do you have boxed-in or open-eave construction? Because of the gaps that typically occur between blocking and rafter tails, open-eave construction is more vulnerable in wildfire conditions. Are these gaps visible?	Plug openings in open-eave area with durable caulk, or install a non-combustible covering over blocking to eliminate openings. An alternative method is to enclose or box-in the eaves. This method may require that vents be installed in the soffit material to allow for excess moisture to be removed from attic and enclosed soffit spaces, particularly if combustible siding is present, combustible materials are stored adjacent to the building, or the nearby vegetation is poorly maintained.	\$-\$\$\$
2. If your eave area is boxed-in, is the soffit material non-combustible?	Replace with non-combustible or other material that is fire or ignition-resistant. Common soffit materials include those that are non-combustible, such as a fiber-cement product or exterior fire-retardant treated plywood, or combustibles such as plywood or solid wood boards. Vinyl soffit materials are not recommended due to the lower temperature at which it will deform and sag.	\$\$-\$\$\$

## Notes

[illegible]

WINDOWS - During a wildfire the most vulnerable window is one that is open. The most vulnerable part of a closed window is the glass. Close windows to prevent embers and flames from entering the home.		
1. Do you have single-pane windows?	At a minimum, install dual-pane windows, which will provide more protection from wildfire. Preferred are dual-pane, insulated glass windows, which have the added benefits of greater energy conservation and insulation during cooler and warmer months.	\$\$\$-\$\$\$\$  Costs vary with the location and number of windows.
2. Does your window have tempered glass?	Tempered glass is about four times more resistant to breaking during a wildfire. When replacing single-pane windows consider dual-pane, tempered glass. This will provide significant wildfire protection against flames and wind-blown embers. The cost increases are relative to the opening size.	
3. Do your windows have shutters?	Shutters and pre-made covers will protect your window from wildfire exposures such as embers, the impacts of other airborne debris and radiant heat exposures. These devices would be installed prior to evacuation and removed upon returning to the property.	\$-\$\$\$
4. Have you made covers for your windows that can be easily installed prior to evacuation during a wildfire?	A less expensive alternative is ½-inch plywood. Before installation, clear the surrounding area of vegetation and other combustible materials that could ignite the plywood covers.	\$\$

## Notes

[illegible]



SIDING - Fire from Ignited siding can spread into the stud cavity and up the wall into the eave and the soffit area. Vertical fire spread up the wall also can expose the windows to flames.		
1. Is your siding made of a noncombustible material?	Re-siding is an expensive, and can be a worthwhile proposition, particularly if the surrounding defensible space is inadequate or if the building is 15 feet or closer to surrounding properties that, if ignited, could spread the flames.  Panelized products have fewer lap joints, so can be considered less vulnerable. Wood siding shingles and plain bevel lap joints are the most vulnerable to flames.  Since noncombustible siding won't ignite, vertical flame spread will not be a problem unless you have stored combustible materials or planted highly flammable vegetation next to the wall. Vertical flame spread also will be minimal when ignition-resistant material (e.g. exterior fire retardant-treated wood) is used. Siding products and assemblies that are better able to resist the penetration of flames into the stud cavity can be found at <a href="http://osfm.fire.ca.gov/strucfireengineer/pdf/bml/wuipproducts.pdf">http://osfm.fire.ca.gov/strucfireengineer/pdf/bml/wuipproducts.pdf</a>	\$\$\$\$
2. If you have a combustible siding product (e.g., wood siding), is it a panel or horizontal lap product?		
3. If you have a combustible horizontal lap siding product, does it have a simple lap joint, such as a plain bevel joint?		

Notes

## Assessment

[illegible]



TREES		
1. Do trees or branches hang over your home or business?	Prune back to a minimum of 10 feet from your home or business.	FREE-\$
2. Are your trees pruned to eliminate ladder fuels? Ladder fuels are those that will allow fire to climb up the bark and into the upper portion of the tree	Prune trees to eliminate ladder fuels.	FREE-\$
Has vegetative debris accumulated in the areas that connect the deck and walls, under the deck or at the base of exterior walls or fencing?	Inspect for and clear all vegetative debris on a regular basis.	FREE
<p><b>LP Tank -</b> If fire comes too close to exterior liquefied petroleum (LP) tanks, a leak can develop at the pressure relief valve, resulting in a column of flame. Flame impinging on the upper surface of the tank can result in an explosion, particularly when the fuel level is lower.</p>		
Is your LP tank located within 30 feet of your home or business?	Relocate your LP / Propane tank.	\$\$-\$\$\$

## Notes

## Appendix D

Have you created a defensible space around it?	Created 10 to 15 feet of defensible space around your LP / Propane tank.	FREE - \$
<b>DECKS - If Ignited, decks will lead a wildfire directly to your home or business. The flames can burn siding, break the glass in nearby windows or sliding glass doors, and Ignite the eaves and vents. All of these scenarios result in fire moving into your structure.</b>		
1. Are your deck boards made of combustible material? (i.e., solid wood or one of the wood plastic composite products). There are a limited number of metal (non-combustible) deck boards. Exterior fire-retardant treated lumber can also be used to decrease the vulnerability of the deck to wildfire.	When it's time to replace the deck, choose a fire- or ignition-resistant material. As previously mentioned, the new California Building Code requirements pay strict attention to wildfire risks. Learn more about how to choose wildfire-resistant decking materials at <a href="http://osfm.fire.ca.gov/strucfireengineer/pdf/bml/wuiproducs.pdf">http:// osfm.fire.ca.gov/strucfireengineer/pdf/bml/wuiproducs.pdf</a>	\$\$\$-\$\$\$\$
2. Do you have combustible materials stored under or on top of your deck?	Move this material to an enclosed area away from your home or business. If you choose to enclose the underside of your deck, be sure to address moisture management issues through drainage and ventilation.	FREE-\$\$

## Notes

[illegible]



FENCES		
Does a fence come within 5 feet of your home or business, or come into direct contact with it?	Replace with a noncombustible fence or use noncombustible components such as heavy wire mesh in a wood frame. Noncombustible fencing (at least a 5-foot span) should be used in locations where the fence is directly attached to the building.	\$-\$\$\$
YARD STRUCTURES – Any fuel source, decorative or functional, within 30 feet of your home or business.		
Do you have any playground equipment, firewood, trellises or other yard features that could bring flames too close?	Combustible structures should be moved 30 feet to 50 feet from the home or business.	FREE

## Notes

[illegible]



Institute for Business and Home Safety  
4775 E. Fowler Avenue, Tampa, FL 33617  
E-mail: [Info@ibhs.org](mailto:Info@ibhs.org) | Voice: (813) 286-3400  
Web site: [DisasterSafety.org](http://DisasterSafety.org)







## Wildland/Urban Interface Fire Hazards

# A New Look at Understanding HAZARD ASSESSMENT METHODOLOGIES





The development of Wildland/Urban Interface Fire Hazards: A New Look at Hazard Assessment Methodologies is an undertaking of the Wildland/Urban Interface Fire Working Team of the National Wildfire Coordinating Group.

This publication is a revision of Wildland/Urban Interface Fire Hazard Assessment Methodology, developed in 1997. Since the original introduction, the understanding of interface fire behavior, assessment of home ignition hazards, and mitigation planning has increased greatly. In addition, the introduction of the national Firewise Communities/USA Recognition program has encouraged thousands of interface residents to join together to reduce the threat of wildfire around their homes and within their communities. Citizens engaged in wildfire mitigation are changing the traditional approach to prevention and mitigation from a fire agency responsibility to one that encourages active participation by interface homeowners, residents and many others.



## Wildland/Urban Interface Fire Working Team



Mr. Sam Scranton, Chair

BIA/National Interagency Fire Center

Mr. Jack Cohen, USDA Forest Service

Mr. Wayne F. Ching, Hawaii Division of Forestry  
and Wildlife

Ms. Kelly Hawk, US DOI Bureau of Land  
Management

Mr. Alan Dozier, Georgia Forestry Commission

Mr. Will May, International Assn. of Fire Chiefs

Ms. Pamela Jakes, USDA Forest Service

Mr. Frank Richardson, Department of Homeland  
Security/U.S. Fire Administration

Mr. S. Olin Phillips, Minnesota Department of Natural  
Resources

Mr. Lewis Southard, USDA Forest Service

Jim Smalley, National Fire Protection Association

Mr. Kim Zagaris, California Governor's Office of  
Emergency Services

The course documents and materials were prepared under the direction of Cheryl Blake, Products Manager for the National Wildland/Urban Interface Fire Program with assistance from Bill Baden and a Technical Review Task Group. The Wildland/Urban Interface Fire Working Team appreciates the time and commitment that these organizations and individuals took to share ideas, discuss their practical experiences, and review several drafts of the material. Many of the ideas contributed by these reviewers have been incorporated into this document.

### Technical Review Task Group for Wildland/Urban Interface Fire Hazards: A New Look At Home Assessment Methodologies

Mr. Pat Durland, Stone Creek Fire LLC

Mr. Dennis Gage, Insurance Services Office

Ms. Karen Kilgore, UWI/GIS Specialist,  
Texas Forest Service

Mr. Rob Geislinger, Fire Marshal, Parker CO Fire  
Protection District

Mr. Jim Harrell, Fire Mitigation Coordinator, Florida  
Division of Forestry

Mr. Justice Jones, Wildland/Urban Interface  
Coordinator, Texas Forest Service

Mr. Jeffrey Moyer, Spokane Agency BIA Fire  
Management

Mr. Chris White, Fire Management Specialist,  
Anchor Point Group

Mr. Kim Zagaris, California Governor's Office of  
Emergency Services

# CONTENTS

## 4 Scope and Purpose

## 5 Section I.

Introduction to Assessing Wildfire Hazards in the Interface

## 6 Section II.

Relationship of Hazard Assessment and Planning Outcomes

## 7 Section III.

Assessment Elements

A. Home Ignition Zone

B. Firewise Communities/USA Recognition (Residential Developments)

C. Community Wildfire Protection Plan (CWPP)

## 15 Section IV.

The Processes of Hazard Assessment

## 17 Section V.

Applications and Potential/Expected Outcomes

## 19 Section VI.

Assessment Systems and Tools

A. Hazard Assessment Approaches

B. GIS Software Packages and/or Download Information.

## 24 Glossary

## 25 Appendices

Bibliography

Reference Information





## Scope and Purpose

The scope of this document is to create an awareness of a variety of concepts and methodologies for assessing the threat of wildfire to individual homes, residential developments, and communities in wildland areas throughout the United States and bordering countries.

The purpose of this document is to provide individuals and organizations involved or interested in preventing wildland/urban interface fire disasters with concepts, recommendations, and resources that may be used to assess and mitigate wildfire hazards in WUI areas. Specifically, this document addresses the relationships between the assessment of an individual home and the collective homes within a subdivision (residential development). Information is provided as to how the uniform hazard assessment process of the Firewise Communities program may relate to jurisdictional level planning, such as Community Wildfire Protection Plans.





# Section I

## Introduction to Assessing Wildfire Hazards in the Interface

Throughout the United States, it is increasingly common to see homes and other buildings located or being built in wildland environments. This expansion into wildland areas often results in homes located next to and among large volumes and areas of vegetation often untreated or unprepared for development. These homes become extremely vulnerable to wildfire in the surrounding area. However, many actions to reduce the potential ignition of homes in existing housing developments are relatively simple and can be assumed by the homeowner. Many of the principles that guide the mitigation of single homes may also be applied to planned developments.

The most effective way to prevent wildfire disasters is to prevent the ignition of homes by mitigating the hazards associated with the interface homes themselves and their surrounding vegetation. Due to the tremendous variability in fuels, weather, topography, codes and standards, and state and local laws and ordinances, each homeowner, subdivision, community, city or county is encouraged first to adopt a uniform systematic approach to assessment that will result in specific mitigation recommendations for residents

and, second, to develop, modify or employ a rating system, if desired, that will meet specific needs (e.g., hazard evaluation and rating).

This guide will help users understand the need to assess the potential of home ignition by an approaching wildfire and focus on specific mitigation actions that may prevent ignition without the intervention of fire fighting personnel and equipment. To that end, wildfire hazard assessments should ultimately encourage individual and community commitment to the proactive, preventative actions of pre-fire mitigation rather than reactive fire suppression plans.

Since assessments are conducted for many different purposes, this guide addresses several methods for assessment that may be used depending on the desired outcome. Elements that should be assessed at various levels are described in detail. The guide next provides a five-step method to determine the focus and appropriate level of assessment in interface communities. Finally, this guide references a wide variety of systems, displays and tools that form the basis for the hazard components and the methodology described, including qualitative and quantitative approaches.

# Section II

## Relationships of Hazard Assessment and Planning Outcomes

Because there are many reasons to assess fire hazards in the wildland/urban interface, the specific method of assessment will be determined by your desired outcome. For example, if you wish to compare relative hazards or risks of one community to another within a region or state, your method will be different than that used to recommend mitigation actions to a single homeowner.

The purpose of Wildfire Hazard Assessment and Planning (Figure 1) is to graphically display the relationship of information (data) elements to the focus and level of planning within the scale of the geographic area being assessed. Read from left to right and bottom to top, each column represents a continuum of scale, size, number, or concern.

Hazard assessment, like planning, is a matter of scale and the user may begin anywhere along the continuum columns, including the information layers indicated by the overlapping quadrangles. Note that there are no distinct divisions at which one area may end and the next one begin.

The conceptual diagram (see pages 12-13) indicates the many variable elements and their interrelationship that comprise WUI hazard assessments on different levels and for different purposes.

