

ENOUGH IS ENOUGH

What builders can do to help stop wildfire disasters

Back-to-back wildfire seasons in California in 2017 and 2018 killed more than 100 people, destroyed more than 25,000 homes, and racked up \$24 billion in insured property losses. This photo is of burned-out homes from the Camp Fire.

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BEFORE



AFTER

Coffey Park in Santa Rosa was leveled by fire (left). Unfortunately, say NFPA fire experts, they are rebuilding without using wildfire-resistant standards, which leaves the area vulnerable to future fires.

BY MICHELE STEINBERG

OUR LAST E-BOOK about wildfire, “[Design With Fire In Mind: Three Steps to a Safer New Home](#),” was issued in 2015. In it, we described the significant risk that homes face across the nation from wildfire ignition, and laid out the basic steps for builders, developers, and homeowners to take to make new construction more fire resistant.

Design With Fire In Mind noted that nearly every place in the United States has a risk from wildfire, and documented the decades of scientific

research involved in the steps that people should take to design, build, and maintain homes in safer, more sustainable ways. The book also urged people to engage across neighborhoods to act to reduce ignition risks, using such programs as Firewise USA®.

So what’s different four years later? Wildfire still obeys the same laws of physics, and ignites and spreads according to the conditions for combustion. Our national experience since 2015, however, has been traumatic, painful, and eye opening.

In 2016, a single wildfire complex across Gatlinburg and other communities in Sevier County, Tenn., took 14 lives and destroyed

an estimated 2,100 structures. Back-to-back record-setting wildfire seasons in California in 2017 and 2018 destroyed more than 25,000 residential structures, took more than 100 lives, and resulted in an estimated \$24 billion in insured property losses.

Post-fire scenes read like a textbook on how NOT to design and build communities in areas of high wildfire risk. Communities in Tennessee, California, Colorado, and Utah—the top states when it came to home destruction from 2013 to 2018—had a lot in common with one another. In some of the most naturally fire-prone areas, steep terrain and heavy vegetation made fires that started in those communities very hard to control. In addition, many homes, most built without the benefit of codes addressing ignition resistance, were located on slopes that made them more vulnerable to fire, and much harder to reach for any responders attempting to protect them.

In many of the fires of the last few years, homes were also located close enough to one another to make them highly vulnerable to structure-to-structure ignition, resulting in total devastation in places like the Coffey Park subdivision in Santa Rosa, Calif., and much of the town of Paradise in California’s Butte County.

Photographs taken after the fires attest to the atom-bomb hellscape that remains after this type of urban conflagration. It also demonstrates clearly that homes were more flammable than the trees and shrubs surrounding them, still standing in the midst of the devastation.

OBSERVATIONS FROM RECENT WILDFIRE HOME DESTRUCTION EXPERIENCE

What have we found after these disasters? Much of what the science predicts came to pass, and history was repeated, with horrific results. Codes did make a difference, in the few pockets where they were applied, but did not eliminate the likelihood of home destruction. Businesses and critical facilities were damaged and destroyed: In the case of the 2018 Camp Fire in Butte County, a major hospital lost its entire cardiac wing; in the 2017 Tubbs Fire in Sonoma County, a large Kmart store and a hotel in a well-known chain were both destroyed.

Firewise USA sites had mixed results, possibly because wildfire risk reduction was taking place in open-space areas rather than focused on homes and their immediate surroundings. Essentially, far too few homes and businesses built in these vulnerable sites had any kind of design features to help them survive. And far too few neighborhoods have taken the serious steps necessary to resist the destruction of entire subdivisions and communities.

To truly protect people and property, however, takes everyone coming together to raise awareness and bring the necessary solutions to the table. To that end, the National Fire Protection Association® (NFPA®) is promoting a holistic approach to the wildfire problem via its [Fire & Life Safety Ecosystem](#), acknowledging that a single weak link opens the whole system to catastrophic failure. These recent experiences demonstrate that many elements of the system

must be strengthened.

