

USGBC CA
U.S. GREEN BUILDING COUNCIL CALIFORNIA

Wildfire Defense Home Hardening & Defensible Space Toolkit

A toolkit compiles wildfire defense resources from experts like CalFire, FEMA, and NFPA.

INTRODUCTION

Climate change means year-round fires in California, requiring building industry involvement. USGBC-CA has been dedicated to empowering building professionals to prevent wildfire losses.

This toolkit compiles essential wildfire defense resources from experienced professionals, developed by the California Department of Forestry and Fire Protection (CalFire) Ready, Set, Go!, and resources made available by the Federal Emergency Management Agency (FEMA), National Fire Protection Association (NFPA), and others. Contact your local fire and building department for specific requirements or recommendations for your community or feel free to contact us at info@usgbc-ca.org for more information or guidance..

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UNDERSTANDING WILDFIRE

Wildfire advances in 3 ways:

Flying embers
Can destroy homes miles away. Can get into interior of home. Cause 90% of home burnings

Direct flames
A wildfire front can overtake a home.

Radiant heat
High heat from fire can ignite combustible materials. Can melt windows.

What ignites it:

- Dry fine kindling
- Fuels
- Outdoor cushions
- Furniture
- Tools
- Toys
- Wooden structures (fences, decks)
- Dead plants

Myths & Facts

| | |
|---------------------------------------|--|
| Losses are inevitable. | There is much we can do to improve wildfire safety. |
| Wildfire is natural and unpredictable | Our building choices increase or decrease wildfire. |
| Fire "walks" up to homes. | Fire flies, bounces and rolls in the form of embers. |
| Foliage endangers homes. | Embers attack homes, foliage can defend them. |
| Fire-defensive building is onerous. | Simple, inexpensive strategies can go a long way. |

What is WUI?

The US Forest Service defines the wildland-urban interface qualitatively as a place where "humans and their development meet or intermix with wildland fuel." representing an transition zone at risk of wildfires, though not a designation of wildfire severity.

Learn More



The Costs of Wildfire in California: An Independent Review of Scientific and Technical Information



"What Are Fire Hazard Severity Zones?" by Cal Fire



"READY, SET, GO": Measures that the Building Professionals (and Homeowners) Can Take



Source: Radeloff, U.C. et al. "The Wildland-Urban Interface in the United States," *Ecological Applications* 15, 2005.

HOME HARDENING STRATEGIES

What is home Hardening?

Home hardening refers to the process of making a home more resistant to wildfires by using fire-resistant building materials and implementing structural modifications that reduce the ignition risk.

Examples of the strategies?

- Effective positioning on the site
- Creating an impermeable envelope
- Building with fire-resistant materials



Fire testing conducted by UL has found **a home with mostly synthetic-based furnishings** can be entirely engulfed in **less than 4 minutes**.



— How a House Fire Spreads

Based on the Wildfire Home Retrofit Guide:

DURING A WILDFIRE, homes can be threatened by

- 1) Wind-blown embers
- 2) Radiant heat
- 3) Direct flame contact.

Embers cause 60–90% of wildfire losses by igniting materials inside and around homes. Most homes ignite by **wind-blown embers in vents** or ignite nearby vegetation and combustible materials. **Proper home hardening, material selection, and vegetation management** can significantly reduce wildfire risks.

What are some examples of actions from simple to low cost and complex to high cost?

| COST | NEW BUILDING | RETROFITS AND RENOVATIONS |
|---------------------|--|--|
| LOWEST COST | Home Ignition Zone Evaluation (sometimes provided for free by public entity) | |
| LOW COST | Using all native plants (water and fertilizer costs much lower than in other landscaping) | Use ember-resistant vent screens, cover gutters and chimneys with fire-resistant materials, and regularly clear brush and debris . |
| MEDIUM COST | Design a defensible space | Upgrade to multi-pane windows for fire resistance and energy savings, use non-combustible fencing and Class A fire-rated roof . |
| HIGH COST | Ensure proper road access to your home, build more if necessary | Use fire-resistant materials for siding, porches, and decks , and upgrade garages with a backup battery for the door. |
| HIGHEST COST | Use top fire-resistant materials and build to high safety standards. | Create defensible space with native plants and improve access roads . |

BUILDING FIRE RESISTANT STRUCTURE

ROOFS

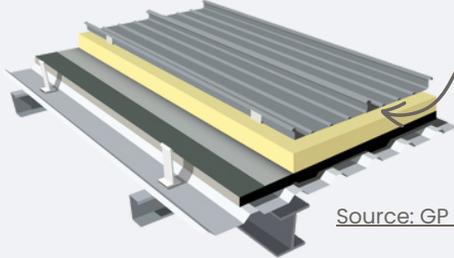
Roofs are vulnerable in wildfires, especially wood or shingle types. **Roof coverings are rated Class A, B, C, or unrated. Class A, offering the best protection,** includes asphalt fiberglass shingles, concrete, metal, clay, and tile.