The first two columns relate to the Focus of Planning and the Level of Assessment. Firewise Communities Planning includes the single structure focus or Hazard Ignition Zone (HIZ) and the residential development level (for the Firewise Communities/USA Recognition program). The higher level includes the larger scope of the Community Wildfire Protection Plan (CWPP).

**Planning Focus** (Column, far left). The selected FOCUS of the planning will drive the LEVEL of the assessment needed (Column 2). For example, if the intent of the assessment process is to focus on the Home Ignition Zone, then the appropriate beginning is the Single Structure level and the information to be gathered is indicated by the multi-level overlapping quadrangles to the right.

**Assessment Level** (Column). This column represents the continuum of a number of homes and structures. For example, if the desired planning outcome is for the residential development to receive national Firewise Communities/USA recognition, consideration should be given for all of the items from “Decks & Fences” to “Infrastructure”.

**Specific Information and Data** (Column). The elements in the layered quadrangles represent progressive concerns as the issue moves from the single structure level (i.e., Home Ignition Zone or ‘HIZ’) upward through subdivisions (i.e., Firewise Communities/USA Recognition) to the city or county level (e.g., Community Wildfire Protection Planning). The types of information in the Home Ignition Zone, Firewise Communities/USA, and Community Wildfire Protection Plans will be discussed in Section III.

Beginning at the HIZ level and moving to the right, the information is very specific because these are visible, physical conditions relating to a single structure, home, or building. As the level of focus or level moves upward, the information areas and data elements become more descriptive than prescriptive and, therefore, less defined and more open to the information that is deemed necessary by the organization conducting the assessment.

As an illustration, the information specific to the HIZ includes the elements from “Roof” to “Hazards 30 ft – 200 ft.” As the level of focus expands above the HIZ level to include multiple homes, subdivisions or communities the information needed for the assessment also changes. The area and the number of buildings involved in the assessment will determine the specific information needed (e.g., “Common Areas and Shared Hazards” to “Ordinances”). At this level of assessment, overlapping Home Ignition Zones become a very important consideration in community (i.e., subdivision) level assessments.



## General Information and Data

**Fuels** (Column). The fuel considerations in the diagram progress from the home upward to include the vegetative fuels in the HIZ and then to include the fuels that compose the common area and the shared hazards of adjoining properties and structures/homes. This progression continues to larger geographic areas where the assessment must include vegetative fuels and fuel complexes that affect planning on a large and/or multi-agency scale.



**Fire Weather/Frequency** (Column). Fire weather and fire frequency increase in importance in the assessment as the number of buildings and area of assessment increase in size and complexity. At the structure level, the prime considerations are on the “little” hazards, or those hazards that contribute to the small ignitions that often go unnoticed or unattended until the house is fully involved and suppression is more difficult, if not impossible. The concern at the city/county level typically shifts to the large, uncontrolled wildfire and the widespread impact on fire response resources and public safety.

**Topography** (Column, far right). Like Fire Weather/Frequency, the importance of Topography increases in relevance for the assessment as areas increase in size. For example, large-scale topographical features may not be as relevant to home ignition as the topographical features within 100-200 feet of the home.

## Section III

### Assessment Elements

The assessment elements describe the building and vegetative fuel hazards that should be taken into consideration when assessing the ignition potential of individual homes and communities should they be threatened by wildfire. The three levels addressed here include the Home Ignition Zone, residential developments, and larger communities (towns, cities or counties).

To understand what to look for in an assessment of a home and its surroundings, it's important to understand how homes can ignite in a wildfire. Ignition occurs when heat is transferred to a combustible object. This transfer occurs by radiation, convection, and/or conduction. In wildland fire situations, all three methods of heat transfer are possible.

To be effective, it's important to understand the basic process of ignition before assessing hazards; in other words, being aware of the factors that contribute to ignition. Understanding the processes that allow a vegetation fire to ignite homes is critical to preventing homes from igniting. The most effective prevention results by removing the requirements of combustion that result in home ignition. To make this happen, a basic understanding of fire and heat transfer is needed.

Heat is transferred by radiation, convection, and conduction, including the collection of firebrands on combustible materials and surfaces. In wildfire situations, one, two, or all three methods of heat transfer may contribute to a home's ignition.

**Radiation.** Radiation is defined as heat transfer by way of electromagnetic energy. The best example of heat transfer by radiation is the sun's heating of earth. Radiant exposure to a home from a wildfire depends on the intensity and duration of the flame front. The chance that a home will ignite from radiant heat exposure is proportional to:

- The size of the flames
- The home's surface area exposed to flames
- The duration of the exposure
- The distance between the flames and the structure

In addition to the threat of direct ignition from radiation, radiant heat from large flames in close proximity to a home may fracture large plate glass windows. Should the fractured glass fall out of its casing, the home becomes vulnerable to firebrands entering these openings and resulting in ignition(s) inside the home.

**Convection.** Convection is defined as heat transfer by circulation within a medium such as a gas or liquid. Convective heat transfer to combustible materials on or near homes requires direct contact with combustible materials by the flames or the hot gases emitted by the flames. In wildland fires,

convective heat energy is usually not sufficient to ignite a wood wall when the distance becomes tens of feet beyond the wall. However, the duration of exposure to flame is more critical than the size of the flame. If materials capable of producing even small flames (e.g., dry grasses, low ground cover, pine needles, leaves, trash) that can come in contact with the home (e.g., eaves, overhangs), convection can ultimately ignite a home. Wind and steep slopes tilt flames and hot gases uphill, increasing the chance of igniting a home. Structures extending out over a slope have the greatest likelihood of ignition from convection.

**Conduction.** Conduction is defined as heat transfer to another body or within a body by direct contact. When heat is sustained near combustible fuels, conduction provides the process that continues to transfer heat through the fuel masses and supports the fuel's continued and complete combustion.

In wildfires, firebrands (embers) falling on combustible surfaces of a home transfer heat energy to the surface by conduction. Firebrands are pieces of burning material that detach from a fire due to the strong convection drafts in the burning zone. They can be carried a long distance (a mile or more) by fire drafts and winds. The chance of these firebrands igniting a home depends on their size and number, where and how they accumulate next to combustible elements of the building, how long they burn after contact, and the materials, design and construction of the home.







## A. Home Ignition Zone

The Home Ignition Zone (HIZ) includes the home and the surrounding area extending out to 100 to 200 feet from the home. The HIZ assessment includes only the home and the fuels within the 100 ft to 200 ft area. The following elements should be considered when completing a HIZ assessment:

**Overview of Surroundings (relative to the location of the home).** Look for features in the surroundings that can increase a home's vulnerability or maximize its survivability. Buildings set back from property lines (at least 30 feet) allow the residents to have some (if limited) control of fuels within the home ignition zone. Buildings located close to dangerous topographic features such as the top of slopes or adjacent to natural chimneys (draws and canyons) require special attention.

**Building Materials and Design (from roof peak to the foundation and then outwards).** Should a building come in contact with heat, flames or firebrands, the building materials and design can prevent or retard the penetration of the fire into the interior of the building.

**Roof.** Roofs are less vulnerable to radiation and convection because of their slope but are more susceptible to ignition by firebrands. A major cause of home damage and loss in wildland areas is combustible roofs (e.g., non-rated wood). Fire-resistant roofs are those that are covered with noncombustible roofing (e.g., asphalt composite, tile, slate, metal) and are inspected for cracks and gaps which could expose ignitable sub-roofing or roof supports.

**Eaves and Overhangs.** Eaves and overhanging features—room push outs, bay windows and extensions over slopes—are very vulnerable to convective exposures and have a design that can sustain ignition. Fuels should be eliminated from contact with eaves and overhangs. Eaves and overhangs should be boxed or enclosed with noncombustible materials to reduce the surface area and eliminate the edges that can trap firebrands.

**Vents.** Vents allow for air circulation and help prevent condensation and subsequent wood decay. However, openings should be screened to prevent firebrands from entering the building. The screens should prevent passage of objects larger than 1/4 inch (3.0mm). Both vents and screens should be constructed of materials that will not burn or melt when exposed to heat or firebrands.

**Walls.** Walls are most susceptible to ignition by radiation and convection. The edges of combustible wall materials, such as trim materials on casings and facing, will ignite before flat surfaces do. The walls should be constructed of ignition or fire resistant materials. Wall materials that resist heat and flames include cement, plaster, stucco, and concrete masonry (stone, brick or block). Though some material, such as vinyl, will not burn they may lose their integrity when exposed to high temperature and fall away or melt, exposing interior materials.



**Windows.** Exposure to heat can cause windows to fracture and collapse leaving an opening for flames or firebrands to enter and ignite the interior of a home. Using glass products that can withstand the potential convective and radiant heat will reduce this risk. Tempered glass will withstand much higher temperatures than plate glass and should be used for large windows—particularly windows overlooking slopes or vegetation. Double pane glass is slightly more resistant to heat than single pane glass.

**Attachments.** Attachments include any structures connected to the residence such as decks, porches, and fences. When assessing the ignition potential of a home, attachments are considered part of the structure. For example, if the ignition potential of the attachment is high, the ignition potential of the inclusive structure is considered high.

**Vegetative Fuel Hazards.** Vegetative fuels include living and dead vegetation materials. The amount of heat energy released during a wildland fire is defined by the amount, arrangement and rate of combustion of the vegetative fuels. Vegetative fuel flame lengths can exceed 100 feet and the radiated heat can ignite combustible materials from distances of 100 feet or more. Winds can carry live firebrands over a mile from the wildfire.



Vegetative fuels within the immediate vicinity (within approximately 30 ft of the home) can have a significant impact on the potential of a home to ignite. The size of the “immediate vicinity” will vary depending on the vegetation and characteristics of the land. Vegetation within the immediate vicinity of the building should be fire resistant and maintained in fire resistant condition.

Vegetative fuels beyond the immediate vicinity (from 30 ft to 200 ft or to the extent of the HIZ) are those that surround the building but are not immediately adjacent to it. The concern with these fuels is primarily their ability to produce firebrands that can ignite the residential structure and their ability to produce long flame lengths and intense radiant energy. Fuels beyond the immediate vicinity of the building should consist of fire resistant ground cover and trees that are thinned and pruned to prevent ground fires from igniting the crowns, or tops of trees.



## B. Firewise Communities/USA Recognition (Residential Developments)

The national Firewise Communities program is a multi-agency effort designed to reach beyond the fire service by involving homeowners, community leaders, planners, developers and others in the effort to protect people, property and natural resources from the risk of wildland fire—before a fire starts. The Firewise Communities approach emphasizes community responsibility for planning in the design of a safe community as well as effective emergency response, and individual responsibility for safer home construction and design, landscaping and maintenance.

The national Firewise Communities program is intended to serve as a resource for agencies, tribes, organizations, fire departments, homeowners, residents, and communities working toward a common goal: to reduce loss of lives, property, and resources to wildfire by building and maintaining homes and communities in a manner compatible with the natural surroundings.

Firewise Communities/USA recognition is a homeowner/resident driven program, usually initiated and guided by a homeowners’ association or similar organization. In order to be nationally recognized as Firewise, the residential area or community must complete the following actions:



1. Enlist a wildland/urban interface specialist to complete an assessment and create a plan that identifies locally agreed-upon, achievable solutions to be implemented by the community.
2. Sponsor a local Firewise task force, committee, commission or department that maintains the Firewise Community program and tracks its progress or status.
3. Observe a Firewise Communities/USA Day each year that is dedicated to a local Firewise project.
4. Invest a minimum of \$2.00 per capita annually in local Firewise Communities/USA projects. (Work by municipal employees or volunteers using municipal and other equipment can be included, as can state/federal grants dedicated to that purpose.)
5. Submit an annual report to Firewise Communities/USA that documents continuing compliance with the program.

The community assessment for Firewise/USA recognition purposes, indicated in Step 1 (above), will include the “Common Areas and Shared Hazards” as they relate to the overall development and the predominant features of the HIZs within the community. In other words, a Firewise Community assessment is more than the sum of the individual home assessments because it must address the hazards

around and among the homes (in general) within a community as well as the common elements that may put the community at risk. These include:

- The extent of use of combustible roofing materials.
- Overlapping home ignition zones.
- Placement of homes with respect to topography (e.g., at the top of a bluff).
- Dense/unhealthy vegetation.
- The extent and types of vegetation in direct contact with homes and around homes.
- Leaf/needle build-up on roofs and in gutters.
- Attached wooden fences/decks.
- Homeowner covenants and deed restrictions that may or may not allow Firewise mitigation measures.
- Evidence of the general level of fire safety education and awareness of the residents.
- Infrastructure conditions that may not contribute to Firewise mitigation.

Just as changing the character of the home ignition zone can alter the path of a wildfire approaching a single home, community residents have the opportunity to alter the path of a wildfire for an entire community by changing the character of their community’s ignition zone.

## C. Community Wildfire Protection Plan (CWPP)

The Healthy Forests Restoration Act (HFRA) of 2003 provides for the development of the Community Wildfire Protection Plan (CWPP). These plans, generally initiated and led by fire agencies, can be as simple or as complex as the community or community’s desire.