So are disasters like this avoidable in the future? The evidence points to a qualified yes—if builders, developers, and home buyers insist on a greener, safer, more sustainable way of building and rebuilding our neighborhoods in high-risk areas.

WHAT WE LEARNED FROM THE FIRES

Since 2013, the California Department of Forestry and Fire Protection, better known as CAL FIRE, has used a standardized method of collecting data about structures within the perimeter of major wildfires. Over the course of six years, the agency captured information from 98 major wildfires. Structures within fire perimeters are classified from the worst case, “destroyed,” which are structures suffering an estimated 50 percent or more damage, to major (26–50% damage), minor (10–25% damage), affected (1–9% damage), down to “no visible damage.”

NFPA and CAL FIRE combined this information from recent fires in California (the 2017 Tubbs, Atlas, and Nuns Fires) with environmental, neighborhood, and property information to explore indicators of structure survivability.

Early findings indicate that predictors of home destruction include the combination of the position of structures on slopes (structures on east-facing slopes during fires where the wind was pushing flames from east to west fared the most poorly) and high-density development of wood frame structures. [An analysis of the same damage information](#)

Fire leveled this cardiac center at Feather River Hospital in Paradise. PHOTO COURTESY OF NFPA



for the Camp Fire by Sacramento-based publishing company McClatchy showed that newer homes—specifically those built after the passage of California’s 2008 Building Code that required specifics for design and construction of homes in designated fire hazard areas—survived with much greater frequency than older homes nearby.

More than half of those homes were undamaged, while the survival rate for the pre-code construction was a meager 18 percent. But only 350 of the more than 12,000 homes in the wildfire’s perimeters were built recently enough to benefit from the code.

While only 1 to 2 percent of destroyed buildings in the 2017 and 2018 wildfires were commercial buildings, the fact that a hospital, a major retail store, and a hotel all suffered major damage or destruction was surprising to some observers, especially when noting that many similar structures survived. Just like homes, commercial structures can be vulnerable to ignition depending on their siting, design, maintenance, proximity to flammable vegetation and other structures, and their ability to withstand the onslaught of embers.

Significant business-related impacts beyond destruction of physical facilities included disruption of business operations due to closed roads, power outages, contaminated water, displaced customers, and displaced or homeless employees.

WE REPEAT: THE KEYS ARE MATERIALS, DESIGN, LANDSCAPING, AND MAINTENANCE

A well-built home or business with landscaping modified to reduce ignition potential, that is maintained carefully over time, will fare better in a wildfire. As noted in *Design With Fire In Mind*, taking the

fire science research into account when siting, designing, building, and maintaining homes is not difficult, but does take some careful planning. It’s important to realize that embers from a wildfire can travel over a mile before landing on roofs, in gutters, and in landscaping materials around homes. To prevent ignition from embers and flames traveling across grass or in nearby vegetation, consider the following:

- Use non-flammable roof and ignition-resistant construction elements including siding, decking, and windows.
- Understand that openings in the home—vents, doggie doors—are potential ember entry points and protect accordingly.
- Review roof/gutter/vent design carefully. For example, complex roofs pose more hazards; edges are vulnerable, including skylight edges; gutters can collect debris; gable end vents are most vulnerable to ember entry from wind. The best solutions include simple roofs, no gutters (if practical), no vents (if practical) or under-eave vents.

Remember that attachments—porches, decks, fences—are physical extensions of the home that can also be points of ignition that can carry fire to the main structure. Those must be designed with ignition resistance in mind as well.

Addressing both landscaping and construction in making structures safer is critical. The concept of the home ignition zone—the home itself and everything around it within up to 100–200 feet—is what should be addressed in new construction as well as in retrofit and home maintenance. These basic principles also apply to commercial buildings.

Key home ignition zone concepts are explored in more detail on NFPA’s website on preparing homes for wildfire [here](#).