CLASS A ROOFING
Materials include asphalt fiberglass shingles, clay and cement tiles (flat or barrel-shaped), and some metal roofing.

CLASS B ROOFING
Materials often include exterior-rated, fire-retardant-treated shake or shingle coverings (banned in many areas).

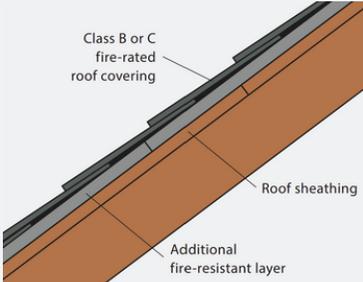
CLASS C ROOFING
Materials include recycled plastic, rubber and aluminum.

BEST PRACTICES



Layer metal roofs with noncombustible material, such as a mineral wool insulation product

Source: GP Densdeck



Source: Wild fire home retrofit guide

Class B and C materials can achieve a Class A rating "by assembly."



Remove vegetative debris from the roof and gutters.



Source: Bill Rogan roofing company

Install a corrosion-resistant, noncombustible metal drip edge for added protection.



Source: Wild fire home retrofit guide

Block any spaces between the roof decking and covering to prevent embers from catching.



Source: Ember defense

Screen roof and attic vents to prevent ember entry.

RAIN GUTTERS

Roofs can be vulnerable at the **roof edge** where a gutter is attached. Debris in the gutter can ignite from embers, and flames can ignite other components at the roof edge (e.g., wood-based sheathing and fascia board).

BEST PRACTICES

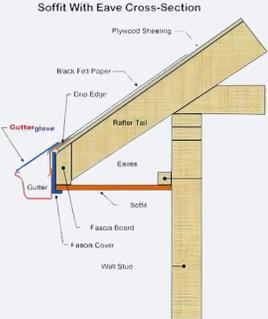


Install a noncombustible gutter cover on gutters to prevent the accumulation of leaves and debris.

Source: Wild fire home retrofit guide

BUILDING FIRE RESISTANT STRUCTURE

EAVES AND SOFFITS

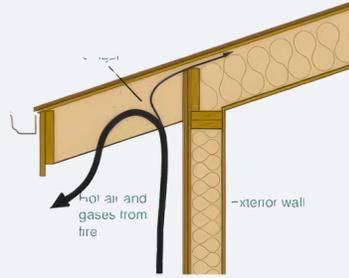


Source: Fire Safe Marin

What are Soffits?

A soffit is a finishing material, like fiber cement or wood, that covers the underside of a roof overhang. It protects the roof deck from heat, embers, and the elements. Vented or perforated soffits allow attic airflow.

BEST PRACTICES



Source: Fire Safe Marin



Source: UCANR Fire Network



Source: UCANR Fire Network

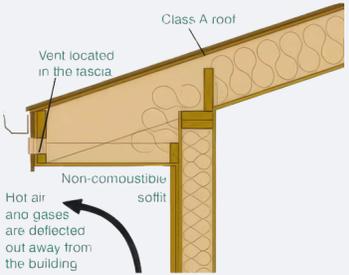
Eaves vulnerabilities

- 1 Embers and Radiant Heat
- 2 Combustible Materials

NOTE: Gaps or poor sealing in soffits can let embers in, increasing fire risk.

Open Eaves

Radiant heat, convective heat, and embers can get trapped behind overhangs and walls, igniting non-fire-resistant materials.



Source: Fire Safe Marin



Tip: Ensure Protective Measures for Closed Eaves

- 1 **Non-Combustible Material**
Metal/Cement
- 2 **Ventilation Screens**
Ember-resistant screens on soffit
- 3 **Regular Maintenance**
Inspect for any gaps or cracks

Closed Eaves

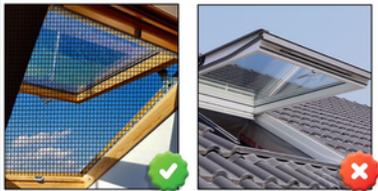
Non-flammable soffits deflect heat and gases, while vents ensure attic ventilation. In comparison to open eaves, closed eaves are more fire-resistant.

SKYLIGHTS

Skylights save energy but can be vulnerable in wildfires. **Their shape, materials, and maintenance affect protection.** Flat skylights on low-slope roofs collect more debris, increasing risk.

Tip: Choose glass skylights on sloped roofs to resist wildfire heat.