The minimum requirements for a CWPP as described in the HFRA are:

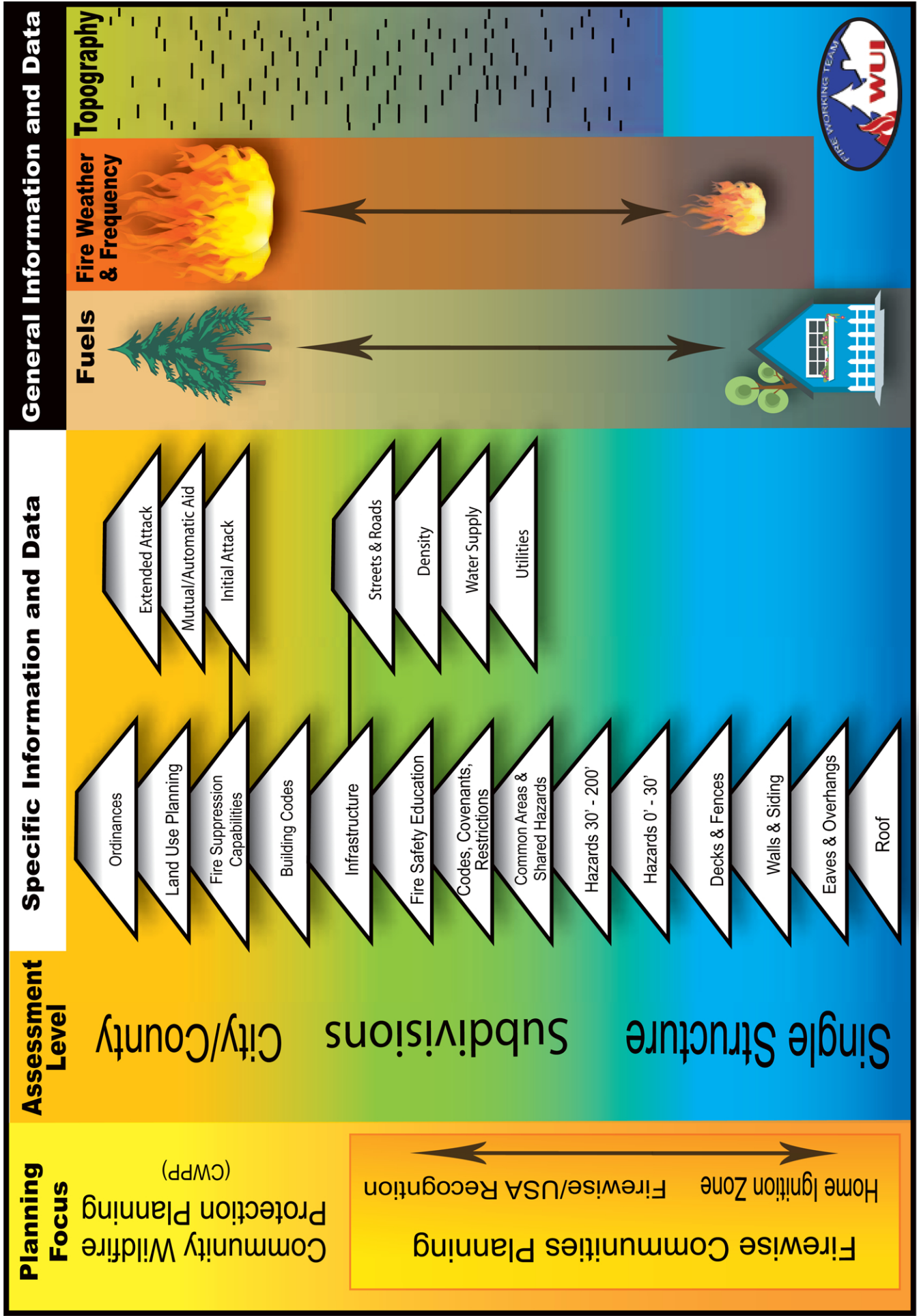
1. **Collaboration:** a CWPP must be collaboratively developed by local and state government representatives in consultation with federal agencies and other interested parties.
2. **Prioritized Fuel Reduction:** A CWPP must identify and prioritize areas for hazardous fuel reduction treatments on federal and non-federal lands and recommend the types and methods of treatment that will protect one or more at-risk communities and essential infrastructure.
3. **Treatment of Structural Ignitability:** A CWPP must recommend measures that homeowners and communities can take to reduce the ignitability of structures throughout the area addressed by the plan.

The HFRA requires that the three entities must agree to the final content of a CWPP:

- The applicable local governments (i.e., counties or cities);
- The local fire department(s); and
- The state entity responsible for forest management.

Community Wildfire Protection Planning and the Firewise Communities/USA programs are both focused on reducing the threat of wildfire to communities and protecting life and property and, therefore, are not mutually exclusive. A community that has received Firewise Communities/USA Recognition could also have a CWPP with the identification, prioritization, and mapping of hazardous fuel treatment that could reduce the risk to the larger community or jurisdiction. The only other element involved in the CWPP would be the concurrence of the local government, local fire department, state forester and other collaborative partners that the Firewise Communities/USA plans do not specifically require.

Figure 1. Wildfire Hazard Assessment and Planning





# Section IV.

## The Processes of Hazard Assessment

This section offers a five-step method for determining the focus and appropriate level and method of hazard assessment in interface communities. In addition, the guide suggests the most effective means of reducing the potential for future wildland/urban interface fire disasters is through a balance of the following approaches:

- Building a structure or altering an existing, structure to reduce its chance of ignition and,
- Completing mitigation measures on the surrounding wildland area., as well as guidance on recommended actions to reduce risk.

### Steps 1 and 2: Define the Focus of Hazard Assessment.

Clearly defining the focus (or purpose) of an assessment is the first step in protecting homes and communities from wildfire. If the purpose is clear, then the second step will provide the level at which assessments are to be conducted. Use Table 1 to help determine the focus (Step 1) and level of the wildfire hazard assessment effort (Step 2).

**Table 1. Determining the Focus and Level of Hazard Assessment**

<i>Step 1 Determine the focus of the planning by answering the following question.</i>	<i>Step 2 If the answer to Step 1 is "yes" the appropriate level of the assessment is</i>	<i>At the selected level, the Desired Outcome(s) will be the:</i>
Is the assessment to be used to provide mitigation guidance for individual homeowners and residents?	<b>The Home Ignition Zone</b> (HIZ of individual homes)	Mitigation of the hazards of a single home and its immediate surroundings, and the vegetation out to 200'. (HIZ)
Is the assessment to be used to perform a subdivision or small community-wide assessment that will lead to Firewise Communities/USA Recognition (specific mitigation guidance for residents in subdivisions and/or small communities or residential developments)?	Subdivisions and small communities and the identification of both individual homes and communal hazards within and surrounding residential developments.	Cooperative mitigation planning and activities within a subdivision or residential development to reduce individual building and communal hazards.
Is the assessment to be used to complete a Community Wildfire Protection Plan (CWPP) for a large geographic area involving multiple private and public ownerships?	Community jurisdictions, towns, cities, counties, including adjacent wildland areas that may be in private or public ownership	Large scale collaborative mitigation planning and activities for improved fire protection and emergency response. Collaboration may include individuals, local, state and federal participation.

### Step 3: Determine the appropriate Hazard Assessment Method.

Identifying the type of system or the purpose and use of the information helps determine the appropriate assessment method. This, in turn, helps determine the resources needed to conduct the assessment in terms of training, Geographic Information System (GIS) resources, personnel, logistics, materials, and other elements. There are two common methods for hazard assessment with many variations within each.

Using the Qualitative (Evaluation) method, the assessor identifies hazards and ignition threats for a particular home and/or groups of homes (e.g., subdivisions) and makes specific recommendations to the resident (homeowner) for correction with an agreed upon schedule for mitigating the hazard and maintaining the mitigation.

Using the Quantitative (Rating) method, the assessor typically notes many kinds of hazards, some of which may include response and fire suppression concerns. These conditions or situations are given a numerical value. Generally, the ratings are then totaled and the resulting hazard condition is determined by where the total falls within a scale of hazard from “low” to “extreme”.

Between the two approaches are several considerations that must be taken into account. Table 2 provides a quick overview of some of the assets and liabilities of each method.

**Table 2. Comparison of Qualitative and Quantitative Assessment**

Qualitative (Evaluation) Assessment		Quantitative (Rating) Assessment	
Asset	Liability	Asset	Liability
Easy to assess factors around the home	Subjective evaluation based on the level of training and experience of assessor	Easy to train assessors (e.g., a road is either 24 feet wide or it isn't)	Lack of scientific justification on values; includes infrastructure elements (e.g., street grades, water supplies) that have little to do with a home's ignition potential
Results in mitigation recommendations based on observation	Hard to quantify for analysis purposes	Quantified values can be used in GIS maps and analysis	Often includes elements that are not specifically home ignition related (e.g., combustible street signs)
Less threatening to residents	Difficult to enforce	Quantified elements can be easily re-evaluated for compliance	Some situations are difficult to quantify, particularly in relation to other elements
Allows latitude in resident goal setting and scheduling of mitigations	Assessed hazards include infrastructure issues but only as appropriate	Results in data array for analysis	Numerical ratings often lead to misunderstanding and resulting misuse of final value
Allows for flexibility on a site-by-site basis	Does not provide an objective way to compare one property to another	Provides a quantitative way to compare features, risks, attributes	Will not work well if raters cannot agree on weights/values of factors being rated
Allows evaluator to account for context of Home Ignition Zone features as well as site characteristics (e.g., topography, setback)	Relies heavily on the knowledge and background of the evaluator	For large-scale decision-making, helps quantify and rank data to help focus on where to begin mitigation efforts	Must have scientific, defensible basis for rating numbers or risks being too subjective to be used in some cases
An evaluation report can include plenty of detail about the features being observed and what makes them more/less vulnerable	Can be misunderstood if evaluator cannot translate technical information into plain language	Provides ease of evaluation and follow-up for compliance	Oversimplifies complex data to a number or level which becomes the focus (rather than focusing on what actions can be taken to improve)
What is being evaluated is evident	Results do not lend themselves readily to scientific/quantifiable analysis	Simplifies an array of complex factors into a numerical or “level” value	Can appear to be linked to other kinds of rating schemes affecting property insurance rates/availability
Allows for resident participation to gain understanding of what hazards	Results can lose impact if they fail to focus on the Home Ignition Zone in favor of context and infrastructure	Can help motivate those being rated to improve their number/level	Without detailed explanation of what the rating means, can be easily misunderstood by those being rated
Evaluation speaks directly to the property owner and what they can do about the hazards at the property (does not provide numbers to be used to compare to others)			Without detailed explanation of how to improve a rating score, can initiate defensiveness, fear, apathy





## Step 4: Determine the information needed for assessment

Knowing the level (focus) of the assessment will help determine the types and range of information that will be needed. Using the diagram that describes Wildfire Hazard Assessment and Planning Relationships (Figure 1) will help determine the information and data that is need to adequately assess hazards at various levels. Some of these elements may be readily quantified and useful in GIS mapping or other graphic display, but other elements may require descriptions that are not as easy to quantify.

**Example 1:** If the focus is on the Home Ignition Zone (HIZ) with the intent of encouraging mitigation actions for a single home or “one home at a time,” Figure 1 indicates that the specific information will include the “Roof” through “Hazards 30'–200'.” The assessment approach at this level may be either qualitative or quantitative, depending on the desired outcome(s) and how best to achieve those outcome(s).

**Example 2:** If the focus is on a subdivision wishing to qualify for recognition under the Firewise Communities/USA program, then the needed information (as indicated in Figure 1) will include “Hazards 30'–200'” through “Infrastructure”. Because this level of assessment is not simply the collection of detailed HIZ assessments on every home, it will also include general notations on predominant wildland hazards and conditions within the HIZs of subdivision. This will result in notations of the overall use of wood roofs and decks, the density of vegetation with HIZs, and other factors of the overall subdivision that help produce an overall assessment of the entire development. From this community-wide assessment, mitigation action and maintenance plans for he homeowners' association (for instance) can be developed. The assessment approach at this level may be a combination of qualitative or quantitative information, again depending on the desired outcome(s) and how best to achieve those outcome(s).

**Example 3:** Community Wildfire Protection Planning (CWPP) normally requires a broader view of a much larger geographic area. Focusing on broader scale issues might mean that the required elements (as indicated in Figure 1) begin at “Common Areas and Shared Hazards” or above (e.g., “Infrastructure”) and end at “Ordinances”. Again, at this level, the assessment approach at this level may be a combination of qualitative or quantitative information.

Again, there are no distinct boundaries indicated within the focus and the assessment levels in Figure 1. The specific information elements (quadrangles) should be adjusted as necessary to meet the needs of a specific assessment.

## **Step 5: Conduct the Hazard Assessment and compile the Information**

First, develop a method to collect the information required based on the level of the assessment desired. Make sure that an evaluation of each individual component will be included in the assessment and work to develop logical statements and supporting data that describe the overall hazard of the target (i.e., home, subdivision, city, county). Second, compile the information in a useable form. Often, a variety of display methods are necessary to make the data usable and understandable by groups and individuals who may not be used to working with technical information. Consider maps, clear overlays and computer modeling as methods for analyzing and displaying data as well as brief summaries and reports.

# Section V.

## Applications and Potential/Expected Outcomes

Maintenance of mitigation measures taken, whether from the single home to the community level, is key to ensuring that mitigation will achieve a long term impact. Only by reducing the ignition hazards will future interface fire disasters be prevented. Depending on the type, quantity and quality of information, the data developed from the assessment may be used to develop strategies that may further reduce or eliminate wildfire hazards in the wildland/urban interface.