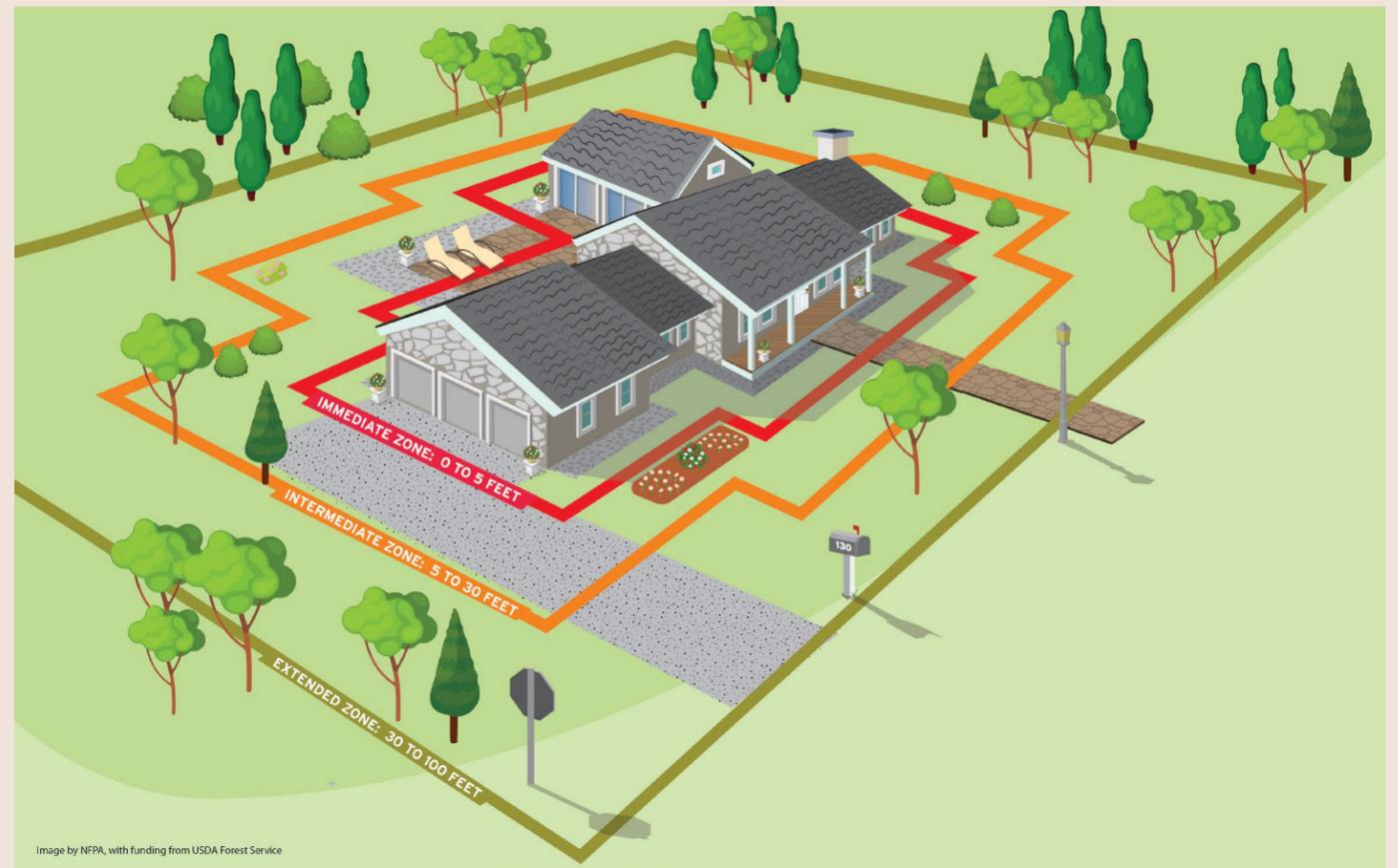


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