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CRS Report for Congress

Wildfire Protection in the Wildland-Urban Interface

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Summary

Congress is giving increased attention and funding to wildfire threats. Much of the concern focuses on protecting homes and other structures in and near forests, an area known as the *wildland-urban interface*. However, not all agree on what can and should be done during wildfires, in their aftermath, and especially beforehand to protect the interface. This report describes the growth of the wildland-urban interface, wildfire suppression efforts, post-fire responses, and especially the programs and options for protecting the interface before the next wildfire strikes.

Wildfires have made national headlines in recent years, with major fires in the West and South killing firefighters, burning homes, and threatening communities. Federal funding for fire protection has more than doubled in the past decade, and administration and congressional leaders have urged additional wildfire protection. (See CRS Report RL33990, *Wildfire Funding*, by Ross W. Gorte.) Attention has focused on protecting people, homes, and communities in the *wildland-urban interface* (WUI), but opinions vary over how to protect the interface.

What Is the Wildland-Urban Interface?

The term *wildland-urban interface* (WUI) has been used for more than two decades to suggest an area where homes are in or near wildlands (forests or rangelands). The report from a 1986 conference on fire protection defined the WUI as "where combustible homes meet combustible vegetation."[1] In January 2001, the Forest Service (FS) and the Department of the Interior (DOI) identified types of interface communities.[2] Based on

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[1] USDA Forest Service, National Fire Protection Association, and U.S. Fire Administration, *Wildfire Strikes Home!* (Jan. 1987), p. 2.

[2] U.S. Dept. of Agriculture and Dept. of the Interior, "Urban Wildland Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire," 66 *Fed. Reg.* 753 (continued...)

state data, they listed nearly 4,500 interface communities (with 11 states not providing data). In particular, the agencies defined an *interface community* as where wildlands abut structures with a clear line of demarcation between houses and wildland fuels, while an *intermix community* is where houses are scattered and intermingled with wildlands and fuels.

Recent research has found that the area of intermix communities is large and is growing faster than the area of interface communities.[3] In 2000, intermix communities in the three Pacific Coast states totaled 9.8 million acres, almost three times the 3.3 million acres in interface communities in those states. The 10-year growth in area of intermix communities was 14.1%, compared to only 2.5% for interface communities. However, the study acknowledged that determining the area of WUI communities was imprecise: "Mapping [the *Federal Register*] definition of the WUI using data and operational definitions we developed, we arrived at one possible representation of the WUI."[4] The intermingled nature of intermix communities poses significant challenges for fire protection efforts.

Fire Suppression

In most of the Unites States, wildfires are inevitable. Biomass plus dry conditions equals fuel to burn. Add an ignition source (e.g., lightning or a thrown cigarette) and a wildfire happens. Fire is a self-sustaining chemical reaction that perpetuates itself as long as all three elements of the fire triangle — fuel, heat, and oxygen — remain available. Fire control focuses on removing one of those elements.

There are two principal kinds of wildfire, although an individual wildfire may contain areas of both kinds.[5] A *surface fire* burns the needles or leaves, grass, and other small biomass within a foot or so of the ground and quickly moves on. Such fires are relatively easy to control by removing fuel with a *fireline*, essentially a dirt path wide enough to eliminate the continuous fuels needed to sustain the fire, or by cooling or smothering the flames with water or dirt.

A *crown fire* burns biomass at all levels, from the surface through the tops of the trees. Crown fires do not consume all the biomass; rather, a crown fire quickly burns the needles or leaves and small twigs and limbs on the surface and throughout the crown of the trees. Because the needles and leaves in the crown are green, they require more energy to burn than dry fuels on the surface. Furthermore, because of the green fuels and the often discontinuous biomass of the canopy, wind is usually needed to sustain a crown fire. Once burning vigorously, a crown fire can create its own wind — the strong upward

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[2] (...continued)
(Jan. 4, 2001).