Uses of the information include:

- Create mitigation and maintenance strategies
- Project future requirements of community services
- Provide data for mapping hazard areas
- Develop fire and emergency community evacuation plans
- Provide reference tools for planners and local code officials
- Supplement information for fire suppression evaluation in conjunction with the Insurance Service Office’s (ISO) Fire Suppression Rating Schedule to improve emergency fire response
- Distribute public fire safety education information
- Improve fire fighter and public safety
- Improve fire and emergency response
- Perform cost/benefit analysis for proposed programs
- Implement or evaluate existing programs
- Adopt a more sophisticated fire modeling program
- Strategically focus fuel reduction projects
- Educate property owners, local and state governments and fire-service agencies



# Section VI.

## Assessment Systems and Tools

The following references are the basis for the hazard components and the methodology outlined in this publication. These publications give details on a variety of hazard rating systems and can be used as additional information.

### A. Hazard Assessment Approaches

#### 1. Qualitative Hazard Assessment

- a. NFPA 1144 Reducing Wildfire Hazards in the Structure Ignition Zone, 2008 edition (proposed). This document, developed by the NFPA Technical Committee on Forest and Rural Fire Protection, provides a standardized approach to assessing wildfire hazards and contains examples of both a qualitative and quantitative assessment forms that may be used to gather information and provide mitigation recommendations to the resident/homeowner. This edition, unlike the previous 1997 and 2002 editions (see below) does not include specifications for fire protection infrastructure (e.g., water supplies, street width, signage, access) whose presence or absence has little impact on whether homes ignite from exposure to wildfire. For more information: [www.nfpa.org](http://www.nfpa.org)
- b. Assessing Wildfire Hazards in the Home Ignition Zone—training course from the National W/UI Fire Program ([www.firewise.org](http://www.firewise.org)) This is a two-day course developed to 1) provide reference material and basic knowledge to increase an understanding and competency in wildland/urban interface fire prevention and mitigation strategies and 2) assist wildfire mitigation and prevention professionals, regardless of organizational affiliation, in assessing risks to individual homes in wildland, forested, or grassland areas, and 3) encourage and prepare residents and homeowner associations to participate in Firewise Communities/USA® Recognition Program. For more information: [www.firewise.org](http://www.firewise.org)
- c. The Firewise Learning Center offers courses at no charge and is designed to encourage self-paced learning on a variety of topics. The courses feature video, lectures, interactive quizzes and tests. The Firewise Learning Center is part of the newly re-designed Firewise Web site, which features a new look and easier navigation. The Firewise Learning Center is available at [www.firewise.org/learningcenter](http://www.firewise.org/learningcenter).

#### 2. Quantitative Hazard Rating

- a. NFPA 1144 Standard for Protecting Life and Property from Wildfire, 2002 edition. (Formerly NFPA 299) This document, developed by the NFPA Technical Committee on Forest and Rural Fire Protection, provides criteria for fire agencies, land use planners, architects, developers and local governments to use in the development of areas that may be threatened by wildfire. This edition of NFPA 1144 contains information on hazard assessment and an example of a quantitative form that may be used to gather and provide a hazard rating value (number) for each home. The hazard assessment system in this edition includes assessment ratings for fire protection infrastructure concerns of water supplies, street width, signage, access, and others. For more information: [www.nfpa.org](http://www.nfpa.org)



- b. International Code Council. Wildland-Urban Interface Code, 2006 edition. This wildland interface code provides specifications for water supplies, defensible space and access in wildland interface areas. It includes a rating system that provides a numeric value based on the severity of the hazard based on vegetation, slope, fire and weather frequency, and fuel models. For more information: [www.iccsafe.org](http://www.iccsafe.org)
- c. Texas Forest Service. Wildfire Hazard Risk Assessment, a Microsoft Access-based Subdivision Survey 2005. The intent of this Access-based wildfire hazard risk assessment program is to identify communities at risk based on overall hazards to the homes in a particular subdivision.
- d. Virginia Division of Forestry. Wildfire Risk Analysis, 1997. This statewide project used the Wildfire Prevention Analysis and Planning procedure. Field personnel determined the level of risk, hazard and value in each county, based on local knowledge of an area and historical fire occurrence. The result was a series of GIS-based maps to be used to identify and prioritize planned specific actions to reduce fires in problem areas. The Virginia Department of Forestry also conducted woodland home and development forest fire hazard ratings, and a five-year woodland home survey.
- e. Colorado State Forest Service. Colorado Wildland Urban Interface Hazard Assessment Methodology 2002. This methodology builds on the work of earlier hazard methodologies and provides new and updated data to further enhance accuracy and scale. This assessment also includes all of the counties in Colorado. For more information: [www.colostate.edu/dept/CSFS/Methodology.pdf](http://www.colostate.edu/dept/CSFS/Methodology.pdf)
- f. Florida Dept of Forestry. Wildfire Hazard Assessment Guide for Florida Homeowners 2002. Developed to help Florida neighborhoods: (1) determine if a wildfire hazard exists for their neighborhood or subdivision, (2) evaluate the wildfire risk of the neighborhood, and (3) take action to mitigate the existing wildfire hazard, thereby reducing the risk to an acceptable level.
- g. Protecting Life and Property from Wildfire: An Introduction to Designing Zoning & Building Standards for Local Officials. Great Lakes Forest Fire Compact, 1996. This document focuses on planning needs and considerations for assessing the urban interface and includes recommendations for firewise landscapes, access, water supplies, and structural design. The appendix provides ideas for risk assessment and a sample risk rating system for a subdivision or development.
- h. Wildfire Hazard Evaluation—Field Notes. Colorado State Forest Service, 1992. This hazard-rating field form, developed for subdivision level use, considers many of the key elements defined in the NWCG document. It is simple in function and design using low, moderate and high fire risks based on numeric scores.
- i. Wildfire Hazard Identification & Mitigation System (WHIMS), Boulder, Colorado. 1992. Through the involvement of multiple local, state, and federal government agencies, wildfire components have been tied together to identify hazardous areas. The fire protection district can foresee these high-hazard areas, passing along mitigation tips to the individual residents, homeowners and homeowner associations and showing them the importance of mitigation around their homes. [www.co.boulder.co.us/lu/wildfire/whims.htm](http://www.co.boulder.co.us/lu/wildfire/whims.htm)
- j. Fire Risk Rating for Existing and Planned Wildland Residential Interface Development. Montana Department of Natural Resources and Conservation, Missoula, MT, March, 1993. This rating system allows prevention planners to assess interface areas for risks and hazards, rank them according to their risk score, and then set priorities for prevention resources and actions. It organizes physical site information, such as road access, topography, fuels, construction and water sources, so that the fire managers can easily review all the information at once.



## B. GIS Software Packages and/or Downloads

1. ESRI—ArcGIS—is an integrated collection of geographic information system (GIS) software products for building a complete GIS for your organization. The ArcGIS framework enables you to deploy GIS functionality and business logic wherever it is needed—in desktops, servers (including the Web), or mobile information systems. [www.esri.com](http://www.esri.com)
2. ERDAS Imagine Professional—is raster-based software designed specifically to extract information from images. Vast arrays of tools allow the user to study data using complex image analysis, radar analysis and advanced classification tools. <http://gi.leica-geosystems.com/default.aspx>
3. MapInfo Professional—is a powerful Microsoft Windows-based mapping application that enables business analysts and GIS professionals to easily visualize the relationships between data and geography. With MapInfo Professional, you can perform sophisticated and detailed data analysis by leveraging the power of location. Including location in your decision-making and daily operations can help you increase revenue, lower costs, boost efficiency and improve services.) [www.mapinfo.com](http://www.mapinfo.com)
4. Geographic Resources Analysis Support System—Commonly referred to as GRASS, this is a GIS used for geospatial data management and analysis, image processing, graphics/maps production, spatial modeling, and visualization. GRASS is currently used in academic and commercial settings around the world, as well as by many governmental agencies and environmental consulting companies.
5. MS MapPoint—MapPoint 2006 includes updated geographic and demographic data, plus new features including advanced GPS functionality, text and voice-prompted driving guidance for Windows XP users, Location Finder, and more. MapPoint 2006 with GPS Locator combines complete business mapping and analysis software with the latest Global Positioning System (GPS) receiver. [www.mappoint.com](http://www.mappoint.com)
6. Delorme XMap 4.5 Professional—is powerful and scalable mapping software that provides users with easy-to-use and affordable digital mapping tools. Add-on software modules expand capabilities further encompassing image registration and aerial photography mission planning. XMap software can be bundle with Earthmate USB GPS receiver. [www.delorme.com](http://www.delorme.com)
7. National Geographic Topo! Pro Products—series combine National Geographic Atlas Maps, topographic data sets, and GIS technologies creating powerful, intelligent and interactive mapping tools that are easy to use, can be used anywhere and in real-time. The National Geographic TOPO! Fire Pro is an associated turn-key solution that optimizes the process of capturing and sharing Urban and Wildland Fire information. <http://maps.nationalgeographic.com/topo/index.cfm> and [www.nationalgeographic.com/maps](http://www.nationalgeographic.com/maps)
8. Google Earth—is free for personal use. No registration is required. Optional upgrade to Google Earth Plus. (Windows only). The technology makes it easy for non-specialist users to interact with massive quantities of satellite imagery and GIS data to penetrate the clutter of data and get to the knowledge that could make a critical difference. [www.earth.google.com](http://www.earth.google.com)
9. GEOMA—Geospatial Multi-Agency Coordination Group or GeoMAC, is an internet-based mapping application originally designed for fire managers to access online maps of current fire locations and perimeters in the conterminous 48 States and Alaska. Using a standard web browser, fire personnel can view this information to pinpoint the affected areas. [www.geomac.gov](http://www.geomac.gov)



# Glossary of Terms

**Assessment** – The evaluation and interpretation of measurements, intelligence, and other information to provide a basis for decision-making.

**Attachments** – Any structure connected to the residence such as decks, porches, garage, wooden walkways, and fences etc.

**Chimney** – 1) Steep narrow draw or small canyon that draw fire up them in the same manner a flue draws heat from a fireplace. 2) Containing one or more vertical or nearly vertical passageways for conveying flue gases to the outside atmosphere.

**Combustible** – Any material that, in the form in which it is used and under the conditions anticipated, will ignite and burn.

**Combustion** – The rapid oxidation of fuel in which heat and usually flame are produced. Combustion can be divided into four phases: pre-ignition, flaming, smoldering, and glowing.

**Common Area** – An area set aside that is shared by all property owners within a homeowner association or subdivision for recreational purposes.

**Community** – A body of people living in one place or district and considered as a whole; a neighborhood, subdivision, small town, village or township with boundaries defined by the residents or by regulatory jurisdiction. For the purposes of Firewise action and mitigation, the definition of community also includes shared home ignition risk from wildfire.

**Conduction** – Conduction is defined as heat transfer to another body or within a body by direct contact. When heat is sustained near combustible fuels, conduction provides the process that continues to transfer heat through the fuel masses and supports the fuels continued and complete combustion.

**Convection** – Convection is defined as heat transfer by circulation within a medium such as a gas or liquid. Convective heat transfer to combustible materials on, or near, homes requires direct contact with combustible materials by the flames or the hot gases emitted by the flames.

**Decks** – See Attachments.

**Defensible space** – An area, typically a width of 9 m (30 ft) or more, between an improved property and a potential wildfire where the combustibles have been removed or modified.

**Eave(s)** – The projecting overhang at the lower edge of a roof.

**Ember** – A particle of solid material that emits radiant energy due either to its temperature or the process of combustion on its surface. Also see: Firebrands

**Environment** – The complex surroundings of an item or area of interest, such as air, water, natural resources, and their physical conditions (temperature, humidity).

**Exposure** – 1) Property that may be endangered by a fire burning in another home or by a wildfire. 2) Direction in which a slope faces, usually with respect to cardinal directions. 3) The general surroundings of a site with special reference to its openness to winds.

**Fence** – A freestanding wall, balustrade, or railing (as of wood, plastic, or wire) having a height of no less than 1 m (3 ft) erected to divide property, to serve as a barrier or guard, or for decoration. also see: Attachments

**Fire** – Rapid oxidation, usually with the evolution of heat and light; heat fuel, oxygen and interaction of the three.

**Fire Behavior** – The manner in which a fire reacts to the influences of fuel, weather, and topography.

**Firebrand** – Any source of heat, natural or human made, capable of igniting wildland fuels. Flaming or glowing fuel particles (embers) that can be carried naturally by wind, convection currents, or by gravity into unburned fuels. Also see: Embers

**Fire Prevention** – Activities such as public education, community outreach, law enforcement, and reduction of fuel hazards that are intended to reduce wildland fire and the risks it poses to life and property.

**Fire Resistant** – Construction designed to provide reasonable protection against fire.

**Fire Resistive** – Refers to properties or designs to resist the effects of any fire to which a material or structure can be expected to be subjected.

**Firewise** – 1) A national, multi-agency effort designed to reach beyond the fire service by involving homeowners, community leaders, planners, developers, and others in the effort to protect people, property, and natural resources from the risk of wildland fire before a fire starts. 2) A series of practical steps that individuals and communities can take to minimize wildfire risks to people, property and natural resources. It emphasizes community responsibility for planning in the design of a safe community as well as effective emergency response, and individual responsibility for safer home construction and design, landscaping, and maintenance. 3) The condition or state of being knowledgeable about how to protect homes and resources from wildfire threats.

**Firewise Construction** – The use of materials and systems in the design and construction of a home to safeguard against the ignition from a wildfire.

**Firewise Landscaping** – Vegetative management that removes combustible fuels from around a home to reduce ignition exposure from radiant heat. The combustible fuels may be replaced with green lawn, gardens, certain individually spaced green, ornamental shrubs, individually spaced and pruned trees, decorative stone or other non-combustible or flame-resistant materials.