BEST PRACTICES



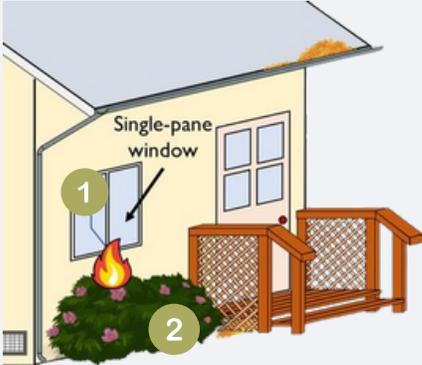
Source: CAL FIRE
Add 1/16-inch noncombustible corrosion resistant-metal mesh screening to block embers



Source: NFPA Factsheet
Glass type skylight - more vegetation debris accumulates on low slope roof
Dome-type skylight - Less vegetation debris accumulates on low slope roof

BUILDING FIRE RESISTANT STRUCTURE

WINDOWS



Source: UCANR Fire Network

Windows are vulnerable if frames burn or glass breaks, letting embers in. Single-paned and large windows are at higher risk.

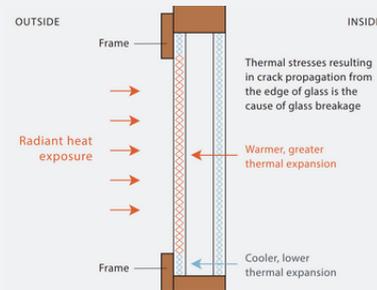
Window Vulnerabilities

- 1 Single pane windows
- 2 Windows along vegetation



Note: Even tempered dual-pane windows can't protect your home if left open. Always close windows before evacuating during a wildfire and install metal or plastic-clad fiberglass screens for better ember resistance.

BEST PRACTICES



Source: Wild fire home retrofit guide

- Dual-pane windows with tempered glass offer strong wildfire protection against flames and embers.
- They also improve energy efficiency and insulation year-round.
- Tempered glass is four times more fire-resistant, with the interior pane best tempered if only one is used.

EXAMPLES OF WINDOW FAILURES Source: UCANR Fire Network



Exposure duration: Radiant heat can break dual-pane windows and vinyl screens.

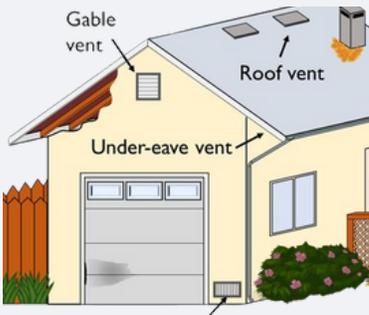


Exposure from surrounding: Radiant heat deformed the vinyl frame, but the glass remained intact.



Window cracks due to Exposure: A double-pane annealed glass window broke due to radiant heat.

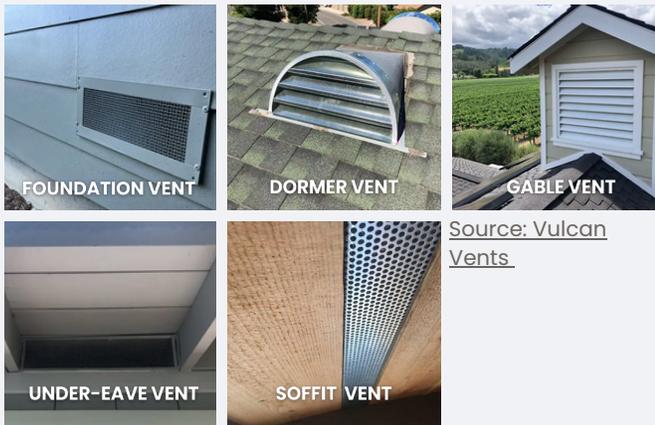
VENTS



Source: UCANR Fire Network

Vents can let in embers; ensure corrosion-resistant metal mesh covers them as required by building codes.

BEST PRACTICES



Source: Vulcan Vents

- **Cover vents with 1/16-inch to 1/8-inch metal mesh;** avoid fiberglass or plastic.
- **Use ember-resistant WUI vents** and keep away combustibles.
- Inspect vents regularly and **seal with metal tape if time allows before a wildfire.**

NOTE: Ember-resistant vents are addressed in **Chapter 7A** of the **California Building Code**.

BUILDING FIRE RESISTANT STRUCTURE

WALL AND OTHER SIDING MATERIALS



Source: UCANR Fire Network

Combustible siding like wood, composites, and vinyl can ignite in fire-prone areas, allowing flames to spread through studs, windows, vents, or attics. Fire risk comes from direct flames, radiant heat, or embers igniting nearby materials.

Siding vulnerabilities

- 1 Attached Fence
- 2 Vegetation along siding
- 3 Attached Deck

NOTE: It is **not recommended to use fire-retardant coatings**, such as fire-retardant paint, to provide fire protection for combustible siding.

BEST PRACTICES



Source: Fire Safe Marin



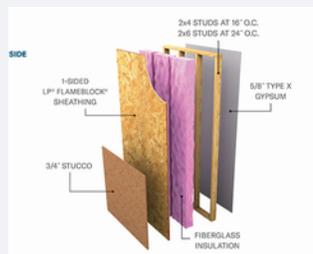
Remodel: Use **non-combustible siding** like stucco, brick, or fiber cement from foundation to roof.

