



# **MEGA FIRES: The Case for Mitigation**

**RETROFIT GUIDE**



## GETTING READY

The Institute for Business & Home Safety (IBHS) has conducted multi-faceted research to determine what may have caused various types of homes to be damaged or destroyed by wildfires in Southern California in late 2007. The results of that research were used to develop the following important information to help individuals and families protect their homes against wildfires.

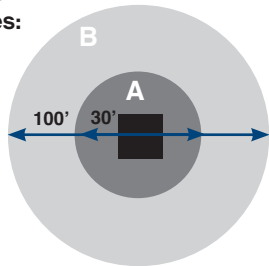
There are three clear areas of vulnerability: landscaping, surroundings and the home itself. Each of these areas can be dealt with through maintenance and structural improvements. Most of these projects are affordable and can be done in a weekend. Some of the projects have an additional financial benefit: they can help improve the energy efficiency of your home.

### DEFENSIBLE SPACE: IT'S THE LAW

Since 2006, most Californians have been required by law to create 100 feet of "defensible space" around their properties. The goal is simple: to reduce the amount of potential fuel that can bring a wildfire dangerously close to your home. Defensible space also creates a safer area for firefighters to defend your home.

#### This 100-foot buffer is divided into two zones:

The first zone (A) extends 30 feet (or to the property line) from your home and requires the most thinning and separation of plants, trees and other vegetation. Once established, careful maintenance is needed to keep the area clear of undergrowth over time.



The second zone (B) extends from 30 feet to 100 feet (or to the property line). Trees, plants and other vegetation here should be maintained and dead plant materials or weak tree branches should be removed. If not, the vegetation will become a fuel source providing a wildfire a direct path to your home.

## THREE STEPS EVERY HOMEOWNER SHOULD TAKE

### MAINTAINING YOUR LANDSCAPE

# 1

#### PLANTS

**WHAT YOU SHOULD KNOW:** Close to the house, plants can become a major fire hazard. Plants against combustible siding, as well as plants under or next to windows or the inside corners of a house present the greatest hazard. Embers from a wildfire can become trapped in corners, igniting nearby plants and exposing siding and roof overhang to flames.

**WHAT YOU SHOULD DO:** Remove dead vegetation close to the house, paying attention to material on and underneath plants. Mulch can



### Figures 1-2

1. If ignited, flames from this burning bush would impinge on the single pane glass window, and the nearby eave vent.
2. Interior corners are more vulnerable because of the proximity of the corners. If ignited, flames will more rapidly spread up the walls.



help keep the ground moist and reduce the need for watering, but it also can become a fire hazard. Avoid using combustible materials for mulch, particularly small pieces of bark. Consider 1/2 inch “rock” mulch or other non-combustible materials. Prune or use only small plants around siding, windows and at inside corners.

## GUTTERS

**WHAT YOU SHOULD KNOW:** Wind-blown vegetative debris and overhanging trees can lead to accumulation of leaves and needles on your roof. Once dry, this debris becomes quick-starting fuel for a wildfire. Gutters and other roof-to-wall intersections are particularly vulnerable to wind-blown embers. Even if you have a Class A fire-resistant roof covering, such as tile or concrete, the edges and underside of the roof and exterior siding can become exposed to flames.



### WHAT YOU SHOULD DO:

Prune tree branches that overhang the roof and remove any dead vegetation, including branches, within your defensible space. 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 as needed. Inspect these areas at least twice a year, preferably when seasons change. Remove accumulated leaves, pine needles and any other combustible debris.

Covering your gutters with screens can minimize the build-up of debris. Remember that even gutters with screens should be inspected to make sure covers are still in place and performing properly.



## ASSESSING YOUR HOME'S SURROUNDINGS 2

By taking stock of what is in your yard, and looking beyond the plants and trees, you can reduce the risk of otherwise harmless items becoming fuel for a wildfire. This is the second and often overlooked step toward better wildfire protection.

### YARD STRUCTURES

**WHAT YOU SHOULD KNOW:** Trellises, playground equipment, gazebos and other structures located close to your home can increase vulnerability to wildfire. Wind-blown embers can accumulate in or on such structures and start a fire. Depending on how close the items are to vegetation, they might be ignited by direct contact with flames. Trellises are especially susceptible, since they are often made of lightweight wood, covered with vegetation, and attached to, or close to, the house.