**Fuel(s)** – 1) Any material that will maintain combustion under specified environmental conditions. 2) Any substance that reacts with the oxygen in the air or with the oxygen yielded by an oxidizer to produce combustion. 3) A material that yields heat through combustion.

**Geographic Information Systems (GIS)** – GIS is a technology that is used to view and analyze data from a geographic perspective. GIS, most often associated with maps, links locations to information (such as people to addresses, buildings to parcels, or streets within a network) and layers that information to give you a better understanding of how it all interrelates.

**Gutter** – A U-shaped device hung under the eaves to collect and transport rainwater from the home.

**Hazard Assessment** – Assess hazards to determine risks. Assess the impact of each hazard in terms of potential loss, cost, or strategic degradation based on probability and severity.

**Hazard Reduction** – Any treatment of living and dead fuels that reduces the potential spread or consequences of fire.

**Home** – A constructed object, usually a free-standing building above ground providing complete and independent living facilities for one or more persons, including, permanent provisions for living, sleeping, eating, cooking, and sanitation.

**Home Assessment** – Evaluation of a dwelling and its immediate surrounding to determine its potential to escape damage by an

approaching wildland fire. Includes the fuels and vegetation in the yard and adjacent to the home, roof environment, decking and siding materials, prevailing winds, topography, fire history, etc., with the intent of mitigating fire hazards and risks.

**Home Ignition Zone** – The Home Ignition Zone principally determines a home's ignition potential during an intense fire. The "Zone" includes the homes and their immediate surroundings within 100-200 ft.

**Ignition Potential** – Chance that a firebrand will cause an ignition when it lands on receptive fuels.

**Land Use Plan[ning]** – A set of decisions that establish management direction for land within an administrative area; an assimilation of land-use-plan-level decisions developed through the planning process regardless of the scale at which the decisions were developed.

**Mitigation** – Those activities implemented prior to, during, or after an incident, which are designed to reduce or eliminate risks to persons or property that lessen the actual or potential effects or consequences of an incident. Mitigation measures can include efforts to educate governments, businesses, and the general public on measures they can take to reduce loss and injury and are often informed by lessons learned from prior incidents. Also see Prevention and Hazard Reduction.

**Noncombustible** – Any material that, in the form in which it is used and under the conditions anticipated will not ignite and burn nor add appreciable heat to an ambient fire.

**Prevention** – Activities directed at reducing the incidence of fires, including public education, law enforcement, personal contact, and reduction of fuel hazards (fuels management). Also see: Mitigation

**Radiant Heat** – Heat energy carried by electromagnetic waves longer than light waves and shorter than radio waves. Radiant heat (electromagnetic radiation) increases the sensible temperature of any substance capable of absorbing the radiation, especially solid and opaque objects.

**Radiation** – Radiation is defined as heat transfer by way of electromagnetic energy. The best example of heat transfer by radiation is the sun's heating of earth.

**Risk** – 1) The chance of fire starting as determined by the presence and activity of causative agents; 2) A chance of suffering harm or loss; 3) A number related to the potential of firebrands to which a given area will be exposed during the rating day. (NFDRS – National Fire Danger Rating System). Risk factors can be either natural (weather i.e. wind, temperature) or human-associated. Human-associated risk factors are those we have control of such as building materials (roofs, chimneys, siding, windows etc), design and location of the home that can influence whether a home or structure can easily ignite, and if so, whether fire can be sustained to the extent the structure would be lost.

**Roof Classification** – Roof classification is determined by tests that expose the top surface of roof decks (primarily the roof covering) to both gas flames and standardized burning wood brands. Tests are arranged to provide three levels of severity by adjusting the temperature and duration of the gas flame and the sizes of the burning wood brands. Successful coverings are rated Class A, Class B, or Class C, with Class A withstanding the most severe exposure, Class B withstanding intermediate exposure, and Class C withstanding the least severe exposure.

**Roof Covering** – The membrane, which may also be the roof assembly that resists fire and provides weather protection to the building against water infiltration, wind, and impact.

**Slope** – Upward or downward incline or slant, usually calculated as a percentage.

**Structure** – A constructed object, usually a free-standing building above ground.

**Subdivision** – An area of land laid out and divided into lots, blocks, and building sites, and in which public facilities are laid out, such as streets, alleys, parks, and easements for public utilities.

**Topography** – A configuration of the earth's surface, including its relief and the position of its natural and man made features.

**Vegetation** – Plant life and or covering.

**Weather, Fire** – Weather conditions that influence fire ignition, behavior, and suppression.

**Wildland** – An area in which development is essentially non-existent, except for roads, railroads, powerlines, and similar transportation facilities. Homes, if any, are widely scattered.

**Wildland Urban Interface (WUI)** – An area so designated such that a wildfire directly influences with flames and firebrands the potential ignition of the structures within that area.

## Appendices

### A. Bibliography

Below is a list of additional literature and audiovisual resource material.

California's I-Zone—Wildland/Urban Fire Prevention and Mitigation. Rodney Slaughter, editor. Governor's Office of Emergency Services. 1996. This book was made possible by hazard mitigation grant funding from the Federal Emergency Management Agency and involved several agencies. It is a reference manual that addresses: model codes, hazard zoning and enforcement; building standards and technology; domestic and wildland fuels; and community programs. It is available from CFESTES Bookstore, 7171 Bowling Drive, Sacramento, CA 95823-2034.

California Fire Plan: A Framework for Minimizing Costs and Losses from Wildland Fires. California State Board of Forestry. 1996. This document gives a detailed framework for evaluating and prioritizing wildfire hazards including structures, watersheds, timber, range land, air quality, recreation potential, sensitive habitats and cultural resources. It includes a process for developing assessments that involve multiple jurisdictions and interested parties.

Colorado Wildland Interface Pre-plan Initiative. Colorado State Forest Service (CSFS). 1997. This system is being taught through classroom and field sessions. It provides a simple method to rate homes within the wildland/urban interface on their ability to withstand wildfire. This system uses the Wildland Home Fire Risk Meter, a rating sheet developed jointly by CSFS and the Fire Protection Districts and the Fire Hazard Severity Form as shown in the 1997 Urban/Wildland Interface Code.

Development Strategies in the Wildland/Urban Interface. International Association of Fire Chiefs and Western Fire Chiefs Association. 1996. This handbook was designed to be an educational tool for the fire service and academic and development professionals protecting or developing wildland or forested areas. It provides strategies for land use decisions, risk assessment, vegetation management, public education and fire operations.

Fire Safety Considerations for Residential Development in Forested Areas—A Guide for Fire Agencies, Planning Boards and Subdivision or Housing Developers. New Hampshire Rural Fire Protection Task Force. February, 1997. This guide lists minimum fire safety considerations for woodland development, guidelines for a sample subdivision rating, and a wildfire hazard rating form for subdivisions.



Incline Village/Crystal Bay Defensible Space Handbooks: A Volunteer's Guide to Reducing the Wildfire Threat. University of Nevada Cooperative Extension Service, 1991. This handbook, designed as a reference guide for neighborhood leaders, provides guidance in understanding the threat of wildfire, implementing defensible space and developing the role of leadership in neighborhood efforts.

North Whitefish Fire Risk Rating GIS Project. Fire and Aviation Management Office, Montana Department of Natural Resources and Conservation, Missoula, MT, 1995. This project applies geographic information systems (GIS) to Montana's Fire Risk Rating System (FRA). Twenty-eight key variables are assigned a weighted score and the scores are added to achieve a composite score. This publication is useful for agencies wishing to automate all or part of an existing fire hazard rating system.

US Department of the Interior. Wildfire Prevention Analysis and Planning, 1992. This procedure was developed to determine the locations and levels of fire risks, hazards (fuels and topography of an area), and values (areas where loss of destruction by fire would be unacceptable) in fire-prone forests or wildland developments. Ratings of low, medium and high are determined for risks, hazards and values (delineated on a map), as well as a ranking system for planned activities in specific areas.

## Articles

Fahnestock, George. Rating Forest-Fire Hazard in Residential Developments in Colorado, 1971.

Lynch, Dennis and Standish, Broome. Mountain Land Planning. 1973.

Summit Country Colorado. Fire Hazard Mitigation Requirements For New Construction Amended. 1995.

Cohen, J., What is the Wildland Fire Threat to Homes?, Presented as the Thompson Memorial Lecture, April 10, 2000, School of Forestry, Northern Arizona University, Flagstaff, AZ

USDA Forest Service, Fire Science Laboratory, Missoula, MT, Wildland-Urban Fire – A different Approach, presentation at the IAWF Fire Safety Summit, Missoula MT, 2001

Preventing Disaster, Home Ignitability in the Wildland/urban Interface, Journal of Forestry, 1998 (3): 15-21

Zoning News, "Saving Homes from Wildfires: Regulating the Home Ignition Zone," American Planning Association, Chicago, IL 2001

## Wildland/Urban Interface Fires Case Studies

Stanford Research Institute, Howard, et. Al. 1973, The Belair-Brentwood Fire of 1961

National Wildland/Urban Interface Fire Protection Initiative,

Black Tiger Fire Case Study, July 9, 1989

Stephen Bridge Road Fire Case Study: Crawford County, Michigan, May 8, 1990

The Oakland/Berkeley Hills Fire Case Study, October 20, 1991

Fire Storm'91 Case Study, Spokane, Washington, October 16, 1991

Wilson, Rex, The Devil Wind and Wood Shingles, NFPA Quarterly, January 1962,

Firemen Magazine, Conflagration in Los Angeles Hills, December 1961

University of California, Berkeley, CA, Foote, Ethan, 1994, Santa Barbara Paint Fire

## Print Materials and Videos

(Unless otherwise noted, the following booklets, brochures and videos may be ordered from the Firewise Online Publications Catalog at [www.firewise.org](http://www.firewise.org).)

Planning for Wildfires, American Planning Association, Chicago, IL, 2005 (Available at [www.apa.org](http://www.apa.org).)

Wildland/Urban Interface Hazard Assessment Training, 4-CD Set, 2003

Wildfire! Preventing Home Ignitions, Video, 2001

Protecting Your Home from Wildfire, Video, 2000

Firewise: Community Solutions to a National Problem, 2006

Assessing Hazards in the Home Ignition Zone (training course materials), 2006

## NFPA Codes and Standards/Publications

(NFPA publications may be ordered from the online catalog at [www.nfpa.org](http://www.nfpa.org).)

NFPA 220 – Standard on Types of Building Construction, 1999 edition

NFPA 256, Standard Methods of Fire Tests of Roof Coverings, 2003 edition

NFPA 1142 – Standard on Water Supplies for Suburban and Rural Fire Fighting, 2007 edition

## Other references

International Code Council (ICC), International Wildland Urban Interface Code, 2006 edition

## Websites for Additional Information

[www.fs.fed.us](http://www.fs.fed.us) – USDA Forest Service

[www.doi.gov](http://www.doi.gov) – United States Department of the Interior

[www.firewise.org](http://www.firewise.org) – Firewise Communities/USA

[www.firelab.org](http://www.firelab.org) – Fire Science Laboratory, Missoula, MT

[www.fema.gov](http://www.fema.gov) – Federal Emergency Management Agency

[www.planning.org](http://www.planning.org) – American Planning Association

[www.geomac.gov](http://www.geomac.gov) – GeoMAC: Geospatial Multi-agency Coordination

[www.wildfireprograms.com](http://www.wildfireprograms.com) – National Database of State and Local Wildfire Hazard Mitigation Programs

[www.nfpa.org](http://www.nfpa.org) – National Fire Protection Association

[www.nifc.gov](http://www.nifc.gov) – National Interagency Fire Center

[www.nwcg.gov](http://www.nwcg.gov) – National Wildfire Coordinating Group

[www.iccsafe.org](http://www.iccsafe.org) – International Code Council

For more information on Firewise Communities™ and the National Wildland/Urban Interface Fire Program, contact: Firewise Communities, 1 Batterymarch Park, Quincy, Massachusetts, 02169 or go to [www.firewise.org](http://www.firewise.org)

The National Firewise Communities Programs is an interagency program designed to encourage local solutions for wildfire safety by involving homeowners, community leaders, planners, developers, firefighters, and other in the effort to protect people and property from the risk of wildfire. The Firewise Communities program is sponsored by the National Wildfire Coordinating Group's Wildfire/Urban Interface Working Team, a consortium of wildland fire agencies that includes the USDA Forest Service, the Department of the Interior, the Federal Emergency Management Agency, the International Association of Fire Chiefs, the National Emergency Management Association, the US Fire Administration, the National Association of State Fire Marshals, the National Fire Protection Association, and state forestry organizations. For more information, visit [www.firewise.com](http://www.firewise.com).