[3] Roger B. Hammer, Volker C. Radeloff, Jeremy S. Fried, and Susan L. Stewart, "Wildland-Urban Interface Housing Growth During the 1990s in California, Oregon, and Washington," *International Journal of Wildland Fire*, v. 16 (2007): pp. 255-265.

[4] Hammer et al., "Wildland-Urban Interface Housing Growth," p. 256.

[5] See Stephen F. Arno and Steven Allison-Bunnell, *Flames in Our Forest: Disaster or Renewal?* (Washington, DC: Island Press, 2002), pp. 45-46.

convection of the heated air can draw in cooler air from surrounding areas, thus creating a wind that feeds the fire. The strong upward convection can also lift burning biomass (*firebrands*) and send it soaring ahead of the fire, creating spot fires and accelerating the spread of the wildfire. Thus, crown fires are difficult, if not impossible, to control. Firelines are often ineffective, especially if winds are causing spot fires. Water or fire retardant (*slurry*) dropped from helicopters or airplanes can sometimes knock a crown fire down (back to a surface fire) if the area burning and the winds are not too great. Often, however, crown fires burn until they run out of fuel or the weather changes (the wind dies or it rains or snows).

Fires burn structures in one of three ways: through direct contact with fire (the fire burning right up to the structure); through radiation (heating from exposure to flames); and through firebrands landing on a flammable roof.[6] Surface fires generally only burn houses through direct contact, and protection is a relatively simple matter of a break in the continuous burnable material. In observing houses that burned in Los Alamos in 2000, one researcher stated "in several cases, a scratch line that removed [pine] needles from the base of a wood wall kept the house from igniting."[7] Crown fires, however, can burn houses in any of the three ways. The opportunity and ability to prevent structures from burning during a crown fire is small. Occasionally, water or some other wetting agent sprayed on walls or roofs can prevent ignition or extinguish firebrands from an advancing wildfire, but the firefighters could die of heat exposure or smoke inhalation from the approaching fire.

In the Aftermath

Recovery and efforts to support recovery after a severe wildfire vary, depending on the nature of the damages. For burned structures, insurance payment is the standard means for homeowners to pay for recovery — repair, if that is possible, or replacement, depending on the insurance policy. In a severe event, a presidential declaration of an emergency (in response to a request from a governor) initiates a process for federal assistance to state and local governments and to families and individuals to help with recovery. The nature and extent of the assistance depends on several factors, such as the nature and severity of damages and the insurance coverage of the affected parties.

For burned areas, site rehabilitation is sometimes warranted. In many temperate ecosystems, wildfires (including crown fires) are natural events, and the ecosystems are adapted to recover from the fire. Often, in severely burned areas, grass seed is spread to try to accelerate growth of ground cover and slow erosion, but grass often inhibits tree seed germination and growth, and thus may slow forest recovery. Rehabilitation efforts commonly focus on the firelines created to try to control the fire, since firelines are exposed bare earth that often run uphill, and thus can readily erode into gullies if left untreated. Some severely burned areas, particularly in coastal southern California, are susceptible to landslides during the subsequent rainy season. Monitoring can provide a

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[6] National Wildland/Urban Interface, Fire Protection Program, *Wildland/Urban Interface Fire Hazard Assessment Methodology*, p. 5, at [http://www.firewise.org/resources/files/wham.pdf].

[7] Jack Cohen, "The Cerro Grande Fire: Why Houses Burned," *Forest Trust Quarterly Report*, no. 13 (Dec. 2000): p. 11.

warning to homeowners to evacuate an area prior to a landslide, but little can be done to prevent landslides in such situations.

Minimizing Wildfire Damages

Various efforts can protect structures and wildlands from some of the damages of wildfires. (See CRS Report RL34517, *Wildfire Damages to Homes and Resources: Understanding Causes and Reducing Losses*, by Ross W. Gorte.)