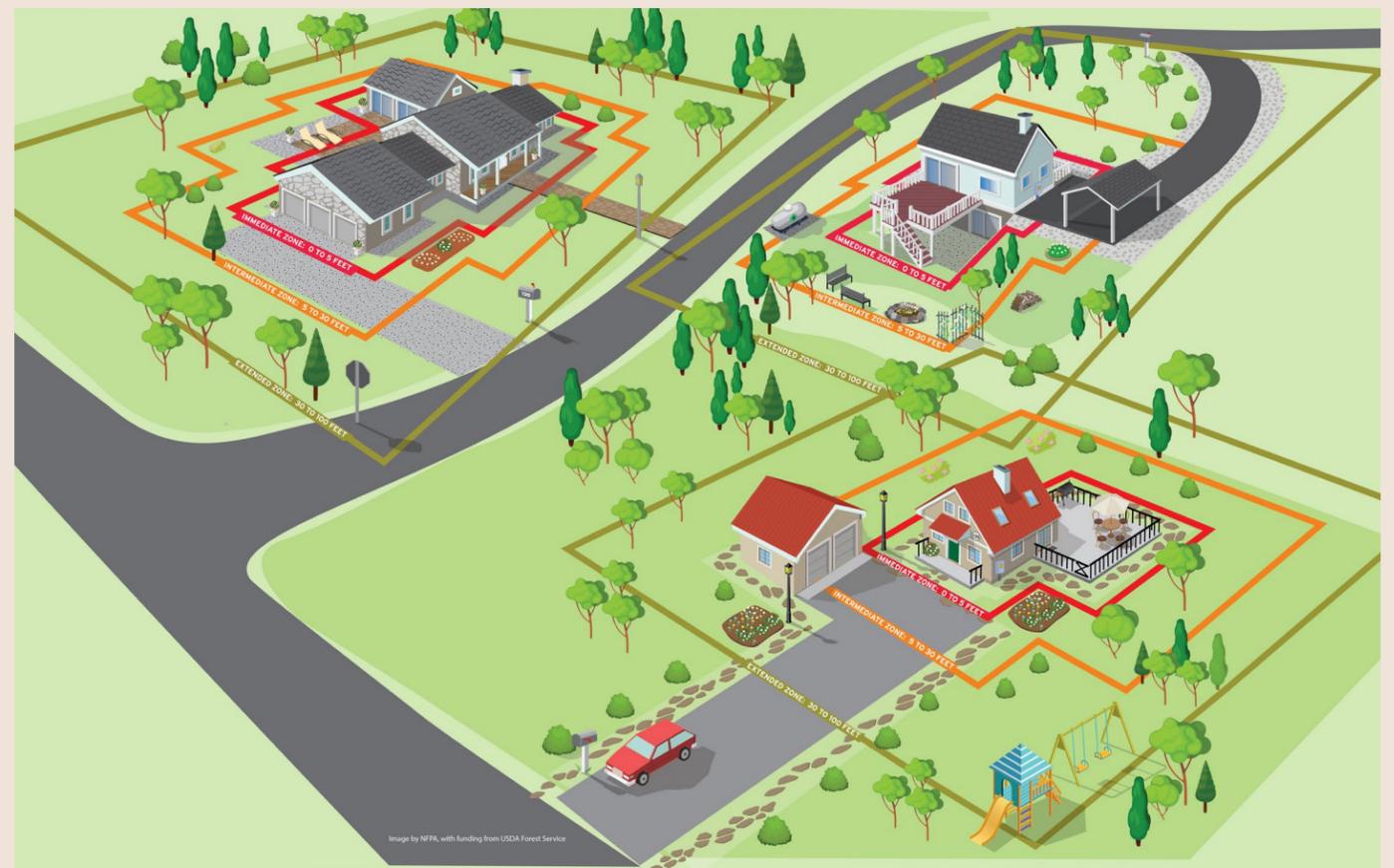
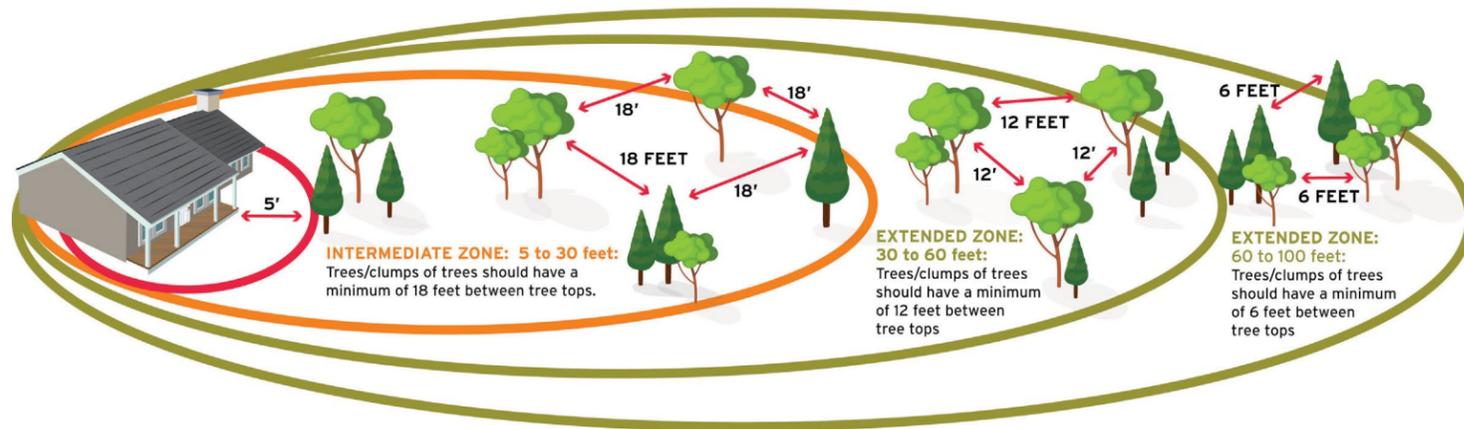