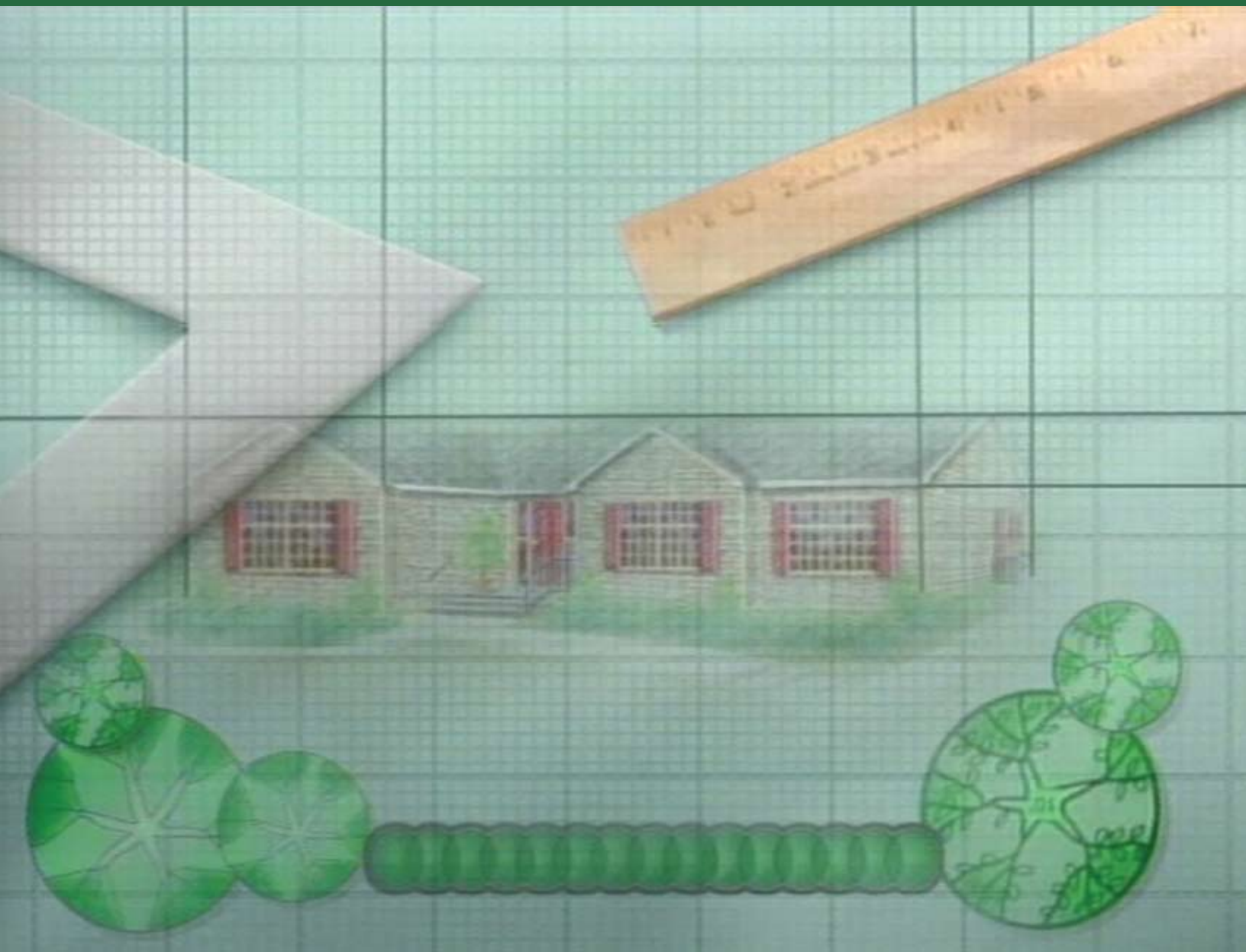
Firewise® and Firewise Communities/USA® are registered trademarks of the National Fire Protection Association; Quincy, MA







# Firewise Guide to Landscape and Construction



# Guide to Landscaping

The primary goal for Firewise landscaping is fuel reduction — limiting the level of flammable vegetation and materials surrounding the home and increasing the moisture content of remaining vegetation. This includes the entire 'home ignition zone' which extends up to 200 feet in high hazard areas.

## Use the Zone Concept

**Zone 1** is the 30 feet adjacent to the home and its attachments; **Zone 2** is 30 to 100 feet from the home; **Zone 3** is 100 to 200 feet from the home.

**Zone 1 (All Hazard Areas)** This well-irrigated area encircles the structure and all its attachments (wooden decks, fences, and boardwalks) for at least 30 feet on all sides.

- 1) Plants should be carefully spaced, low-growing and free of resins, oils and waxes that burn easily.
- 2) Mow the lawn regularly. Prune trees up six to ten feet from the ground.
- 3) Space conifer trees 30 feet between crowns. Trim back trees that overhang the house.
- 4) Create a 'fire-free' area within five feet of the home, using non-flammable landscaping materials and/or high-moisture-content annuals and perennials.
- 5) Remove dead vegetation from under deck and within 10 feet of house.
- 6) Consider fire-resistant material for patio furniture, swing sets, etc.
- 7) Firewood stacks and propane tanks should not be located in this zone.
- 8) Water plants, trees and mulch regularly.
- 9) Consider xeriscaping if you are affected by water-use restrictions.

**Zone 2 (Moderate and High Hazard Areas)** Plants in this zone should be low-growing, well-irrigated, and less flammable.

- 1) Leave 30 feet between clusters of two to three trees, or 20 feet between individual trees.
- 2) Encourage a mixture of deciduous and coniferous trees.
- 3) Create 'fuel breaks', like driveways, gravel walkways and lawns.
- 4) Prune trees up six to ten feet from the ground.

**Zone 3 (High Hazard Areas)** Thin this area, although less space is required than in Zone 2. Remove smaller conifers that are growing between taller trees. Remove heavy accumulation of woody debris. Reduce the density of tall trees so canopies are not touching.

## Maintaining the Firewise Landscape

- ✓ Keep trees and shrubs pruned six to ten feet from the ground.
- ✓ Remove leaf clutter and dead and overhanging branches.
- ✓ Mow the lawn regularly and dispose of cutting and debris promptly.
- ✓ Store firewood away from the house.
- ✓ Maintain the irrigation system regularly.
- ✓ Familiarize yourself with local regulations regarding vegetative clearance, debris disposal, and fire safety requirements for equipment.



Use grass and driveways as fuel breaks from the house.



Use faux brick and stone finishes and high-moisture-content annuals and perennials.



Use groupings of potted plants that include succulents and other drought resistant vegetation.



Create a cinder block wall around the perimeter of your yard and use grass and slate to break up the landscape.



The use of pavers and rock make for a pleasing effect and creates a fuel break.







The roof is the most important element of the home. Use rated roofing material.



Cover openings with 1/8" metal screen to block fire brands and embers from collecting under the home or deck.



Use non-flammable fencing if attached to the house such as metal.



Use glass skylights; plastic will melt and allow embers into the home.

*"When considering improvements to reduce wildfire vulnerability, the key is to consider the home in relation to its immediate surroundings. The home's vulnerability is determined by the exposure of its external materials and design to flames and firebrands during extreme wildfires. The higher the fire intensities near the home, the greater the need for nonflammable construction materials and a resistant building design."* – Jack Cohen, USDA-Forest Service

**Use Rated Roofing Material.** Roofing material with a Class A, B or C rating is fire resistant and will help keep the flame from spreading. Examples:

- ✓ Composition shingle
- ✓ Metal
- ✓ Clay
- ✓ Cement tile

**Use Fire-Resistant Building Materials on Exterior Walls.** Examples include:

- ✓ Cement
- ✓ Plaster
- ✓ Stucco
- ✓ Masonry (concrete, stone, brick or block)

While vinyl is difficult to ignite, it can fall away or melt when exposed to extreme heat.

**Use Double-Paned or Tempered Glass.** Double-pane glass can help reduce the risk of fracture or collapse during an extreme wildfire. Tempered glass is the most effective. For skylights, glass is a better choice than plastic or fiberglass.

**Enclose Eaves, Fascias, Soffits and Vents.** 'Box' eaves, fascias, soffits and vents, or enclose them with metal screens. Vent openings should be covered with 1/8" metal screen.

**Protect Overhangs and Other Attachments.** Remove all vegetation and other fuels from around overhangs and other attachments (room additions, bay windows, decks, porches, carports and fences). Box in the undersides of overhangs, decks and balconies with noncombustible or fire-resistant materials. Fences constructed of flammable materials like wood should not be attached directly to the house.

Anything attached to the house (decks, porches, fences and outbuildings) should be considered part of the house. These act as fuel bridges, particularly if constructed from flammable materials.

- 1) If a wood fence is attached to the house, separate the fence from the house with a masonry or metal barrier.
- 2) Decks and elevated porches should be kept free of combustible materials and debris.
- 3) Elevated wooden decks should not be located at the top of a hill. Consider a terrace.



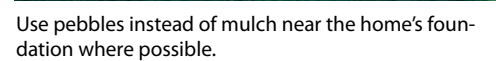
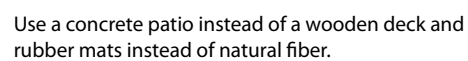
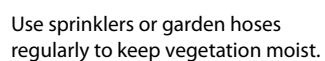
Enclose eaves and soffits.



Enclose under decks so firebrands do not fly under and collect.



This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.





# Trends in Wildland Fire Entrapment Fatalities...Revisited

By James R. Cook

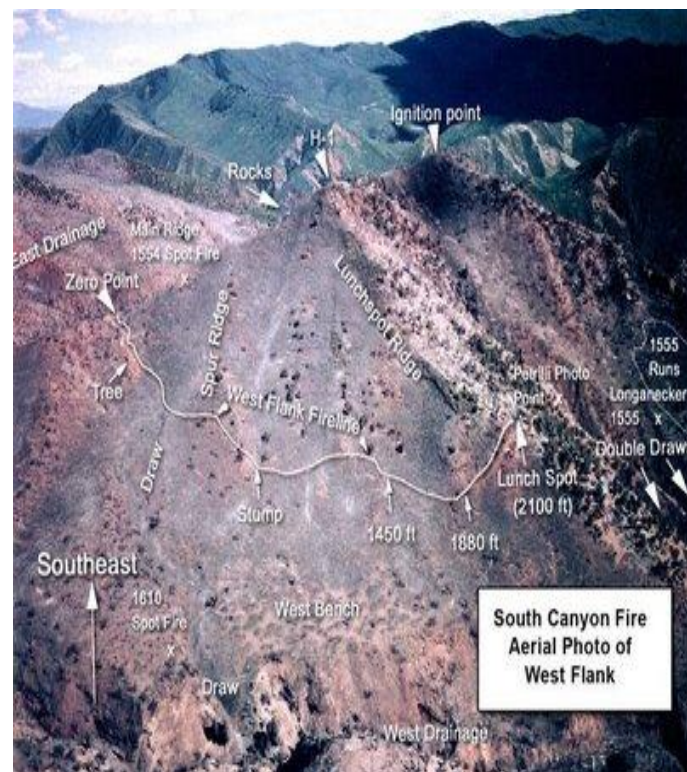
February 2013



*Wildland firefighters today are spending more hours fighting fires than ever before, and they are engaging fires of historic magnitude. The risk environment associated with wildland fire is being re-defined, and firefighters too have begun to redefine their own culture as a professional endeavor. This exercise of redefinition is not new.*

*With the upcoming 10-year anniversary of South Canyon Fire and the impacts from the Thirtymile and Cramer Fires still fresh, the interest in lessons learned from the past will be intense, and scrutiny of the safety and effectiveness of wildland firefighting agencies will continue to increase. Part of this process requires we examine our hard won lessons in a different light.*

These were the opening words of a briefing paper that I wrote in 2004 for my employing agency, the U.S. Forest Service. The basis for that briefing paper was a comparison of fire entrapment fatalities in relation to significant organizational changes within the wildland fire service from 1933 through 2003. The discussion demonstrated during that period of time, for all wildland firefighting agencies combined, the average number of firefighter entrapment fatalities decreased from about six each year to about two each year. This premise came under criticism from some in the research field for not being a true statistical analysis. The subject will probably never lend itself to a valid statistical analysis for several reasons. First, the reporting bias that exists between the current work environment and how accidents were reported in the 1930s or 1940s and even into the 1970s, suggests that many historical events have never been documented. In addition, with so many varied wildland fire response organizations involved now, the current level of exposure in terms of total person-hours worked on the fireground certainly exceeds what it was 70 or 80 years ago...and even today it would be difficult to put a firm number on what that true exposure level would look like.





So, while the wildland fire work environment continues to increase in complexity, this author argues that there is a steady, downward trend in the overall frequency of fire entrapment fatalities. Because organizational change and its effects are slow to manifest themselves, a longer view is important...and it has importance because it articulates that progress on firefighter entrapment is being made in the very hazardous, high risk / high consequence work environment on wildland fires.

What follows is a brief timeline of some significant organizational changes in the wildland fire service along with the annual entrapment fatality numbers. The format is the same as was outlined in the original briefing paper, however, it now includes updated information from 1926 to 2012, courtesy of the National Wildfire Coordination Group (NWCG) Lessons Learned Center. The timeline delineates six distinct time periods that span more than 85 years. These periods of time are not equal in duration, rather they are defined by key events that significantly changed how the wildland fire service operated at a national level. As the 20-year anniversary of the South Canyon Fire approaches, wildland firefighters should be inspired to continue improvement efforts by seeing that training and operational changes made over the years have made a difference.



