Wildland/Urban Interface Construction

FEMA

Home Builder's Guide to Construction in Wildfire Zones **Technical Fact Sheet No. 1**

Purpose

To provide information about wildfire behavior and recommendations for building design and construction methods in the wildland/urban interface. Implementation of the recommended design and construction methods can greatly increase the chances of a building's survival in a wildfire (see Figure 1).

Figure 1. A home in the wildland/urban interface that survived a wildfire (Anchor Point Group, Boulder, CO).

Background

Wildfires are a common, natural, and essential occurrence in the forests, woodlands, brushlands, and grasslands of the United States. When conditions are acceptable, fire professionals use fire to revitalize the ecosystem and reduce accumulated vegetation that can fuel a wildfire under certain conditions.

Although the severity and timing of fire seasons vary widely from region to region, wildfires often pose a threat to lives, property, and resources. During an average fire season, hundreds of homes are damaged or destroyed by wildfire, and in extreme fire conditions, thousands of homes can be damaged or destroyed. Severe fire weather in areas with significant amounts of wildland fuels can lead to extreme fire behavior.

Wildland fuels vary throughout the United States. In the Pacific northwest and the Lake States, forests are the predominate wildland fuel. In southern California, chaparral brush predominates. The plains states have grass and oak woodlands, New Jersey has Pine Barrens, and the southeast has pine and hardwood forests.

Wildfires can damage buildings through direct flame contact, convection (heat that rises from a fire and creates a smoke column), conduction (heat that transfers through material such as metal roofs and railings), and radiation (heat from a fire next to the building). Wildfires can also create burning embers that rise in the smoke column and fall on buildings. Firebrands (large pieces of wind-driven, burning material) can be blown through windows or lodged against a building and lead to ignition of the building.

Traditional efforts to protect buildings from wildfires have focused on fighting the fire before it reaches the buildings. With the expansion of residential construction into previously undeveloped forests and wildlands, more buildings are now at risk from wildfires. Fighting or suppressing the fire is often difficult or impractical; buildings must therefore also be constructed to be fire-resistant. No building can be completely fireproof, but implementing the recommendations that are described in these Fact Sheets should greatly reduce the potential for damage to a building and greatly increase its chance of survival.

Construction in the Wildland/Urban Interface

The following factors affect the probability that a building will survive a wildfire:

- Topography and weather
- Defensible space
- Building envelope
- Community infrastructure

Topography and Weather

Wildfires generally follow or are driven by terrain and weather. Buildings at the top of a canyon or ridgeline, at mid-slope, or in a ravine have a higher risk for damage from a wildfire due to the interaction of these features with strong winds than at locations such as valley bottoms. When a construction site is selected, the topographic features on and surrounding a site should be evaluated for their potential contribution to the exposure of a building to a wildfire. A building's configuration and location on a site should be predicated on minimizing the risk from these topographic features.

See Fact Sheet #3, Selecting the Construction Site.

Defensible Space

Wildfires travel quickly in areas where vegetation is dry and abundant. A defensible space around a building can improve the probability that the building will survive a wildfire. A defensible space is an area where combustible material, including vegetation, has been treated, cleared or modified to slow the rate and intensity of an advancing wildfire and to create a safer area for fire-suppression operations to occur. Buildings surrounded by zones of non-vegetated areas or areas populated by fire-resistant vegetation are more likely to survive.

See Fact Sheet #4, Defensible Space.