Plain bevel lap joints allow flames to penetrate, while **shiplap** (left) or **tongue-and-groove** (right) joints offer better fire resistance.

Replace the **lowest foot** of siding with **brick, stone, or exposed concrete for fire resistance.**



Replace wood mulch within five feet of structures with dirt, stone, or gravel.



Source: LP Building Solutions

A one-hour wall design adds fire resistance when using vulnerable siding materials.

GARAGE



Garages store combustibles and risk wildfire entry. **Keep a fire extinguisher and basic tools** such as a shovel, rake, bucket, and hose ready.

BEST PRACTICES

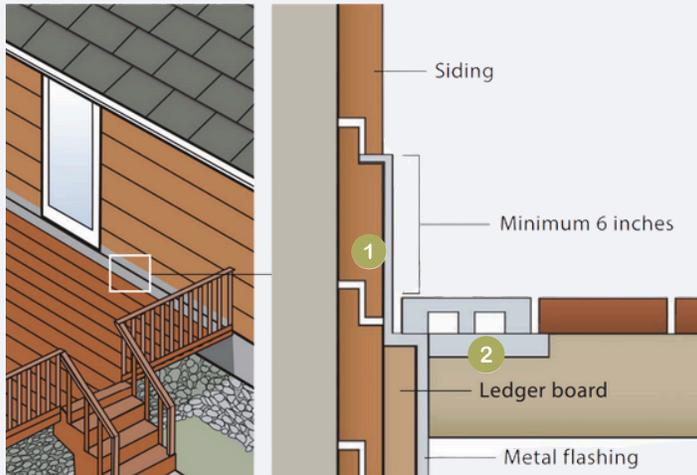
Source: UCANR Fire Network



Install a garage door battery backup, seal gaps, store flammables safely, and protect windows/vents like the house.

BUILDING FIRE RESISTANT STRUCTURE

DECKS AND PORCHES



Source: Wild fire home retrofit guide

A burning deck can ignite siding or windows, letting fire into the home. **Use fire-resistant materials, design wisely, and keep a noncombustible zone around and under the deck.**

BEST PRACTICES

- 1 **Install metal flashing** above and below the ledger board to protect combustible siding.
- 2 **Use noncombustible material** for the deck board nearest the house.

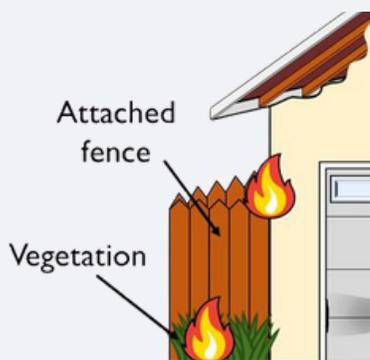


Source: UCANR Fire Network

Keep **areas under decks and porches** clear of flammable materials, dead vegetation, and debris.

- **Create a defensible space downslope** of overhanging decks.
- **Use metal joists** and fire-resistant materials for new decks.

FENCES



Source: UCANR Fire Network

Fencing vulnerabilities

To prevent fire spread, **separate combustible fences from the home** or use noncombustible material for the last 5 feet.

BEST PRACTICES



Source: UCANR Fire Network

Regularly clean the base of fences and **avoid** using them as **plant trellises** to prevent debris buildup.

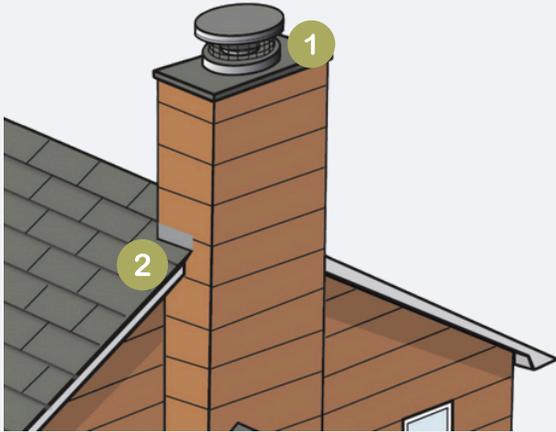
Replace the fence **within 5 feet of the home** with noncombustible material.

Vinyl lattice fences resist embers but can ignite from direct flames if debris accumulates at the base.

NOTE: Good neighbors (planks alternating) are more porous and difficult to ignite via ember exposure. But all fences are **more vulnerable when vegetative debris has accumulated at their base.**

BUILDING FIRE RESISTANT STRUCTURE

CHIMNEYS

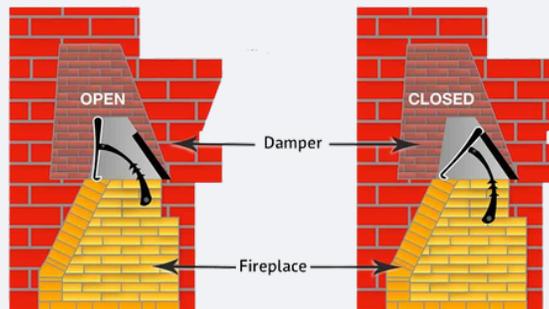


Source: Wild fire home retrofit guide

Chimneys and stovepipes are another entry point for fire embers in homes if not installed correctly and properly cleaned and maintained.