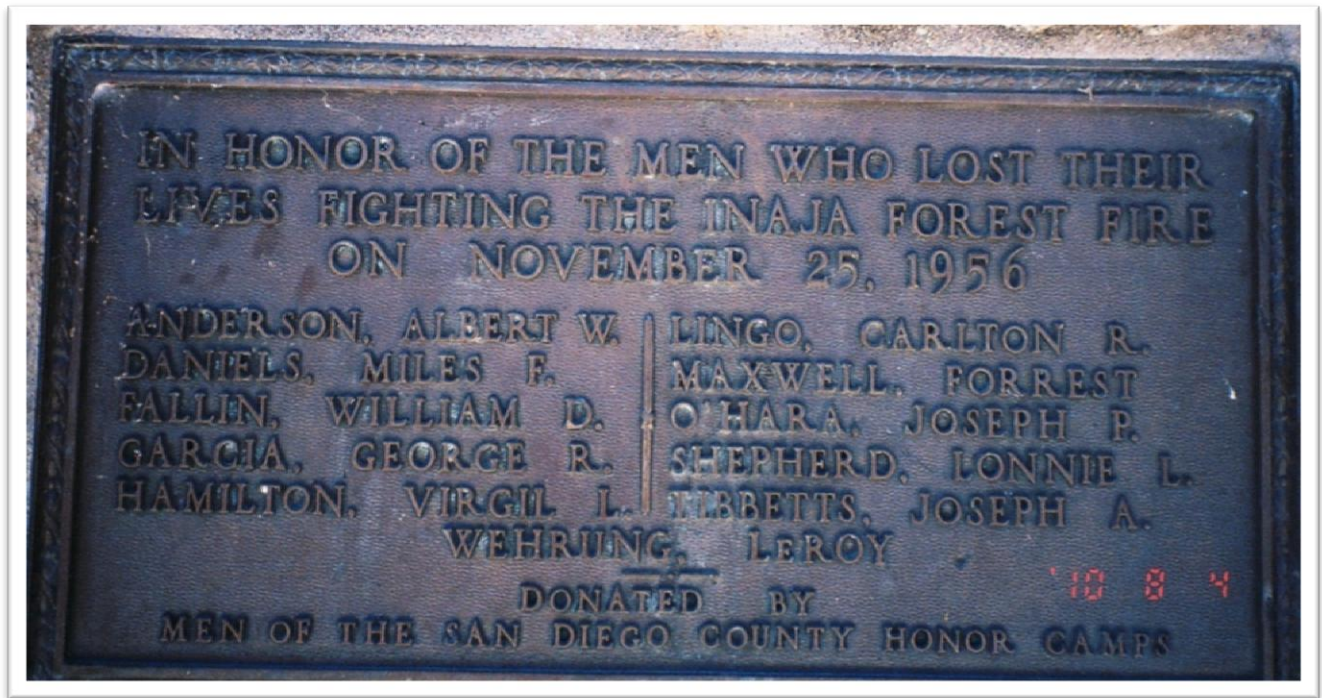
Mann Gulch Fire





Griffith Park Fire, 1933

1926 – 1956 The year 1926 was chosen for the baseline as this was the year reporting data for wildland firefighting fatalities begins to show any continuity. The early 1930s mark the advent of organized, wildland fire suppression crews through the Civilian Conservation Corps (CCC). The years 1926 to 1956 were characterized by firefighting efforts primarily staffed with CCC crews, pick-up civilian laborers, or inmates supervised by agency fire overhead. This same period saw the beginning of the Smokejumper project in 1940 and first Hotshot crews in 1948.



1957 – 1966 Key event is a series of large tragedy fires culminating with the 1956 Inaja Fire and the follow-up *Report of the Task Force to Recommend Action to Reduce the Chances of Men Being Killed by Burning While Fighting Fire, 1957*. Two significant changes resulted from this report. The “10 Standard Firefighting Orders” and “13 Situations That Shout Watch Out” were established...and the first formal fire behavior and fire generalship courses were developed. Wildland firefighting was characterized by an increase in dedicated agency initial attack resources, the advent of effective aviation assets, and start of the Interregional Crew concept in 1961.







up



1967 – 1979 Key event is the 1966 Loop Fire and the follow-  
*Report of the Fire Safety Review Team – A Plan to Further Reduce the Chances of Men Being Burned While Fighting Fires, 1967.* Among the many recommendations from this report were three significant changes: the “Downhill Line Construction Checklist” was adopted; emphasis was placed on using portable weather equipment including belt weather kits for crews on the fireline; and there was direction to develop more effective fire shelters and fire resistant clothing. The Boise Interagency Fire Center went into service as participation of non-federal agencies increased. In 1972, the interagency FIRESCOPE initiative began in California, and in 1974, NWCG was chartered nationally.



1980 – 1994 Key event is a rash of multi-fatality fires in the late 1970s and the follow-up *Report of the Task Force on Study of Fatal and Near Fatal Wildland Fire Accidents, 1980*. More significant changes were the result: development of the national S-course training system; requirements for all firefighters to wear fire resistant clothing and carry fire shelters; and a national radio cache system was established. This time period saw the evolution from fire control to fire management. Interagency cooperation improved with the Incident Command System becoming a national standard along with the national mobilization system and national incident management team concept. The wildland / urban interface became a top priority in fire management decisions at all levels. The firefighting rules of engagement continued to grow with the publication of the *Fatal and Near-*

*Fatal Forest Fires – The Common Denominators* research paper and revision of existing tools into the “10 Fire Orders” and “18 Watch Out Situations.”



1995 – 2003 Key event is the 1994 South Canyon Fire and the follow-up *Interagency Management Report Team, 1995* and *TriData Wildland Firefighter Safety Awareness Study, 1998*. Many significant recommendations were offered in these reports that helped wildland fire agencies to become better funded and more professionally staffed. Equally important was the 1995 Human Factors Workshop that generated an awareness of the need to better prepare firefighters for the leadership and decision-making demands of the fireground, and eventually evolved into a formal leadership development program for wildland firefighters. Forest health emerged as the primary issue affecting fire management efforts. The firefighting rules of engagement were questioned and debated, with one of the outcomes being the acceptance of the L.C.E.S. and Risk Management concepts alongside the 10 Fire Orders and the 18 Watch Outs.

#### STORM KING 14



KATH BECK



TAMMI BICKETT



SCOTT BLECHA



LEVI BRINKLEY



TERRI HAGEN



BONNIE HOLBY



ROB JOHNSON



JON KELSO



JIM THRASH



RICHARD TYLER



DOUG DUNBAR



ROBERT BROWNING



ROGER ROTH

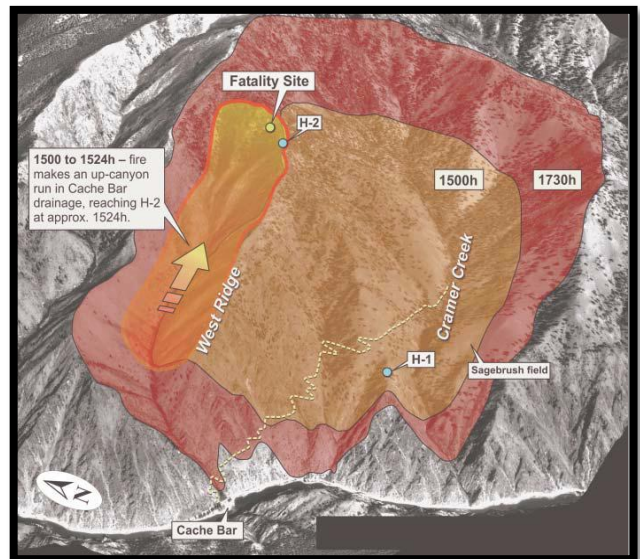


DON MACKEY



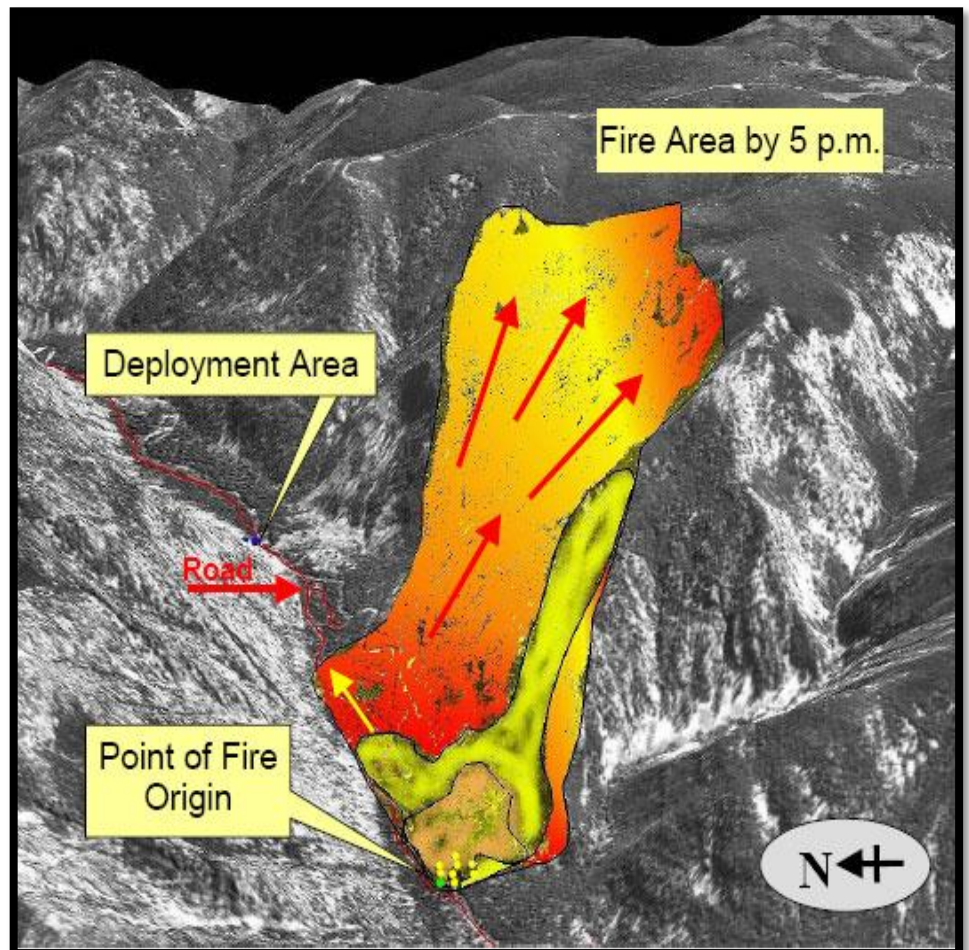


Cramer Fire Fatality Site



Cramer Fire Spread Map

2004 – 2012 Key event is the quick succession of the Cerro Grande, Thirty-Mile, and Cramer fires from 2000 to 2003. The resulting reports and intense political scrutiny of wildland fire agencies caused constant policy and procedural changes. One of the most notable safety advances is the increased willingness by many in the wildland fire service to learn from our past actions by using staff rides and the facilitated learning analysis (FLAs) along with initiatives such as the Lessons Learned Center, the Annual Refresher Training, and the SAFENET system. Also significant are the efforts by some wildland fire agencies to improve EMT and medevac protocols. Another driver of change is the evolution of how large incidents are managed...both at the strategic level, with the latitude to engage large wildfires with less than full suppression alternatives, and at the political level, with the focus on cost containment as well as all-hazard response expectations. At the tactical level, the firefighting rules of engagement continue to evolve with the widespread acceptance of the Incident Response Pocket Guide



Thirty-Mile Fire Spread Map

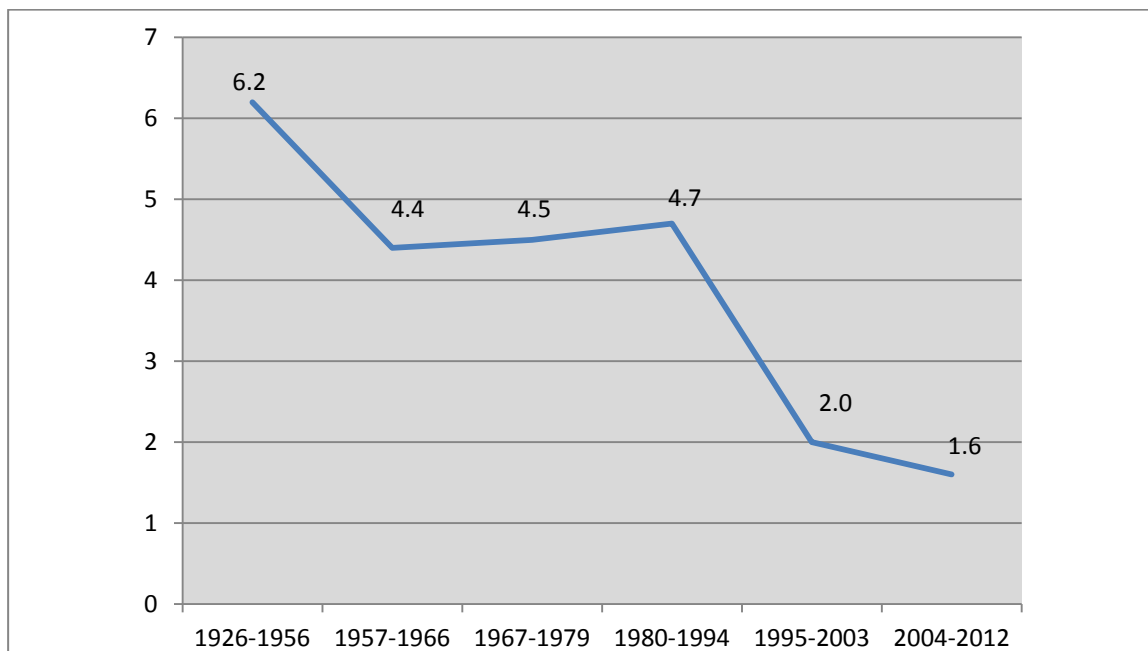
The following graph illustrates the trend in wildland firefighter entrapment fatalities from 1926 to 2012. It should be noted that fire entrapment is only one of four major fatality mechanisms in the wildland fire environment and has accounted for only 11% of all fatalities on the fireground since 1995 (295 total fireground fatalities with 32 by burnover/entrapment) and 38% since 1926 (1030 total fireground fatalities with 392 by burnover/entrapment).

