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MITIGATION DIRECTORATE

Rebuilding After a Wildfire

Returning to your fire-damaged home will undoubtedly be an emotional experience. But as you go about the task of rebuilding, there are many ways to rebuild safer, stronger, smarter, and more resilient to wildfires. The Federal Emergency Management Agency (FEMA) has teamed with Firewise Communities, the Federal Alliance for Safe Housing, and the Institute for Business and Home Safety to provide this resource for rebuilding after a fire.

JUST THE RIGHT CONDITIONS

Conditions must be just right for a wildfire to start and spread. Specifically, fuel, weather, and topography work together to determine how quickly a wildfire travels and at what intensity.

- **Fuels:** The two basic fuel types in the wildland/urban interface are vegetation and structures.
- **Vegetation:** Fuel in its natural form consists of living and dead trees, bushes, and grasses. Typically, grasses burn more quickly and with less intensity than trees. Any branches or shrubs between 18 inches and 6 feet are considered to be ladder fuels. Ladder fuels help convert a ground fire to a crown fire (tree tops), which moves much more quickly. Check with your local cooperative extension service to get a list of local plants that are less flammable.
- **Structural Density:** The closer the homes are together, the easier it is for the flames to spread from one structure to another.
- **Weather:** High temperatures, low humidity, and swift winds increase the probability of ignitions and difficulty of control. Short- and long-term droughts further exacerbate the problem.
- **Slope:** Slope is the upward or downward incline or slant of terrain. For example, a completely flat plain represents a 0 percent slope and a hillside that rises 30 feet for every 100 feet horizontal distance represents a 30 percent slope. Hot gases rise in front of the fire

along the slope face, pre-heating the up-slope vegetation, moving a grass fire up to four times faster with flames twice as high as a fire on level ground.

HOW A HOME CATCHES FIRE

There are three ways that the wildfire can transfer itself from the natural vegetation or other burning homes – through radiation, convection, or firebrands.

- **Radiation:** Wildfires can spread by radiating heat in the same way a radiator heats rooms in the wintertime. Radiated heat is capable of igniting combustible materials from distances of 100 feet or more.
- **Convection:** Contact with the convection column (flames) may also cause the wildfire to ignite homes and other buildings. Typically, the convective heat column rises vertically, within the smoke plume.
- **Firebrands:** Firebrands are burning materials that are blown by fire-generated winds. Firebrands can be carried long distances – more than a mile.

In all cases, your home's building materials and design play a significant role in establishing the level of exposure that can be endured before ignition from radiation, convection, firebrands, or any combination of these three.



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CREATING A SURVIVABLE SPACE FOR YOUR HOME

A survivable space is an area of reduced fuels between your home and the untouched wildland. This provides enough distance between the home and a wildfire to ensure that the home can survive without extensive effort from either you or the fire department. The space also allows the fire department more time to fight the fire before it reaches your home. One of the easiest ways to establish a survivable space is to use the zone concept. Zone 1 is the closest to your home and Zones 2 and 3 move progressively farther away.

- **Zone 1:** Establish a well-irrigated area around your home. It should extend a minimum of 30 feet from your home on all sides. But as much as 50 to 100 feet may be necessary, depending on your risk, especially on any downhill sides of the lot.
- **Zone 2:** Place low-growing plants, shrubs, and carefully spaced trees in this area. Maintain a reduced amount of vegetation. Your irrigation system should also extend into this area. Trees should be at least 10 feet apart, and all dead or dying limbs should be trimmed. For trees taller than 18 feet, prune lower branches within 6 feet of the ground. No tree limbs should come within 10 feet of your home.
- **Zone 3:** This farthest zone from your home is a slightly modified natural area. Thin selected trees and remove highly flammable vegetation such as dead or dying trees and shrubs.