BEST PRACTICES

- 1 Cover your chimney and stovepipe outlets with a **non-flammable screen with openings no smaller than 3/8-inch and no larger than 1/2-inch** to prevent embers from escaping and igniting a fire.
- 2 **Using metal step flashing at roof-to-siding intersections** (flashing extending up the wall) can reduce the vulnerability to embers.



Close the fireplace flue during fire season when the chimney is not in use.

Source: Full service chimney

DRIVEWAY AND ACCESS ROADS BEST PRACTICES

- **Address Visibility:** Ensure your home's address is clearly marked and visible from the street for emergency responders.
- **Driveway Clearance:** Maintain at least 10 feet of vegetation clearance on both sides of driveways and access roads.
- **Emergency Access:** Gates should open inward, be wide enough for emergency vehicles, and have trimmed overhead branches.



WATER SUPPLY AND OUTDOOR SPRINKLERS BEST PRACTICES



Source: Fire Safe Marin

You can also **position sprinklers around the home** to cover all vulnerable areas and prevent ember ignition of nearby combustibles.

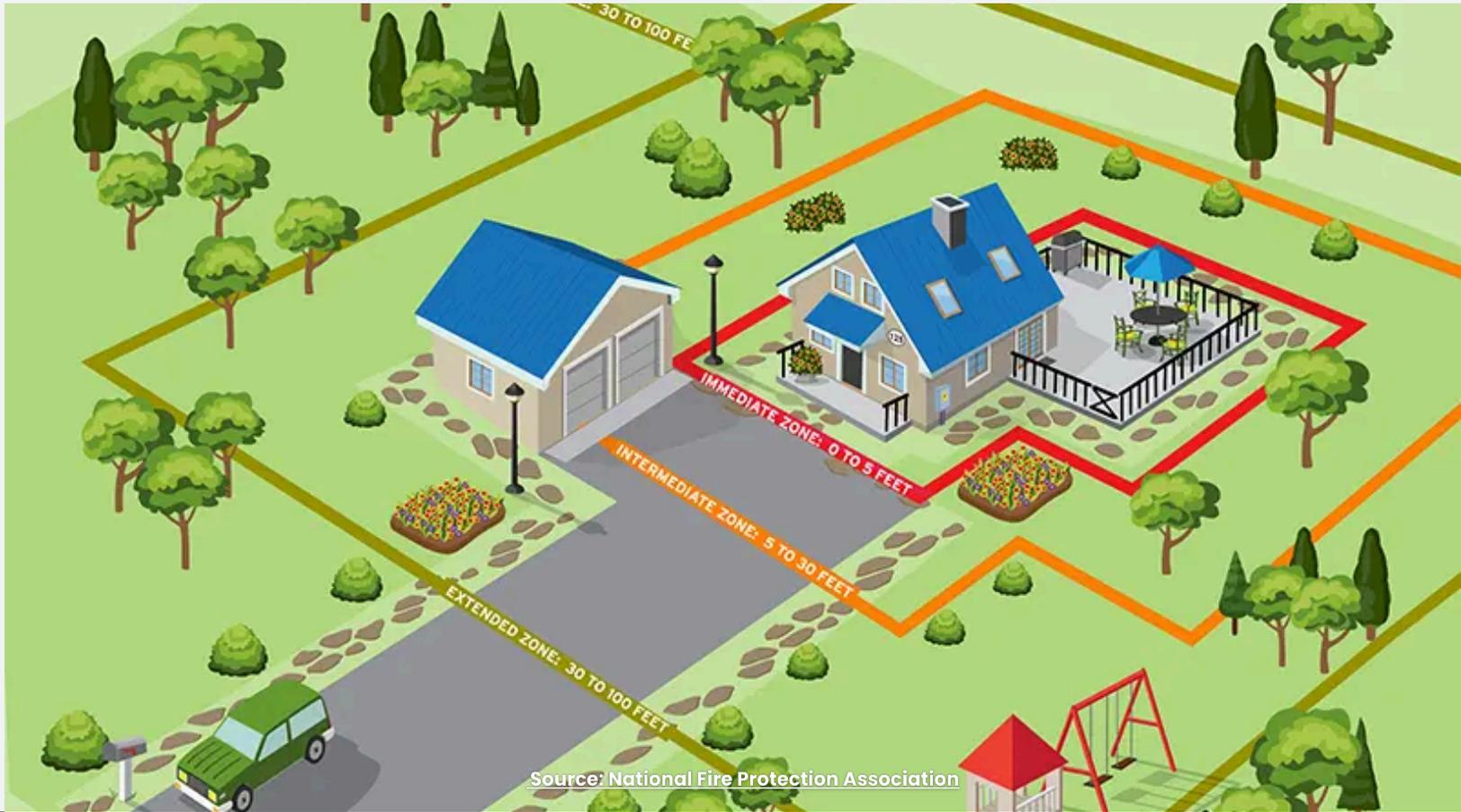
The **function of an exterior sprinkler system is to minimize the opportunity for ignition by wetting the home and surrounding property.** Sprinkler systems should be able to protect a home against the three basic wildfire exposures: wind-blown embers, radiant heat, and direct flame contact.