**The other three fatality mechanisms account for the majority of wildland firefighter fatalities:**

- ❖ **Gravity (hazard trees, rolling rocks, and falls)**
- ❖ **Transportation (vehicle and aircraft incidents)**
- ❖ **Medical (heart attack and heat injury)**

**While the fatality mechanism of Entrapment is a lower frequency event based on our recent history, it is also the higher consequence event with the potential to affect larger numbers of firefighters at one time.**

### Entrapment Fatality Averages





Wildland Fire Entrapment Fatalities 1926-2012

Year	Fatalities	Significant Fires	Year	Fatalities	Significant Fires
1926	5	Springville-5	1980	2	
1927	0		1981	4	
1928	0		1982	1	
1929	1		1983	9	Northfield-3
1930	1		1984	12	Rainbow Springs-2
1931	8	Lewis & Clark-8	1985	5	
1932	0		1986	0	
1933	27	Griffith Park-25	1987	2	
1934	2		1988	1	
1935	1	Chatsworth-8	1989	1	
1936	9		1990	10	Dude-6
1937	20	Blackwater-15	1991	3	Point-2
1938	9	Pepper Run-8	1992	0	
1939	9	Rock Creek-5	1993	3	
1940	5		1994	18	South Canyon-14
1941	5		<b>Total</b> <b>1980-1994</b>	71	
1942	0		1995	2	
1943	15	Hauser Creek-11	1996	2	
1944	0		1997	0	
1945	1		1998	1	
1946	0		1999	2	
1947	2		2000	2	
1948	1		2001	5	Thirty-Mile Mile-4
1949	15	Mann Gulch-13	2002	0	
1950	5	Pelitor-4	2003	4	Cramer-2
1951	0		<b>Total</b> <b>1995-2003</b>	18	
1952	3		2004	1	
1953	16	Rattlesnake-15	2005	1	
1954	6	Gap Creek-3, Tunnel-3	2006	7	Esperanza-5
1955	8	Hacienda-5	2007	0	
1956	12	Inaja-11	2008	1	
<b>Total</b> <b>1926-1956</b>	186		2009	0	
1957	0		2010	0	
1958	2		2011	4	Blue Ribbon-2
1959	10	Decker-6	2012	0	
1960	3		<b>Total</b> <b>1995-2003</b>	14	
1961	5		<b>Total</b> <b>1926-2012</b>	392	
1962	4	Timber Lodge-4			
1963	1				
1964	3				
1965	4	Fairview Hollow-3			

### Wildland Fire Entrapment Fatalities 1926-2012

1966	12	Loop-12			
<b>Total</b> <b>1957-1966</b>	44				
1967	8				
1968	12	Canyon-8			
1969	0				
1970	0				
1971	7	Romero-4			
1972	1				
1973	1				
1974	0				
1975	2				
1976	4	Battlement Mesa-4			
1977	14	Bass River-4; Honda Canyon-3; Cart Creek-3			
1978	1				
1979	9	Spanish Ranch 4			
<b>Total</b> <b>1967-1979</b>	59				

#### Links to Additional Information and Locations of Significant Fatality Fires:

[http://www.nifc.gov/safety/safety\\_documents/Fatalities-by-Year.pdf](http://www.nifc.gov/safety/safety_documents/Fatalities-by-Year.pdf)

[http://www.fireleadership.gov/toolbox/staffride/main\\_library.html](http://www.fireleadership.gov/toolbox/staffride/main_library.html)

<http://www.coloradofirecamp.com/honoring-our-fallen/fatality-sites.htm>

#### National Wildland Firefighters Association

<http://www.wffoundation.org/Index.asp>



## USEFUL LINKS





See the Before and After the Fire document in Supplement Documents portion of this appendix for basic listing of most essential phone numbers and websites.

Austin American-Statesman. "Brush-eating goats could help prevent fires."

<http://www.statesman.com/news/news/state-regional/brush-eating-goats-could-help-prevent-fires/ndPw9/>

Boulder County. *Community Wildfire Protection Plan*.

<https://www.bouldercounty.org/property/forest/pages/lucwppmain.aspx>

Fire Adapted Communities. *Grants and Other Funding Opportunities*.

<http://www.fireadapted.org/resources/funding-opportunities.aspx>

Firewise Communities. "Wildland/Urban Interface Fire Hazards: A New Look at Understanding Hazard Assessment Methodologies."

<http://www.firewise.org/~media/Firewise/Files/Pdfs/Booklets%20and%20Brochures/BookletWildlandFireHazards.pdf>

High Country News. "A wildfire forum takes radical approach to protecting wildland-urban interface."

<http://www.hcn.org/blogs/goat/behind-closed-doors-wildfire-solutions-forum-takes-radical-approach-to-protecting-wui-from-wildfire>

High Country News. "Wildfire mitigation program helps homeowners create safer communities."

<https://www.hcn.org/blogs/goat/wildfire-partners-hopes-free-mitigation-plans-rebates-other-incentives-will-create-fire-adapted-communities/view>

Interface South. "Human Influences on Forest Ecosystems, Chapter 4."

<http://www.interfacesouth.org/swui-assessment/ch4.pdf>

Texas A&M Agrilife Extension. "Environmental and Economic Tradeoffs Associated with Vegetation Management on the Edwards Plateau."

<http://texnat.tamu.edu/library/symposia/juniper-ecology-and-management/environmental-and-economic-tradeoffs-associated-with-vegetation-management-on-the-edwards-plateau/>

Texas A&M Forest Service. "Community rallies to protect homes from wildfire."  
[http://texasforestservice.tamu.edu/uploadedFiles/FRP/New -  
\\_Mitigation/Unsafe Debris Burning/Walker%20County%20success%20story\(1\).pdf](http://texasforestservice.tamu.edu/uploadedFiles/FRP/New_-_Mitigation/Unsafe_Debris_Burning/Walker%20County%20success%20story(1).pdf)

Texas A&M Forest Service. "Cross Plains, Texas, Wildland Fire Case Study."  
<http://txforestservice.tamu.edu/uploadedFiles/FRP/DownloadAsset.pdf>

Texas A&M Forest Service. *Texas Tree Planting Guide*.  
<http://texastreeplanting.tamu.edu/ExpressSelector.aspx>

Texas Parks and Wildlife. *Wildscapes: Texas Wildscapes Certification*.  
[http://www.tpwd.state.tx.us/huntwild/wild/wildlife\\_diversity/wildscapes/wildscape\\_certification.phtml](http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/wildscapes/wildscape_certification.phtml)

The Texas Drought. *Dealing with Drought, Freshwater Shortages, and Climate Change*.  
<http://texscience.org/water/>

USDA Forest Service. *Applied Wildland Fire Research in Support of Project Level Hazardous Fuels Planning – Publications*.  
<http://forest.moscowfsl.wsu.edu/fuels/publications.html>

USDA Forest Service. *Applied Wildland Fire Research in Support of Project Level Hazardous Fuels Planning – Fact Sheets*.  
<http://forest.moscowfsl.wsu.edu/fuels/factsheets.html>



## ADDITIONAL RESOURCES



City of Austin. "Balcones Canyonlands Preserve Land Management Plan: Tier IIA, Chapter IV, Vegetation Management." August 2007.

City of Austin and Austin Energy. "Managing Trees Near Power Lines: A Customer's Answer Book."

City of Austin, Watershed Protection Development Review. "Central Texas Invasive Plants: Volunteer Field Guide."

City of Austin. "Invasive Species Management Plan."

City of Austin. "Maintain a Defensible Space."

City of Austin, Wildfire Ready Austin. "Understanding the Risk of Wildfire near Austin's Creeks."

City of Austin, Wildfire Ready Austin. "Before and After the Fire: Environmental Best Management Practices for Wildfire Risk Reduction and Recovery."

City of Austin, Grow Green. "Creekside Homeowners: A Guide for Creekside Residents."

City of Austin. "Upper Bear Creek Mitigation Case Study". November 2013.

Texas A&M Forest Service. "Firewise Landscaping."

Texas A&M Forest Service. "Vegetation Management in the Wildland Urban Interface."

Texas A&M Forest Service. "Pruning Guidelines for Prevention of Oak Wilt in Texas."

Texas A&M Forest Service. "Community rallies to protect homes from wildfire."

Texas A&M Forest Service. "Firewise Landscaping in Texas."

USDA (Morris C. Johnson, David L. Peterson, and Crystal L. Raymond). "Guide to Fuel Treatments in Dry Forests of the Western United States: Assessing Forest Structure and Fire Hazard."

USDA. "Wildlife and Invertebrate Response to Fuel Reduction Treatments in Dry Coniferous Forests of the Western United States: A Synthesis." September 2006.

USDA (Roger D. Fight and R. James Barbour). "Financial Analysis of Fuel Treatments." December 2005.

USDA. "Social Science to Improve Fuels Management: A Synthesis of Research Relevant to Communicating with Homeowners About Fuels Management."

USDA (M.E. Hunter, W.D. Shepperd, L.B. Lentile, J.E. Lundquist, M.G. Andreu, J.L. Butler, and F.W. Smith). "A Comprehensive Guide to Fuels Treatment Practices for Ponderosa Pine in the Black Hills, Colorado Front Range, and Southwest." September 2007.

USDA. "Wildland Fire in Ecosystems: Fire and Nonnative Invasive Plants." September 2008.

USDA. "Fuels Management – How to Measure Success: Conference Proceedings, 28-30 March 2006, Portland, OR." September 2006.



USDA (Elizabeth D. Reinhardt, Robert E. Keane, David E. Calkin, Jack D. Cohen). "Objectives and considerations for wildland fuel treatment in forested ecosystems of the interior western United States." September 2008.

USDA (Sarah M. McCaffrey and Christine S. Olsen). "Research Perspectives on the Public and Fire Management: A Synthesis of Current Social Science on Eight Essential Questions." February 2012.

USDA (Eric Toman, Melanie Stidham, Sarah McCaffrey, and Bruce Shindler). "Social Science at the Wildland Urban Interface: A Compendium of Research Results to Create Fire-Adapted Communities." July 2012.

USDA. "The Public and Wildland Fire Management: Social Science Findings for Managers." November 2006.

USDA (Ingrid M. Martin, Wade E. Martin, and Carol B. Raish). "A Qualitative and Quantitative Analysis of Risk Perception and Treatment Options as Related to Wildfires in the USDA FS Region 3 National Forests." September 2011.

USDA. "Fuel Treatments in Juniper and Oak-Juniper Woodlands throughout the Range of the Golden-Cheeked Warbler."

USDA (Eric M. White). "Woody Biomass for Bioenergy and Biofuels in the United States – A Briefing Paper." July 2010.

USDA, University of Florida, Interface South, NIST. "Quick Guide to Firewise Shrubs." September 2009.

University of Idaho Extension (Yvonne C. Barkley, Chris Schnepf, and Jack Cohen). "Protecting and Landscaping Homes in the Wildland/Urban Interface." September 2010.

USDA, University of Florida (Anna L. Behm, Alan J. Long, Martha C. Monroe, Cotton K. Randall, Wayne C. Zipperer, and L. Annie Hermansen-Baez). "Fire in the Wildland-Urban Interface: Preparing a Firewise Plant List for WUI Residents."

USDA, University of Florida (Cotton K. Randall, L. Annie Hermansen-Baez, and Glenn Acomb). "Fire in the Wildland-Urban Interface: Reducing Wildfire Risk While Achieving Other Landscaping Goals."

USDA, University of Florida (J. Douglas Doran, Cotton K. Randall, and Alan J. Long). "Fire in the Wildland-Urban Interface: Selecting and Maintaining Firewise Plants for Landscaping."

University of Nevada Cooperative Extension (Lake Tahoe Basin, Second Edition). "Living With Fire: A Guide for the Homeowner." May 2008.

USDA, University of Florida, Institute of Food and Agricultural Sciences, Interface South. "Selecting Firewise Shrubs to Reduce Wildfire Risk." May 2011.

USDA (Gavriil Xanthopoulos, David Caballero, Miguel Galante, Daniel Alexandrian, Eric Rigolot, and Raffaella Marzano). "Forest Fuels Management in Europe." March 2006.

USDA (Katharine R. Stone, David S. Pilliod, Kathleen A. Dwire, Charles C. Rhoades, Sherry P. Wollrab, Michael K. Young). "Fuel Reduction Management Practices in Riparian Areas of the Western USA." May 2010.

USDA (Andre Arsenault). "Managing Coarse Woody Debris in British Columbia's Forests: A Cultural Shift for Professional Foresters." 2002.

California Department of Forestry and Fire Protection, State Board of Forestry and Fire Protection. "General Guidelines for Creating Defensible Space." February 2006.

"Firewise Plant List – Texas."

Elsevier (Jian Yao, Darrel B. Murray, Arjun Adhikari, Joseph D. White). "Fire in a sub-humid woodland: The balance of carbon sequestration and habitat conservation." May 2012.

Elsevier (Kathleen A. Dwire, J. Boone Kauffman). "Fire and riparian ecosystems in landscapes of the western USA." 2003.

Wildfire Magazine. "Tongue-Tied." July/August 2004.

Oregon State University, Department of Forest Ecosystems and Society (Bruce Shindler, Ryan Gordon, Sarah McCaffrey, Eric Toman). "Collaboration for Healthy Forests and Communities: A Guide for Building Partnerships Among Diverse Interests." October 2011.

Center for Invasive Plant Management. "After the Fire: Restore and Protect our Western Ecosystems." April 2001.

University of California, Division of Agriculture and Natural Resources (Claralynn Nunamaker, Michael De Lasaux, Gary Nakamura). "Wildfire and Fuel Management." 2007.