**WHAT YOU SHOULD DO:** Consider removing trellises, unless they are made of exterior-rated, fire retardant wood, heavy timbers or some other type of noncombustible materials. Keep all yard structures free of accumulated debris. Any structures, such as a child's play set, that are built from combustible materials should be relocated at least 30 feet away from the house.

### Figures 3-6

3. A number of gutter cover devices are available that can help minimize debris accumulation in gutters.

4. Some of the screen-type gutter covers can become detached. Using a wire to tie the wire mesh to the gutter can help it stay in place.

5. This device helps keep the downspout open, but as you can see, periodic cleaning may still be required.

Figure 6 (above). Extensive needle accumulation has occurred in this metal gutter. If ignited by embers, the fire exposure would impinge on the roof sheathing at the edge of the roof, not the roof covering.



**Figure 7**

This is an example of a 'complex' roof. If ignited, the debris that has accumulated would provide a flaming exposure on the siding and underside of the roof sheathing.

## OUTBUILDINGS

**WHAT YOU SHOULD KNOW:** All buildings on the property face the same types of risks as the home when it comes to wildfire. Once ignited, these buildings can bring flames closer to the house and may cause it to ignite.

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

## FIREWOOD, LEFTOVER MATERIALS AND DRY MULCH

**WHAT YOU SHOULD KNOW:** It may seem obvious, but firewood, plywood remnants or dry mulch located too close to a home can be factors in spreading wildfires.

**WHAT YOU SHOULD DO:** Move firewood, dry mulch, leftover building materials and items such as wheelbarrows containing these materials as far away from your house as possible.

## IMPROVING YOUR HOME'S FIRE RESISTANCE

3

You probably already have a running list of home improvement projects large and small. As your third and final step, add these structural projects to that list because they can 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. IBHS research shows combustible roof coverings are the greatest threat to a house in wildfire conditions. Roof shape also plays a role. Take a careful look at your roof. If you have a lot of ridges and valleys that intersect with the walls of the house, you have a complex roof. Debris readily accumulates in these areas. Burning embers can, too. So, keep your roof clean of debris.

**WHAT YOU SHOULD DO:** 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 replace your roof, choose a Class A rated roof covering (your building code may require this upgrade anyway) and completely remove the old covering.



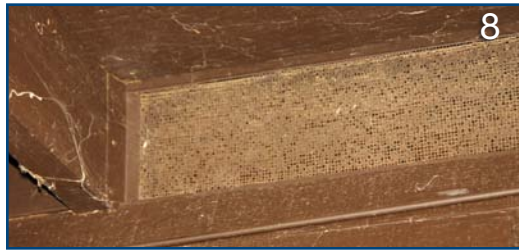
**Here are some things to keep in mind when choosing a Class A roof covering:**

- Many roof coverings have a Class A rating based only on the top/external part of the roof that you can see. Some examples include asphalt composition shingles, steel roofs, and clay or concrete tiles.
- Other roof coverings obtain their Class A rating because additional materials that enhance fire resistance are used in the roof assembly, underneath the part of the roof that you can see. These coverings are considered Class A by assembly. Examples include wood shakes treated with an exterior fire retardant chemical, aluminum, and some newer composite roofs made from recycled plastic materials.

## EAVES, SOFFITS AND OTHER ATTIC OPENINGS

**WHAT YOU SHOULD KNOW:** IBHS researchers have learned from post-fire surveys of buildings damaged and destroyed by wildfires that attic/roof vents are vulnerable entry points for embers and flames. Among the most vulnerable are vents in the eave and soffit areas, but there are also risks associated with the most common type of eave, known as open 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 edge of your roof. There are gaps where the blocking and rafter tails intersect; as a result, wind-blown embers can become lodged here and ignite the house.

**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 a 1/4 inch metal mesh screen, or better yet, 1/8 inch metal mesh screens. 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.



**Figures 8-10**

8. Finer mesh screen, such as the 1/8" screen shown here, will provide more protection against the entry of burning embers, but it is also easier for finer mesh screens to become plugged with debris, thereby reducing air flow into the enclosed space.

9. This is an example of open eave construction. Note the gaps between the blocking and horizontal members in the joist bays between the blocking that has the vent holes.