Tip: Consider having **multiple garden hoses** that are long enough to reach all areas of your home and other structures on your property. If you have a pool or well, consider a pump

DEFENSIBLE SPACE ZONES

Defensible Space is the first line of defense around your home. There are several zones of defensible space — each call for different strategies.

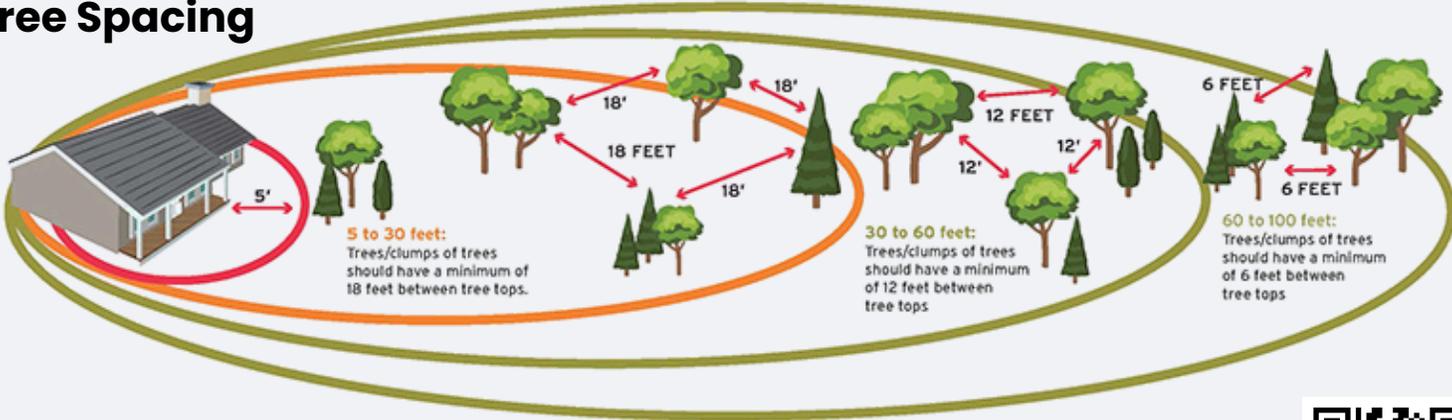
| ZONE 0 0–5 feet Ember Resistant | ZONE 1 5–30 feet Lean, Clean, & Green | ZONE 2 30–100 feet Reduce Fuel |
|---|---|--|
| <ul style="list-style-type: none"> Remove all dead and dying weeds, grass, plants, shrubs, trees, branches, and vegetative debris. Use hardscape like gravel, concrete, and other non-cumbustable mulch materials. Relocating garbage & recycling containers, vehicles, and other combustible items outside this zone. | <ul style="list-style-type: none"> Remove dead vegetation, leaves, and pine needles from your yard, roof, and gutters. Remove vegetation and items that could catch fire around and under decks and stairs, away from windows and chimneys, and remove branches that hang over your roof. Trim trees regularly to keep branches a minimum of 10 feet from other trees. | <ul style="list-style-type: none"> Remove fallen leaves, needles, and branches. Plant fire-resistant, low-volume vegetation that retains moisture. Mow grass down to a maximum of 4 inches. Create horizontal and vertical space between grass, shrubs, and trees. Distance detached structures by at least 50 feet (more if combustible materials are stored). |



DEFENSIBLE SPACE STRATEGIES

How you create defensible space around your home will vary depending on your home’s location, the landscape’s topography, proximity to other homes and foliage, etc. A good rule of thumb is to keep 5 to 10 feet of clear space around your structure(s) but be sure to check with your local department as you plan your defensible space.

Tree Spacing



Plant and tree spacing is applicable to all Zones. In general, remove all tree branches at least 6 feet off the ground. To see a formula to determine proper horizontal spacing, follow the QR code to go to the [CalFire website](#).



SITE SELECTION

What should planners consult when zoning?

| | | |
|---|--|---|
| Zone new development away from wildfire areas | Use up-to-date fire hazard maps to identify high-risk parcels. | Existing local wildfire studies and plans should be reviewed. |
| Minimize WUI Expansion | Homes in WUI areas need wildfire protection upgrades. | Strong home hardening and defensible space standards. |

Did you know?