Protecting Structures. A structure's characteristics and landscaping significantly affect its chance of surviving a wildfire. Evidence from models, experiments, and case studies demonstrates that structural characteristics, especially the roofing materials, largely determine whether a home burns in a wildfire. Homes of brick or adobe with non-flammable roofs (e.g., tile, slate, metal) are far less likely to burn than homes with wood siding and flammable roofs (e.g., wood shingles).[8] Burnable materials (such as trees, shrubs, grass, pine needles, woodpiles, wood decks, and wooden deck furniture) within 40 meters (131 feet) of the structure also strongly influence whether the structure burns in a wildfire.[9]

Furthermore, the structure and landscape characteristics are more important than the intensity of the fire in determining whether a house burns. The Hayman Fire, in Colorado in June 2002, burned 132 houses — 70 houses (53%) were surrounded by crown fire, while 62 houses (47%) were surrounded by surface fire.[10] In addition, 662 homes (83% of all homes within the fire perimeter) survived the fire, even though 35% of the area was severely burned and 16% was moderately burned.[11] This suggests that at least some of the structures survived despite a crown fire around them; why these structures survived was not reported.

Protecting Wildlands. The impact of wildfires on wildlands depends largely on the nature of the ecosystem. Some ecosystems are adapted to and recover from periodic crown fires — perennial grasslands, chaparral, lodgepole and jack pines, and more. In these ecosystems, the plants have evolved to resprout or reseed the burned areas, and thus recover from crown fires by outcompeting other plant species. Eliminating crown fires could eventually eliminate these ecosystems. However, eliminating crown fires in these ecosystems is probably impossible, since the plants contribute to the development and spread of crown fires — grasses burn quickly; chaparral has a high volatile-oils content; and lodgepole and jack pines grow in dense, even-aged stands.

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[8] Jack D. Cohen, "Preventing Disaster: Home Ignitability in the Wildland-Urban Interface," *Journal of Forestry*, v. 98, no. 3 (Mar. 2000): 15-21.

[9] Cohen, "Preventing Disaster."

[10] Jack Cohen and Rick Stratton, "Home Destruction Within the Hayman Fire Perimeter," *Hayman Fire Case Study*, Gen. Tech. Rept. RMRS-GTR-114 (Ft. Collins, CO: USDA Forest Service, Sept. 2003), p. 264.

[11] Peter Robichaud, Lee MacDonald, Jeff Freeouf, Dan Neary, Deborah Martin, and Louise Ashman, "Postfire Rehabilitation of the Hayman Fire," *Hayman Fire Case Study*, Gen. Tech. Rept. RMRS-GTR-114 (Ft. Collins, CO: USDA Forest Service, Sept. 2003), p. 294.

Other ecosystems are adapted to relatively frequent (5- to 35-year intervals) surface fires. Fire suppression has been moderately successful in controlling surface fires, and thus the needles, twigs, and other fine and small fuels have been accumulating for three or more fire cycles. This abnormal fuel accumulation, combined with fuel ladders of brush, small trees, and low limbs (many of which would have burned in a surface fire), have led to crown fires where such fires were historically rare. Fuel reduction treatments can restore conditions in frequent-surface-fire ecosystems to again make crown fires rare occurrences, reducing damages to resources.

Protecting the WUI. Reducing fuels in the WUI has been a controversial aspect of congressional debates over fire protection legislation. The evidence discussed above indicates that fuel reduction provides little protection for structures. However, some observers have noted that the WUI is more than just a collection of houses:[12]

> A town is not just the place where people have homes. Communities are in the forest because they are emotionally, economically, and socially linked and dependent on the forest. When we consider the areas that need immediate treatment we should consider the human community "impact area" — the entire area that, if impacted by a catastrophic fire, will undermine the health and livelihood of a community.

