Building to Survive in Wildfire Country

The right materials and details are a start. Landscaping and regular maintenance can help. But even these steps sometimes aren’t enough to save your house.

BY SCOTT GIBSON

If you want to build a house in the state of California, you’ll first have to consult a set of maps to find out whether the property is in what’s called a “fire hazard severity zone.” If it is, you’ll be required to follow specific construction guidelines designed to minimize the chance the house will burn down in one of the many wildfires that sweep through the state every year.

These rules, which are part of the California Building Code and are spelled out in the International Wildland-Urban Interface (WUI) Code, address everything from roof coverings and window glass to vent openings on eaves and cornices. In tandem with landscaping practices that keep combustible vegetation safely away from buildings, the WUI (pronounced “wo-ey”) building codes offer a relatively effective way of protecting many buildings from fire.

There’s no doubt that WUI code requirements saved some homes from destruction, though just how many is impossible to say. In Santa Rosa, the 2800 structures that burned in October weren’t even in an area deemed to be at high risk and were not necessarily built to meet the WUI code. Whole neighborhoods left in smoking ruins weren’t included on fire-hazard maps. They were located in an area considered unburnable.

And that raises some questions for code officials, builders, and homeowners in California as well as in other states with areas prone to wildfires: If the property is not included in a fire-hazard zone, do you build to the WUI requirements anyway? What remedial steps can be taken for houses built before wildfire codes were enacted? Do the codes go far enough? Should some areas simply be deemed too risky for construction?

“It’s not just that the building codes need to be revisited,” says Max Moritz, a wildfire researcher with the University of California Cooperative Extension. “It’s also, on a broader scale, how and where we’re building our communities.”

How houses catch fire

The WUI codes are aimed at preventing three ways houses can ignite during a wildfire: by sparks from burning embers pushed ahead of the flames by wind, by radiant heat from nearby buildings or objects that have caught fire, and by direct contact with flames.

David Shew, staff chief for planning and risk analysis at Cal Fire, considers embers...
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With so many houses lost to fire in 2017, and the fire season now stretching into months once considered safe, some review of the codes is all but inevitable. “Probably, overall, it is a little soon,” says Shew of potential changes to WUI codes, “but there are a lot of groups that are already talking about a list of lessons learned.”

A review of state-wide maps was already planned for 2018 before the fires struck last fall. According to Moritz, the next generation of hazard maps should do a better job of incorporating wind patterns that have been altered by climate change. At the least, he says, buffers between WUI areas and densely populated urban areas should be widened “We don’t need to put LA in a WUI zone,” he says, buffers between WUI areas and densely populated urban areas should be widened “We don’t need to put LA in a WUI zone,” he says, “but under some conditions the boundaries have to extend farther into the built environment than they currently do.”

What about existing houses? Building codes can make new houses more fire resistant, but that doesn’t do anything to protect existing houses in WUI zones. Michele Steinberg, wildfire division manager for the National Fire Protection Association, puts it this way: “The problem is already out there. It’s already been built. It’s already been designed, so what do we do with it? It’s extremely challenging to go in as a regulator and say, ‘Hey, you’ve got a wood roof and you’ve got to change it out.’ That doesn’t go over real well.”

Some retrofits are easy. Removing vegetation around the house or cleaning out gutters and installing leaf guards is essentially free if a homeowner doesn’t count his or her time. But replacing a wood-shake roof with a noncombustible material is not only expensive, it’s beyond the skills of most homeowners, points out Steve Quailes, chief scientist for wildfires at the Insurance Institute for Business and Home Safety (IBHS). Many other changes that could make houses less fire prone—such as sealing soffits and closing off underdeck lines on Christmas Day. We’ve never seen that before.”

Scott Gibson is a freelance journalist and a contributing writer at both Fine Homebuilding and Green Building Advisor. When researching, designing, and choosing materials for a home in a wildfire-prone area, you’ll likely encounter these four terms. Though the definition of “combustible” materials may seem obvious, “noncombustible,” “ignition resistant,” and “fire resistant” materials are each slightly different, even though they often can serve the same function. Here are some basic definitions to help you in your quest for a fire-safe home.

**Combustible**

Materials that ignite and burn easily are known to be combustible. They are also likely to release flammable vapors that support further combustion during a fire. Many common building materials are combustible, including wood, wood composites, and plastics. Combustible materials should not be used on the exterior of a home in a wildfire-prone area.

**Noncombustible**

By passing certain ASTM test criteria, materials like concrete, brick, most metals, and glass are rated noncombustible, and as such are known not to ignite, burn, or release combustible vapor during a fire. Noncombustible materials are the best option for a fire-safe exterior.

**Ignition resistant**

This designation is typically used for manufactured products like roof shingles and treated lumber and certifies the amount of time they take to ignite and the rate at which flames will spread over them during a fire. Because ignition-resistant materials are not naturally noncombustible, they are subject to accelerated weatherization during testing to make sure their performance is consistent over time. Sometimes building assemblies are rated as ignition-resistant, though it is more commonly a designation for materials.

**Fire resistant**

This rating is commonly given to materials and assemblies that are designed to contain fire and retain structural integrity, offering time for occupants to escape and for firefighters to arrive. This rating is therefore often accompanied by a specific time. Some exterior doors, for example, will have a fire-resistance rating of 20, 45, 60, or 90 minutes.
Roofs can either be protected by a material with a Class A fire-resistance rating—which includes clay, concrete, and slate, as well as many types of asphalt and metal—or by a fire-resistant assembly. For example, Class B wood roof shingles can be used over a Class A underlayment. If a roofing material is open at the eaves, as is the case with tile and some metal roofing, these gaps should be sealed. Valleys must be continuously covered by a Class A material, so with asphalt shingles a woven or cut valley is preferable to an open valley.