10. This is an example of an enclosed, or 'boxed-in' eave. This one also has a strip vent.

Screens offer a minimum level of protection from wildfire embers, but there is evidence of embers occasionally passing through screening during large fires. Newer vent styles that have recently been designed appear to offer better protection. These are in the testing phase and should become available to the public in the coming months.

If you have open eaves, you can create a box to help keep embers from lodging there. To do this, fasten sheathing made from a non-combustible or fire-resistant material to the underside of the rafter tails. This will create an enclosure that follows the slope of the roof. This can also be accomplished by extending the material from the roof edge horizontally to the exterior wall.



## TILE ROOF

### WHAT YOU SHOULD KNOW:

Some roofing materials have a gap at the edge of the roof. The most common example is a clay barrel tile roof covering, but it's also a problem with some standing-seam metal roofs. The gap can allow birds and other rodents to get into the opening and build nests which 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 materials.

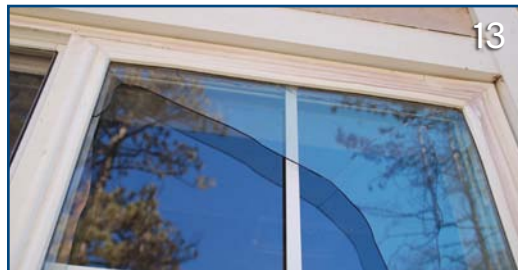
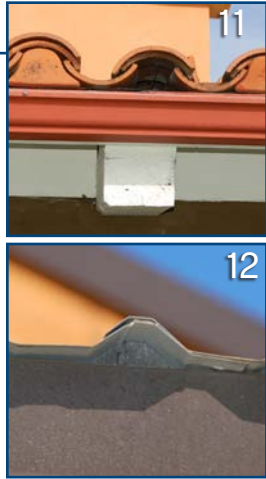
**WHAT YOU SHOULD DO:** Use a form of protection called "bird stopping" to seal the open edges of the roof covering. Bird stops are a manufactured shield that can be purchased from roofing supply stores and are typically provided by the manufacturer of the roof covering. The bird stop can be inserted into the opening. You can also use mortar mix to plug the ends. Remember, the idea is to keep fuel sources and embers out from under the edge of the roof.

## WINDOWS AND DOORS

**WHAT YOU SHOULD KNOW:** The doors and windows of your home 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 house. 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 if they are left open. So, close all windows before you leave the house.

The California Building Code now requires that all new buildings in wildfire-prone areas be built with dual-pane windows with at least one pane of tempered glass. Prior building codes have already required tempered glass be used in exterior doors and windows within 18 inches of the floor. The new code extends the tempered glass requirement to the other windows in the home. The new codes also require that exterior doors be made of noncombustible construction or that solid wood doors be at least 1 3/8-inch thick.



### Figures 11-12

11. In this case, a bird stop piece is missing. If you have bird stops, inspect them regularly to make sure they are all still in place and functional.

12. Smaller gaps can occur in standing seam metal roofs. As shown here, material is also available to plug the ends of these roof coverings.

### Figure 13-14

13. The outer pane of this dual pane window broke during a 2007 wildfire in Southern California. In this case, the dual pane window was one reason why this home survived.

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

**WHAT YOU SHOULD DO:** Determine what kind of windows are in your home. Single-pane windows are more common in older homes, while dual-pane windows are more frequently found in newer construction. Dual-pane windows have two sheets of glass that are separated by an airspace. To find out if your dual-pane windows contain tempered glass, look for an etching ("bug") in the corner that proves it is tempered.

You should replace your single-pane windows with dual-pane windows that have at least one



pane of tempered glass. 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 you on two fronts: fire-resistance and energy efficiency.

If you cannot afford to replace your windows, provided that you have controlled the fuels close to your house, including vegetation, mulch and yard structures, a less expensive alternative is to create 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 windblown embers.

## DECKS

**WHAT YOU SHOULD KNOW:** Decks are important because of where they typically are located – attached to the house, next to windows, sliding glass doors and possibly combustible siding. When thinking about your deck consider its construction material and the types of items that are on top and beneath the decking. You also need to consider the defensible space leading up to the deck, which can act as a wick and move the fire through the vegetation and ignite the decking materials.