At a minimum, most would agree on the need for an area of *defensible space* around homes that needs to be cleared of burnable materials — at least 10 meters (33 feet) and possibly as much as 40 meters (131 feet). One observer recommended that protecting communities should include intensive treatment to reduce fuels and burnable materials in the *home ignition zone*, up to 200 meters (655 feet) around structures, with less intensive fuel treatment in the *community protection zone*, generally up to 500 meters (1,640 feet, or about a third of a mile) from structures.[13]

The Healthy Forests Restoration Act of 2003 (HFRA; P.L. 108-148; 16 U.S.C. § 6511) established a somewhat broader standard for fuel reduction activities under its authorities. Section 101(16) of HFRA defined the WUI to include an area out to ½ mile from the boundary of an *at-risk community* or 1½ miles from the boundary if a sustained steep slope could cause dangerous fire behavior or to an effective fire break, such as a road or ridge top. HFRA included no guidance on how to apply these standards in intermix communities, with no definitive boundary.

Issues for Congress

As more acres and homes have burned in recent years, and more people are at risk from wildfires, Congress is facing increasing pressures for wildfire protection. Congress

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[12] W. Wallace Covington, Director, The Ecological Restoration Institute, Northern Arizona University, "Prepared Statement," *National Fire Plan*, hearing before the Senate Committee on Energy and Natural Resources, July 16, 2002, S.Hrg. 107-834 (Washington, DC: GPO, 2003), p. 61.

[13] Brian Nowicki, *Effectively Treating the Wildland-Urban Interface to Protect Houses and Communities from the Threat of Forest Fire* (Tucson, AZ: Center for Biological Diversity, Aug. 2002).

decides what programs to authorize and fund. Many programs exist, and other options are possible.

Firefighting uses the majority of wildfire management funding, accounting for $1.1 to $1.9 billion annually (including emergency supplemental funds) since FY2003. Appropriations for fire suppression have risen in nearly every year for a decade, going from $277 million in FY1999 to the requested $1.33 billion for FY2009. Given the difficulty in suppressing crown fires, one might question the effectiveness of continued increases in suppression funding, although the agencies also clearly need to show the public that they are doing all they can to stop the threatening and damaging fires.

Federal programs to protect homes are currently limited to information, primarily through FIREWISE, for homeowners on how to protect their homes. Programs could be expanded to educate homeowners, state and local governments, and the insurance industry about the ways to protect homes through actions, planning, and zoning and building regulations. Congress could create and fund new programs to assist homeowners in renovations to make their homes fire-safe and to create defensible space around their structures, through direct federal assistance or through the states.

Congress could also consider expanding protection for defensible space beyond the home ignition zone to a community protection zone. HFRA authorizes an expedited review process for activities on federal lands in the WUI. Perhaps other changes could further accelerate action. Funding for fuel reduction in the WUI could also be expanded. Appropriations for fuel reduction have averaged$500 million annually since FY2006, but only a portion is used in the WUI, and funding is far below the estimated amount needed to treat the lands at risk. (See the discussion in CRS Report RL33990, *Wildfire Funding*, by Ross W. Gorte). State fire assistance funding through the Forest Service could be used for fuel reduction in the WUI, at the discretion of the states, but funding has averaged $88 million annually and the states have many wildfire priorities. Additional funding through the states for fuel reduction on private lands in the WUI is a possibility that Congress could contemplate.

In addition, Congress might debate choices for compensating homeowners for property losses due to wildfires. One option might be to restrict compensation to those who had acted to protect their homes, but got burned anyway. Another option might be to require that compensation for rebuilding be used only for fire-safe building designs and materials. Alternatively, Congress could establish a national wildfire insurance program, with premiums based on fire threats, the fire-safety of the structures, and the defensible space being maintained.

Finally, Congress could consider compensation for landowners that suffer resource losses from wildfires. An emergency reforestation assistance program has existed for many years, although it has not been funded since FY1993. (See CRS Report RL31065, *Forestry Assistance Programs*, by Ross W. Gorte.) In the 2008 farm bill, Congress included forest restoration assistance in an existing emergency conservation program. (See CRS Report RL33917, *Forestry in the 2008 Farm Bill*, by Ross W. Gorte.) These programs can provide assistance in recovery from a wildfire disaster, but do not compensate landowners for losses in the way that homeowners are compensated for the loss of their homes. Congress might consider such additional compensation.