Eaves should be built with ignition-resistant or noncombustible material. Metal and fiber cement are viable options for soffit and fascia details. All exterior vents should be covered with 1/8-in. mesh to prevent embers from getting into the house. Another option is a commercially available product like the Vulcan Vent.

Siding should be noncombustible or ignition resistant and should cover the house from the foundation to the roof. Some codes allow heavy-timber exteriors, log construction, and other exceptions with slow burn rates. Approved fire-resistant siding materials include fiber cement, stucco, plaster, brick, and natural and manufactured stone.

Windows and all other glazing should be fire rated or multipaned with at least one layer of tempered glass.

Doors should be fire rated or built from noncombustible or fire-resistant materials.

Decks are allowed to have wood framing, but should be finished with a fire-resistant material that extends down to within 6 in. of the ground. Cantilevers and other overhangs should be built and finished with noncombustible materials and details as well.

Gutters should have leaf guards and be kept clean of combustible debris.

Roofs should be kept free of leaves, sticks, and other combustible debris.

Lawns should be neatly mowed to below 4 in.

Vegetation should be kept trimmed around sheds, decks, propane tanks, and other outdoor items.

Sprouts and saplings below mature trees should be removed.

Mature trees should be pruned away from the ground, and all dead plants should be removed.

Fuel breaks should be created throughout the landscape to prevent a fire from easily spreading. Common options include driveways, noncombustible walks, patios, and dry streams.

5 ft.
30 ft.
60 ft.
90 ft.

Outbuildings, fences, pergolas, and other structures should be kept away from the house. Though the code may allow them to be built with any material, it’s a good idea to build with noncombustible ones.

Dry stream creates a fuel break.

Trees should be spaced to minimize the spread of fire. All tree tops should be kept a minimum of 10 ft. from the house. Within 10 ft. to 30 ft. away, tree tops should be spaced at least 11 ft. apart. In the area 31 ft. to 60 ft. from the house, they should be at least 12 ft. apart. And outside of 60 ft. to 150 ft. from the home, there should be at least 5 ft. between the tops. Trees on a sloped site should be spaced even further apart.

Outbuildings are kept away from house.

30 ft.
30 ft.
60 ft.

Dry stream creates a fuel break.

A noncombustible area within 5 ft. of the home should have no vegetation or structures that may ignite and spread flames. Use gravel, brick, concrete, or stones as ground cover around the house.

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Roofs should be kept free of leaves, sticks, and other combustible debris.

Lawns should be neatly mowed to below 4 in.

Vegetation should be kept trimmed around sheds, decks, propane tanks, and other outdoor items.

Sprouts and saplings below mature trees should be removed.

Mature trees should be pruned away from the ground, and all dead plants should be removed.

All vegetation and lawn is neatly pruned and mowed.

Mesh is built with all noncombustible materials and fire-resistant assemblies.

Exterior is built with all noncombustible materials and fire-resistant assemblies.

Underside of deck is concealed within 6 in. of grade.

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To design and build a house with the greatest chance of surviving a wildfire, consider exterior materials, landscape details, and regular maintenance. Note that while some of these details are prescribed by codes, all are considered best practice for homes in wildfire-prone areas.
Fire-resistant details like those in California’s building codes can make conventional wood-framed houses safer in the event of a fire. But other types of construction may be inherently better. One of them, according to David Arkin, an architect in Berkeley, California, and director of the California Straw Building Association (CASBA), is straw-bale construction.

A few weeks after the Tubbs fire in Northern California last October, Arkin passed along a hair-raising email he’d received from a client whose straw-bale house successfully weathered the event. Edward Doody woke up in his Mendocino County home at 2:30 in the morning as fire approached. He decided to make a run for it with his dog, but their escape path was blocked, so Doody and his neighbor retreated to the house and waited out the fire.

“Huge booms resonated through the night air as propane tanks exploded, igniting more houses throughout the night,” Doody wrote. “The overused analogy to a war zone comes to mind.” Doody’s house survived. His neighbors’ did not. “We’ve observed with our own straw-bale and earth homes, and have heard stories of other similar buildings, that plastered walls combined with a metal roof and other fire-resistant detailing, and with a defensible space around the buildings, offer a good chance of surviving a fire,” Arkin says, “and we’ve seen these homes survive in situations where nearby homes were lost.”

Arkin says an assembly consisting of rice straw bales stacked on edge and finished with lime-cement plaster achieved a two-hour fire rating in one ASTM test, at least double what might be expected from a standard stick-framed house. “That does not automatically mean that all other straw-bale wall assemblies meet a two-hour rating,” he says. “But can we conclude that they are likely more fire resistant than most other typical residential wall assemblies? Yes.”

For more information

The National Fire Protection Association’s Firewise USA program (firewise.org) offers recommendations for building materials and construction details to reduce the risk of fire.

The California Department of Forestry and Fire Protection (Cal Fire) is the state agency responsible for fire protection and hazard mapping. Its website (calfire.ca.gov) includes information on vegetation management and wildland building codes.

The Insurance Institute for Business and Home Safety (IBHS) has published a series of regional retrofit guides explaining how existing buildings can be fortified against wildfires. Guides can be downloaded for free on their website (disastersafety.org).