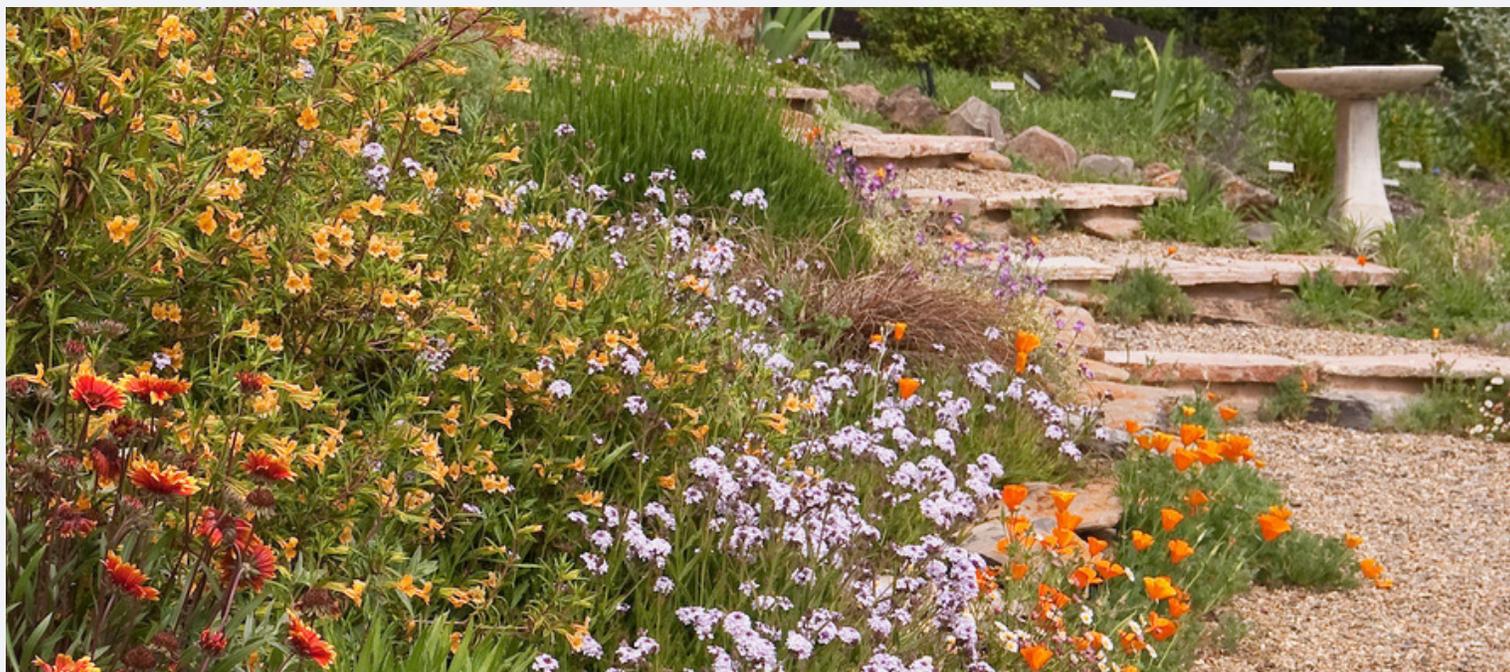
California law (AB 38) requires homeowners in high/very high fire hazard zones to document a Defensible Space Inspection before selling, obtainable via CalFire's website. CalFire's **FRAP program** determines these zones, mapped at the [Fire Hazard Severity Zones](#) site.

What should developers consider when purchasing land?

| | | | |
|--|---|--|--|
| Choose sites that reduce wildfire risk to protect property values & avoid project denial | Use fire hazard data (NFPA, CAL FIRE, USGS) to avoid areas with prior fire-related rejections | Existing land portfolios must follow strict wildfire design guidelines | Develop existing subdivisions or urban infill for lower risk and higher profit |
|--|---|--|--|

FIRE RESISTANT LANDSCAPE

Fire-resistant plants can be strategically planted and maintained to resist the spread of fire to the home. Moisture content, age, total volume, dead material, and chemical content are factors that influence how resistant a plant can be to ignition and spread of fire.



©Saxon Holt/PhotoBotanic; Sticky yellow monkey-flower (*Diplacus aurantiacus*) and other native and drought tolerant perennials.

There are many proactive strategies one can take to create a fire-resistant landscape:

- Create fire-resistant zones with stone walls, patios, decks, and roadways.
- Hydrate plants with a water-wise irrigation system. For example, using mostly drip irrigation will conserve water because it will deliver water right to the plants that need it and how much gets there.
- When planting trees, avoid conifers and plant less flammable hardwoods like maple, poplar, and cherry trees.
- Plant fire-resistant shrubs like (hedging roses, bush honeysuckles, and sumac) and select high-moisture plants that grow low to the ground and have a low sap or resin content.
- Prune plants to provide ample vertical and horizontal space throughout your garden and surrounding structures. This will help eliminate fire ladders (otherwise, a grass fire can move up into shrubs and then into trees).