THE IMPORTANCE OF MAINTENANCE

Once you have created your home's survivable space, you must maintain it or risk losing the benefit of its protection. Treating and maintaining a survivable space is a necessary first step. The next step is to use fire-resistant building materials and construction techniques in retrofitting your home.

THE IDEAL FIRE-RESISTANT HOME

Keep in mind that a wildfire sees your home as just another fuel source. The survivable space you construct around your home will keep all but the most ferocious wildfires at bay. However, if the wildfire does break through your first line of defense, an ignition might occur on your home's exterior. The ideal situation is for your home's exterior materials to prevent or retard the flames from burning into your interior walls, soffits, attic area, and rooms.

IN A NUTSHELL:

Consider using materials such as Class-A asphalt shingles, slate or clay tile, metal or cement, and concrete products for roof construction.

Construct a fire-resistant sub-roof for added protection.

Use fire-resistant materials such as stucco or masonry for exterior walls. These products are much better than vinyl, which can soften and melt.

Consider both size and materials for windows; smaller panes hold up better in their frames than larger ones; double pane glass and tempered glass are more effective than single pane glass; plastic skylights can melt.

Prevent sparks from entering your home through vents by covering exterior attic and underfloor vents with wire mesh no larger than 1/8 of an inch.

Keep your gutters, eaves, and roof clear of leaves and other debris.

Clear dead wood and dense vegetation within at least 30 feet from your house, and move firewood away from your home, fences, or decks.

- **Roof:** The roof is the most vulnerable part of your home to wildfires. During a wildfire, firebrands (e.g., pieces of burning wood) can fall on your roof, landing in your roof's nooks and crannies where a fire can easily start. Once your roof covering ignites, chances are good that the rest of your home will follow. The best way to avoid this situation is to make sure your roof is fire-resistant. The two main fire-resistance tests used today include: ASTM E108 and UL 790. There are three levels of classification awarded under the test protocol A, B, and C, with A being the most fire-resistant. Some treated wood shake shingle products have ratings of Class C or better. However, over time, the effectiveness of this chemical is reduced by weathering before the end of the product's useful life and may leave your roof unprotected. If your roof needs to be re-covered, consider installing a Class A roof covering.
- **Exterior Walls:** Exterior walls are susceptible to a wildfire's radiant and convective heat. A fire on an exterior wall can 'bridge' to more vulnerable areas such as eaves, soffits, vents, and windows. Wall materials that resist heat and flames include cement,

plaster, stucco, and concrete masonry such as stone, brick, or block. Though some materials will not burn, such as vinyl, they may lose their integrity when exposed to high temperatures and fall away or melt, providing the fire with a direct path inside the home.

- **Exterior Windows, Glass Doors, and Skylights:** Exposure to the heat of the wildfire can cause glass to fracture and fall out, leaving an opening for flames and firebrands to enter your home. This applies to both double pane and single pane glass, since double pane glass is only slightly more resistant to heat than single pane glass. On the other hand, single or double pane tempered glass windows, doors, and skylights typically fracture at higher exposures, well above the radiant heat exposures capable of igniting the surrounding wood.



- **Eaves, Fascias, and Soffits:** Eaves, fascias, and soffits are vulnerable to both firebrands and convective exposures; they should be 'boxed' or enclosed with noncombustible materials to reduce the size of the vents. Materials that melt or burn in relatively low temperatures, such as polyvinyl chloride (PVC) and vinyl siding, should not be used, since they do not provide adequate protection and can melt in the heat of the wildfire. Non-combustible screening should be used in the vents.

- **Attic, Subfloor, or Foundation Vents:** Wind and/or direct contact with a fire's convective heat can push firebrands through the vents into your home's basement or crawlspace. Your vent openings should be screened to prevent firebrands or other objects larger than 1/4 inch from entering your home. Both your vents and screens should be constructed of materials that will not burn or melt when exposed to radiate or convective heat or firebrands. Also, these vents should be corrosion-resistant to help minimize required maintenance.