Image by NFPA, with funding from USDA Forest Service

These diagrams are examples of ignition-resistant construction and design. Home ignition zones often overlap onto adjacent properties. This makes the conditions of neighboring homes and vegetation a part of the wildfire threat. It’s extremely important that neighbors work collaboratively with each other to reduce their shared risk. PHOTO COURTESY OF NFPA



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Developments that incorporate ignition-resistant design may also help set a new aesthetic for communities, particularly with regard to the immediate landscaping around the home. Rather than the uninterrupted fuel bed that wood mulch, grasses, and dense shrubs present, design of the landscape can open up tree canopies, and use less thirsty mulches and ground covers.

PHOTO COURTESY OF NFPA

NEW RESEARCH EMPHASIZES THE IMPORTANCE OF THE HOME IGNITION ZONE

Since 2015, the Insurance Institute for Business & Home Safety (IBHS) has conducted hundreds of tests involving embers and home structures at its Research Center, resulting in a series of Wildfire Research Fact Sheets created in partnership with NFPA. These help to translate the scientific findings about ignition potential for structural elements of the home, possible mitigation activities and their relative effectiveness, and strategies that builders and owners can take to design, retrofit, and maintain structures for greater safety.

Some of the key findings include the importance of preparation of the home ignition zone—again, the home structure itself and everything around it within about 100–200 feet. Within this space, modifications to the immediate area around the home—from the perimeter of the structure out to about 5 feet—have proven critical to preventing or minimizing ignitions. More than 180 tests conducted by IBHS vividly demonstrate the difference in results when this immediate zone contains no flammable mulch or other material that can burn and thus ignite the side of the house. Testing has also shown that corners of a building can experience both higher temperatures when exposed to flames and faster flame spread if mulch or other flammable material is on the ground.

While preparation of the area within 5 feet of the home and its attachments is critical, design for ignition resistance doesn't stop there. Careful plant and landscaping choices for the area surrounding the home out to 100–200 feet are also very important to break up paths where fire will ignite grasses, shrubs, or trees and to minimize the accumulation of overgrown vegetation, grasses, or woody debris.

To see the other structure elements that IBHS has tested, check out the free [IBHS/NFPA Wildfire Research Fact Sheets](#).

RISK MAPS ARE NOT REFLECTIVE OF THE SCIENCE OF HOME IGNITION

Post-fire investigations since the 1960s have shown that home destruction during wildfires is not only a function of fire in vegetative

fuels, but also—and often—a result of structure-to-structure ignition. Wood-framed (and sometimes wood-roofed) homes within 50 feet of one another can pose ignition risks once one ignites and begins to burn.