While a landscaper should be consulted when planning for fire-resistance, in general, native California plants will be good options. A list can be found at the [Sustainable Defensible Space](#) website



EMERGENCY PREPAREDNESS AND EVACUATION

Wildfire Action Plan



Ensure your **fire extinguisher** has been recharged and replaced as needed



Locate the **home's gas, electric, and water shut-off controls** and understand how to shut them off in the event of an emergency



Assemble an **emergency supply kit** for each household member and keep an additional kit in the car



Buy a **portable radio or scanner** to stay updated on the fire



Have a list of **emergency contact numbers** near the phone



Sign up for alerts using the **FEMA app**

Emergency Supply Kit

Should be easily accessible and light enough to carry.

- Face masks
- 3-day supply of non-perishable food
- 3 gallons of water per person
- Map with evacuation routes
- Prescriptions or medication
- Change of clothing
- Extra eyeglasses or contact lenses
- Car keys, credit cards, cash or traveler's checks
- First aid kit
- Flashlight
- Battery-powered radio and extra batteries
- Sanitation supplies
- Copies of important documents, including birth certificates and passports
- Cell phone charging device
- Pet food and water (as needed)



Source: UC Berkely, Office of Emergency Management

Evacuation Plan

- A designated meeting location outside the fire hazard area
- Multiple escape routes from the house and surrounding area
- Evacuation plan for pets and livestock
- An out-of-state point of contact that household members can call if they are separated

Cover up against heat and embers by wearing long-sleeved shirts, long pants, a hat, goggles/glasses, and a bandana to cover the face.

Did you know?

A personalized preparedness plan can be created using the **CalFire app firePLANNER**

GLOSSARY

- **CERT:** A Community Emergency Response Team (CERT) helps educate residents about hazards in their community and executes education and action pertaining to wildfire preparedness, evacuation processes, search and rescue, and disaster medical operations.
- **Class A (Etc) Materials:** Class A materials are those verified to better withstand fire. Commonly used for roofing. Includes metal, concrete, clay tiles, and slate.
- **Ember/Ember Cast:** An ember is a small, glowing piece of coal or wood. Can exist within, cause, or follow a fire. An ember cast refers to embers falling from the sky, caused by flames nearby or even miles away. An ember cast can quickly ignite a new fire. It is best to evacuate immediately where there is an ember cast.
- **Envelope:** The entire barrier separating interior from exterior of a building. Includes walls, windows, roof, foundation, and doors.
- **Fire Defensive:** Refers to action that reduces a structure or community's susceptibility to wildfire, such as implementing home hardening and defensible space strategies.
- **Fire Smart:** Fire Smart is using design and construction processes as the first step for combatting fire.
- **Fire Resilient, Fireproof:** Fire resilient and fireproof both mean that something has a better ability to withstand fire compared to other items of its kind (plant, house, material, etc;). Although fireproof may at times imply more fire resistance than the term fire resilient, it is important to note that nothing is entirely able to withstand fire.
- **Firewise:** Firewise refers to a NPFA initiative for teaching people how to adapt to living with wildfire, particularly by building strong communities and equipping them with proper educational resources.
- **Hardened:** A house or structure made of the most fire resistant materials available. A hardened structure contains a defensible space and is correctly oriented on the site for best resistance to fire.
- **Home Hardening:** Using site-selection, structure orientation, retrofitting, and construction materials and practices that can help a home resist ember storms and high heat.
- **Invasive Plant:** A non-native species introduced by humans to a habitat. Tend to wreak havoc on ecosystems and can worsen the effect of phenomena like wildfires or fire regimes.
- **Native Plant:** A plant that existed in a region and habitat prior to human introduction. Generally better adapted to their ecosystems than invasive species.
- **Prescribed fire and cultural burning:** Also called a "controlled burn," prescribed fires were used by indigenous tribes throughout the Western United States to keep vegetation levels and wildfire magnitudes in check. Fire plays an important role in many ecosystems, with some even having frequent fire regimes. Prescribed burns are now implemented by the US Park Service as a way to use smaller and more easily managed fires as a means for preventing larger and more destructive fires caused by over accumulated debris.
- **Regime:** The patterns of fire occurrences expressed in frequency, size, and severity in a given area or ecosystem. Fire regimes are cycles estimated from past fire occurrences.
- **WUI:** The Wildland Urban Interface (WUI) is a term used by the National Park Service to label any area where human settlement borders vegetation with little clearance.

ACKNOWLEDGEMENTS



FEMA



CPA CLEAN POWER ALLIANCE