- **Fireplace Chimneys:** Windblown embers can access your home through your fireplace's chimney flue. Once inside, these firebrands then collect on

flammable objects, greatly increasing the chance of combustion. The situation can also be reversed: embers from your own fire can fly out the chimney and start a wildfire, right in your own neighborhood. The best way to avoid this situation is to install a spark arrestor made from welded wire or woven wire mesh with openings less than 1/4 inch wide.

- **Overhangs and Other Attachments:** Overhangs and other attachments include any additional structures attached to a residence such as room pushouts, bay windows, decks, porches, carports, and fences. These features are often very vulnerable to convective exposures. When assessing your home and property, if the feature in question is attached to your home, it should be considered part of your home.

BEWARE OF INCREASED FLOOD AND MUD-SLIDE RISKS

One of the lesser known, but critical considerations following a wildfire is the increased risk of floods and mudslides, even in areas far away from the fire.

Following a wildfire, charred ground where all plant material has burned away cannot absorb water, resulting in mudflows and floods.

Properties directly affected by fires, as well as those located below or downstream of impacted areas, are most at risk, including many properties not previously considered as having a moderate or high flood risk.



After a wildfire, it may take 3 to 5 years for the vegetation to regain the ability to intercept and retain water. Without vegetation and ground cover, rainfall can cause soil on slopes to become saturated, liquefy, and then flow downhill as a devastating mudflow. Residents in areas susceptible to flash or winter flooding, or in areas of extensive wildfires need to prepare in advance for possible flooding.

TO MITIGATE AGAINST POTENTIAL FLOOD DAMAGE IN WILDFIRE-IMPACTED AREAS

- Use a rototiller to break up the soil surface so more water can be absorbed, especially in charred areas.
- Build channels or deflection walls to direct water around buildings in potential mudflow areas. You can use silt fencing, filled bags (like sandbags), rock and straw bales, check dams, log grade stabilization



structures, and sediment basins to control and slow water flow. But remember, if you divert a mudflow or any water and it crosses to a neighbor's property, you may be liable for damages.

- Control erosion with straw mulch, hydraulic mulch, or other erosion control measures.
- Plant perennial plants and flowers for longer-term soil stabilization. Seed mixtures composed of native plant materials selected to complement indigenous plants is an appropriate long-term strategy. Plant ground cover on slopes and build retaining walls.

BEFORE THE THREAT OF FLOODING IS IMMINENT, YOU SHOULD:

- Evaluate your risk of flooding. Consult with your local planning and zoning office or engineering office to determine if your area is at a higher risk for flooding.
- Purchase a flood insurance policy even if you're not in a high-risk flood zone.

BE PREPARED FOR ALL HAZARDS

- Review your existing insurance policy to ensure the limits adequately protect buildings and personal belongings and become familiar with what is and is not covered.
- Make an emergency plan. Plan evacuation routes and keep important papers in a safe, waterproof place.
- Assemble and maintain or update your family disaster plan and disaster supply kit to ensure both are complete.
- Follow directions of local emergency officials.
- Visit: <http://www.ready.gov> for complete disaster planning information.

FOR MORE INFORMATION

Read *Wildfire Mitigation Tested in Orange County, CA*, at: <http://www.fema.gov/mitigationbp/bestPracticeDetail.do?mitsId=4166>.

For the most comprehensive information for communities and individuals to mitigate their wildfire risk, visit: <http://www.firewise.org>.

For information on mitigating wildfires and many other natural hazards, visit: <http://www.flash.org> or <http://www.ibhs.org>.

The International Code Council® provides a wealth of information at: <http://www.iccsafe.org/safety/wildfire>.

For additional information about returning/rebuilding, visit: <http://www.fema.gov/rebuild/repair.shtm>.

For information on homeowner responsibilities before and after a fire, visit: http://www.fire.ca.gov/education_checklist.php.

For information on flood insurance, visit: <http://www.floodsmart.gov>.