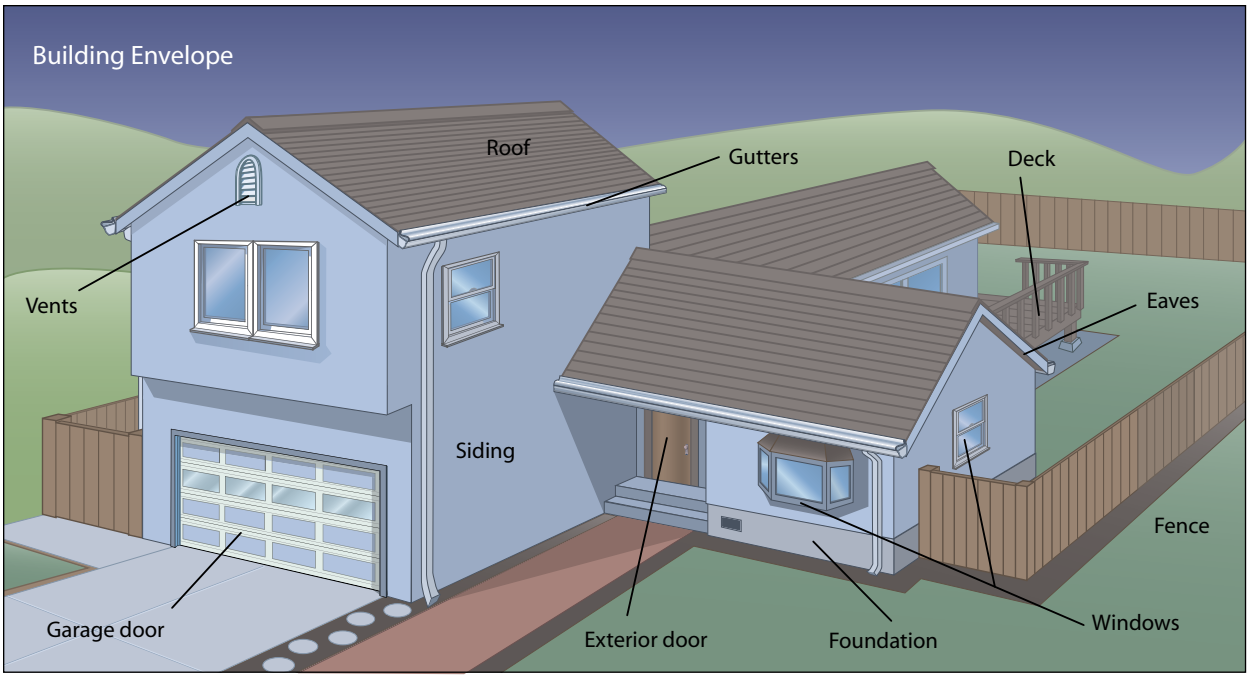

Figure 2. The building envelope.

Building Envelope

During a wildfire, combustible exterior building components such as roof coverings, siding, and decks can ignite, leading to severe damage to or total loss of the building. Therefore, the use of noncombustible or fire-resistant materials should be considered for exterior components. Figure 2 shows the components of the building envelope.

Also critical is the configuration of the noncombustible or fire-resistant materials. Unless construction measures that provide protection from a wildfire are implemented, heat and embers can penetrate the building envelope at vents, unsealed mechanical or electrical openings, and through windows broken by heat or wind-blown firebrands. When these openings are penetrated, the building can burn from the inside out.

If the envelope has been designed and constructed to be fire-resistant, both the exterior and interior of the building will be more capable of resisting a wildfire long enough for the danger to pass or for firefighters to arrive.

See Fact Sheets #5 through #16.

Community Infrastructure

A home that has been constructed to be fire-resistant and has a defensible space may not be sufficient to prevent damage from a wildfire. Surviving a wildfire may also depend on infrastructure such as local water resources for firefighting and roads that are designed for emergency vehicle access. The building site should also have adequate infrastructure to ensure access for firefighting crews.

See Fact Sheet #17, Community Infrastructure.

Prioritizing Fire-resistant Construction Techniques

The risk of wildfire varies greatly and depends on local fuels, weather, and topography. The risk at a building site must be determined before the appropriate design and construction methods for a new or existing building can be selected and the measures can be prioritized.

Hazard and Risk Assessments

The foundation of an accurate hazard and risk assessment is information on wildfire fuels, weather, topography, assets at risk, and the probability of a wildfire occurrence. A site can be in an area with a very high hazard (highly vulnerable to wildfire) but have a low risk of wildfire, such as a site at a high altitude. This information can be used to designate Fire Severity Zones. The zones can then be given a rating, from low to extreme, as shown in Figure 3.