Unfortunately, neither the impact of embers nor the potential for structure-to-structure ignition is considered in traditional risk mapping, which is usually based on the assumption that fire will spread directly from vegetation into the community due to the proximity of flammable structures to the radiant heat from a wildfire. This gap in our ability to visualize and communicate risk has proven severely detrimental to places like Santa Rosa, where the densely developed Coffey Park subdivision was zoned as “urban” (read “unburnable”), yet suffered catastrophic losses when embers from the Tubbs wildfire on the ridge above the city center rained down onto vulnerable landscapes and structures, causing an urban conflagration.

In the absence of more accurate risk mapping that takes embers and structure-to-structure fire spread into account, what can a builder or developer do? One publicly available resource is historical fire maps, images, and accounts. In the case of the Tubbs Fire, different decisions may have been made had local authorities understood fire history, and that the 1964 Hanley Fire had burned in the very same area.

Decision makers may have done things differently had they recognized that wildfire will return to the same locations over time, and that a fire's fuel is not limited to vegetation. The laws of combustion mean that wildfire will continue to burn if fuel is available, and flammable structures—homes and businesses—equate to fuel in this scenario.

BUILDING RIGHT THE FIRST TIME IS EASIER THAN REBUILDING

Past decisions on where and how to build significantly affect not only whether structures will survive or burn, but how rebuilding will proceed.

Historical patterns of development on steep slopes, or on ridgetops, or closely massed wood-frame buildings simply aren't sustainable when trying to rebuild in a safer manner. However, most homeowners

are locked into this pattern because of the land they own and often due to insurance requirements or lack of coverage that limit their options for rebuilding more safely and sustainably. In areas where many homes are destroyed in a single event, the whole community is invested in a speedy rebuild to get people rehoused and to limit the impact on property tax revenue.

Even in areas where circumstances force rebuilding in the same lot line, more can be done to ensure a safer future. Applying the sound principles of ignition resistance need not require regulatory changes. However, it's important to note that having codes in place before a disaster occurs helps to level the playing field for redevelopment. When all rebuilt structures meet minimum standards for wildfire ignition resistance, it contributes to a safer community as recovery progresses.

Another big benefit to having codes or ordinances already on the books before wildfire occurs is in relation to insurance requirements. Savvy homeowners who have opted for insurance coverage that pays for any additional cost to meet updated codes for rebuilding or repair (known as ordinance or law coverage) will benefit by having a way to pay for required safety upgrades.

Developments that incorporate ignition-resistant design may also help set a new aesthetic for communities, particularly with regard to the immediate landscaping around the home. Rather than the uninterrupted fuel bed that wood mulch, grasses, and dense shrubs present, design of the landscape can open up tree canopies, use less thirsty mulches and ground covers in arid regions that also reduce ignition potential, and take maintenance of the surroundings into consideration. If it is easy to maintain, residents will have an easier time keeping their ignition potential low. Builders have an opportunity to strengthen the use of design standards like these by doing their part to work with like-minded groups to tackle the wildfire problem as they address existing weaknesses in the Fire & Life Safety Ecosystem. (For more on this framework, [click here](#).)

IGNITION-RESISTANT BUILDING CAN BE AFFORDABLE—MUCH LESS COSTLY THAN REBUILDING

For years, NFPA and other organizations have held that, especially for new construction, ignition-resistant buildings need not be expensive. Because so many building materials, especially fire-resistant roofing, are common and affordable, it stands to reason that constructing an ignition-resistant home is not going to be out of range for builders or buyers.

In 2018, Headwaters Economics, an independent, non-partisan research organization, [published a report](#) confirming that the cost of building a new structure with ignition-resistant materials and

design could actually cost less than building a traditional home of the same size.

The study points out that affordability can make the important step of requiring ignition-resistant construction much easier for local governments to enact. Without the barrier of excessive cost, builders can also employ these methods even in the absence of local regulation, to provide a safer property. The study indicates that some of the materials recommended may also extend the life cycle of the home and reduce needed maintenance.