Decking material used in wildfire-prone areas in California now must meet minimum fire performance requirements. Using these materials is recommended regardless of whether codes dictate it. The California Office of the State Fire Marshal publishes the *Wildland Urban Interface Product Handbook*, which lists products that have been reviewed and verified by the state for their compliance with the new 2007 California Building Code. Some of the materials reviewed include exterior siding, windows and deck materials. This document is available online and is regularly updated. Download a free copy at <http://osfm.fire.ca.gov/strucfireengineer/pdf/bml/wuiproducts.pdf>



**WHAT YOU SHOULD DO:** Enclosing your deck can help reduce the risk of damage from wildfire. Decks can be enclosed vertically by applying an exterior siding product around the deck's edge, or horizontally by applying an exterior panelized product to the bottom of the deck support joists. Wire screening can also be used.

To determine if enclosing your deck is necessary, consider whether you store combustible materials under your deck, or if your defensible space is inadequate, particularly in the 0 to 30-foot zone. If you can avoid storing combustible materials under your deck, and if you maintain your defensible space, enclosure will not significantly increase your wildfire protection.

If you choose to enclose your deck, make sure you provide sufficient ventilation or other means for water to drain out. A minimum of one square foot of venting for 150 square feet of deck area is recommended for proper drainage. If you do not allow for the deck's structural support members and deck boards to dry out, fungal decay will become your deck's biggest threat.

**Figure 15-17**

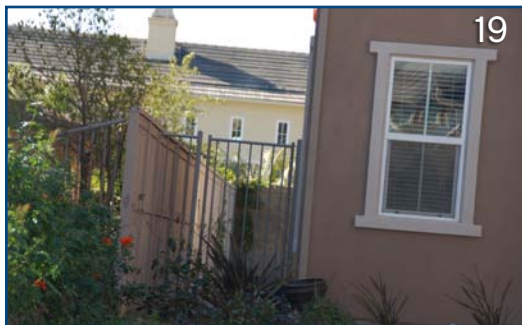
15. The chain link fence enclosure surrounding this deck did not prevent debris from accumulating. It was also high enough off the ground to store things underneath. It was close enough to the ground to make it inconvenient to clean out the debris.

16. A close up photo of Figure 15. The fence probably helped keep rodents and animals out of the open crawl space.

17. This photograph shows two small decks made with two different wood-plastic composite decking products. The one on the left complies with the performance requirements of the California Wildland Urban Interface building code (Chapter 7A). The one on the right does not.



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## Figures 18-19

18. This is an example of a wood frame fence with a noncombustible (wire mesh) infill. Such a design makes it much more difficult for fencing to act as a wick in bringing fire to your home.

19. In this case, a metal gate provides the connection between a wood fence and home.

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

## TOPOGRAPHY

**WHAT YOU SHOULD KNOW:** The topography of the land around your home, which includes the slope of the land and the direction the house faces, is a major consideration in assessing your home's 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. Higher wind speeds would have the same effect.

**WHAT YOU SHOULD DO:** If your home 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 home, IBHS recommends taking additional precautions. These include being more aggressive in creating defensible space and more aware of the materials used to build the house, deck or any outbuildings. Also pay closer attention to any yard structures that could act as wicks and lead the fire directly to the house.

Consider improving your home's protection by constructing a noncombustible retaining wall to help increase the set back. When making future home improvements incorporate fire-resistant features and materials into the home and surrounding landscape.

## CHIMNEYS

**WHAT YOU SHOULD KNOW:** Spark arrestors for your chimney are required to prevent embers in your fireplace from starting wildfires. 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.

**WHAT YOU SHOULD DO:** Install a spark arrestor that has 1/2 inch mesh. These are available at large hardware stores or fireplace specialty stores.

Enclosing your deck will not reduce the risk of the top being exposed to embers. For that, the best protection is to keep the deck clear of leaves, pine needles and other vegetative debris.

## FENCES

**WHAT YOU SHOULD KNOW:** Fences can be a wildfire hazard, particularly if they connect directly to the house. 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 house.

**WHAT YOU SHOULD DO:** New fences should be entirely constructed of noncombustible or 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 house should be retrofitted so the fence ends with a noncombustible material like masonry or heavy timber to keep fire from spreading to the house. 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.

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