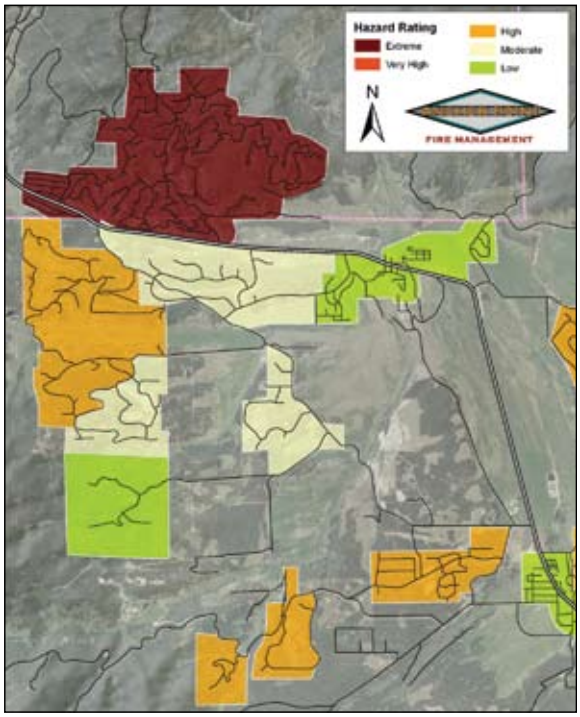

Figure 3. Example of a fire hazard rating map. Fire hazard ratings can help determine the level of mitigation that is necessary for wildfire management (Anchor Point Group, Boulder, CO).

A hazard and risk assessment can help determine the level of mitigation that is needed for a building. The assessment, which can be conducted at a regional, state, or local level, needs to be both credible and professional to ensure that the analysis is accurate, comprehensive, and verifiable. Some regional, state, and local agencies produce hazard risk maps similar to those shown in Figures 3 and 4. These maps may be found in state, tribal, and local agency hazard mitigation plans that have been approved by the Federal Emergency Management Agency (FEMA).

New Buildings

For new construction, FEMA recommends following the design and construction guidance provided in this series of Fact Sheets.

Existing Buildings

FEMA recognizes that it may not be financially possible for the homeowner to implement all of the measures that are recommended in this series of Fact Sheets. FEMA recommends that homeowners consult with local fire and building code officials or other fire management specialists to perform a vulnerability assessment and develop a customized, prioritized list of recommendations for remedial work on defensible space and the building envelope.

Helpful information about the vulnerabilities of the building envelope is available at http://firecenter.berkeley.edu/default.htm. The Homeowner's Wildfire Assessment survey on this

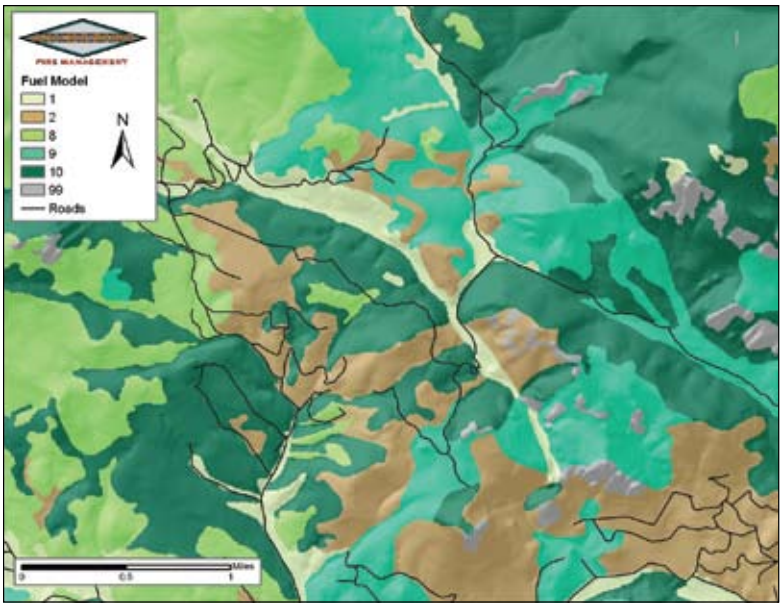

Figure 4. Example of a fuel model map. Fuel models that demonstrate the location of combustible vegetation are part of the foundation for fire behavior calculations (Anchor Point Group, Boulder, CO).

website is a helpful tool that property owners can use to learn about the specific risks a particular building has and the measures that can be taken to address them.

Construction Standards

Many communities enforce regulations regarding where and how buildings may be sited, designed, and constructed. The regulations, however, refer to minimum standards. Individual property owners have the option to exceed these standards, and doing so very often increases the probability that the home will survive a wildfire.

Resources

Center for Fire Research and Outreach. University of California, Berkeley: College of Natural Resources. http://firecenter.berkeley.edu/default.htm.

Christman, L. 2008. *Trial by Fire: Can Your Home Take the Heat?* Redding.com: Home & Garden. http://www.redding.com/ news/2008/Feb/16/trial-fire-can-your-home-take-heat/.

Underwood, J. 1995. "Fire-Resistant Details." *Fine Homebuilding* 96: 90–93. http://www.taunton.com/finehomebuilding/how-to/articles/fire-resistant-details.aspx.