The Headwaters Economics study does point out that retrofit of existing structures can be costlier to do for ignition resistance, particularly for the roof, as it incorporates design elements like gutters and vents that are more specialized. It details strategies for retrofit for the maximum protection and cost savings, but acknowledges that in some cases a complete exterior retrofit could be more expensive than building a new home. However, property owners can break retrofit priorities into smaller projects, and possibly accrue financial breaks, including reduced insurance premiums, for improving the ignition resistance for their roof.

“We are witnessing the power of denial as local officials and residents try to get back to “normal” by rebuilding essentially the same type and arrangement of structures that existed before the fires, with no indication that they are willing to accept the reality of living in a fire-prone environment.”

—Michele Steinberg, Wildfire Division Director, NFPA

The cost of building flammable new structures or failing to retrofit existing vulnerable homes is usually only starkly clear when the wildfire home destruction disaster occurs. Certainly, the wildfire response and suppression elements of such disasters are costly to the federal, state, and local governments, but according to [more research by Headwaters Economics](#), more than

20 percent of the short-term costs for wildfire disasters include home and property loss. Very little of the money to rebuild homes and lives comes from government aid, since insurance covers the building loss.

Unfortunately, [nearly two-thirds of American homeowner insurance payers lack adequate insurance](#) to cover the significant costs of rebuilding a home destroyed by wildfire or other natural disaster. Without adequate insurance, homeowners must dig into any personal savings or opt to start over again in a different place and potentially at a different standard of living.

COMMUNITY-WIDE MITIGATION AND MAINTENANCE EFFORTS ARE CRITICAL OVER TIME

As we've experienced from the last few years of wildfire disasters, individual homes and businesses designed to resist wildfire impacts may perform better, but surroundings—neighboring homes and landscapes—must also be prepared for ignition resistance to improve the odds that homes survive wildfires.

Home ignition zones often overlap onto adjacent properties. This makes the conditions of neighboring homes and vegetation a part



The Texas A & M Forest Service conducts an assessment of the 7R Ranch, providing suggestions for reducing the properties' vulnerability to fire. NFPA provides tools to help in these kinds of assessments, such as its fact sheet [How to Prepare Your Community for Wildfire](#).

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of the wildfire threat. It's extremely important that neighbors work collaboratively with each other to reduce their shared risk.

Initiatives such as NFPA's Firewise USA recognition program help strengthen the survivability of homes and neighborhoods with hands-on efforts to reduce ignition risks and maintain buildings and landscapes with fire in mind. It's a voluntary program that provides a framework to help neighbors get organized, find direction, and act to increase the ignition resistance of their homes and community. Business owners in communities at risk from wildfire can also take part in preparation, not only of their physical plant, but thinking through the steps they need to take to ensure business continuity. There are excellent resources for local small businesses available, including the free customizable **"Open for Business" toolkits** from IBHS.

Efforts to build and design beautiful, safe, and sustainable homes and businesses will be supported by the understanding and action of residents who take part in such voluntary efforts.



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Committee of the Hazard Mitigation and Disaster Recovery Membership Division of the American Planning Association, and holds a Master of Urban Affairs degree from Boston University.

FACTS FOR LOCAL AUTHORITIES

A RECENT FACT SHEET from NFPA's Fire & Life Safety Policy Institute addresses the need for local authorities to know the facts about wildfire disasters and calls on them to prepare their communities now.

According to Institute director Meghan Housewright, "Elected officials and local government staffers need to understand what's at stake in a major wildfire disaster. The lives of both residents and first responders are at grave

risk, and hundreds to thousands of homes and businesses can be destroyed in a single wildfire event. After a destructive wildfire, communities will struggle to reopen businesses, rebuild homes, and retain residents."

The document urges leaders to assess vulnerability, develop a comprehensive regulatory framework for risk reduction, educate residents, plan for evacuations, and provide local fire services with appropriate training and equipment. [Learn more here.](#)