



Insurance Institute for Business & Home Safety

# WHY WE NEED TO ADAPT OUR BUILT ENVIRONMENT TO WILDFIRE

The wildfires of 2017–2018 across California were a stark reminder of what can happen when the ingredients for significant wildfires come together. There remains no better example of the damaging and deadly potential of wildfire than the Camp Fire of 2018. The 2017 and 2018 wildfires caused over \$33 billion in losses and put damages on par with those from landfalling hurricanes and severe storms. Major fires across the country such as the 2016 Chimney Top Fire, which devastated Pigeon Forge and Gatlinburg, Tennessee; the 2012 Waldo Canyon Fire in Colorado;



Figure 1: Photograph of a home destroyed during the 2018 Camp Fire in Paradise, California.

and the 2011 Bastrop County Complex Fire in the Texas Hill Country have highlighted the reality of the threat. There is an urgent need to adapt in order to reduce the future impact of this threat.

Looking back to the Oakland Hills firestorm (Tunnel Fire) of 1991 and the events of the past few years, the most devastating fires have two common factors:

- They exhibit weather-driven extreme fire behavior
- They spread from the wildlands, through the wildland-urban interface and into suburban neighborhoods

It is in the suburban landscape that awareness and adaptation are critical to preventing catastrophe.



For more information, visit [IBHS.ORG/WILDFIRE](https://www.ibhs.org/wildfire)

One of the key ways to lower the risk to homes and businesses is by reducing the available fuel and defending against the three main sources of ignition for structures:

- Direct — Flame in direct contact with a structure or accumulated embers on a structure
- Indirect — Flying embers ignite materials close to a home
- Radiant heat — Heat from the fire causes materials to ignite

Unfortunately, in suburban neighborhoods there has been little consideration of these factors. This problem was highlighted during the Tubbs Fire of 2017 when the Coffey Park neighborhood of Santa Rosa, California was decimated. The homes in the neighborhood were closely spaced, many had combustible fencing attached directly to houses, and dense vegetation and flammable materials were within the 0–5 ft zone surrounding each home. This zone is commonly referred to as defensible space.

## 2017-18 POST-EVENT ANALYSIS

IBHS analyzed post-event data collected by CalFire from the fires of 2017-2018 to determine what factors are most critical to the survivability of a structure. The results showed:

- The top 5 factors identified using machine learning were:
  - Topography
  - Vegetative clearance (i.e. defensible space)
  - Roof material
  - Siding material
  - Vents / screens

These factors influence the degree of flame, heat, and ember exposure a home will experience. The higher the level of exposure, the higher probability that the home will ignite and be lost.

- For individual fires, vegetative clearance within the defensible space zone and topography were always the top two factors critical to a home's survivability. In a closely spaced suburban environment, maintaining good defensible space must be a community-wide effort. Actions taken by neighbors are just as important as those taken by an individual property owner.
- For building components, the level of importance changed from fire to fire. This suggests the need for a system of mitigation steps to be taken to protect a home.
- Partial damage was rare, homes were either destroyed or had minimal exterior damage; interior smoke damage was not included in the analysis.



Figure 2: Panorama looking down sloping terrain in Paradise, California following the Camp Fire (2018). The home on the right side of the image has been destroyed while the home on the left, survived.

## 2018 CAMP FIRE ANALYSIS

Following the devastating Camp Fire of November 2018, scientists from the Insurance Institute for Business & Home Safety (IBHS) conducted a post-event investigation to examine the factors that contributed to this destructive fire.

- Rapid structure-to-structure fire spread due to closely spaced homes occurred.
- Building damage levels after the Camp Fire were almost always either undamaged or destroyed, similar to past devastating fires.
- Defensible space was an important characteristic of homes that survived. However, well-maintained defensible space did not guarantee survivability in this fire. It was clear in some instances that rapid fire spread, under ideal conditions, defeated even well-maintained defensible space.



Figure 3: Ember attack simulation in the IBHS large test chamber. Note the fire ongoing in the gutter due to accumulated combustible material (i.e. pine needles).

- Testing at the IBHS Research Center has accurately reproduced some of the scenarios observed. The ability to reproduce these events in a controlled environment will help science fight back by ultimately identifying which combinations of proactive measures provide the best chance for a home to survive.

## TURNING SCIENCE INTO ACTION

By bringing the current state of science to bear, IBHS has identified eight critical parts of a home and its surroundings.

- Fuel management – Defensible space, combustibles around a home
- Fences
- Decks
- Building shape
- Walls
- Roofs
- Roof vents
- Eaves & overhangs



Figure 4: Photographs from Paradise, California following the Camp Fire (2018) showing evidence of ignition in a gutter. In this case, firefighters likely removed the gutter while it was burning saving the home from being destroyed.



## RETHINKING HOW WE REBUILD

The vulnerability of a home or business can be reduced by adapting to the threat of wildfire for each of these eight components. IBHS will release adaptation roadmaps for each of these vulnerabilities in 2020.

A critical step in defending against the wildfire threat faced by communities is to build back better than before. Unfortunately, we have already seen missteps taking place. For example, Coffey Park in Santa Rosa, California has rebuilt using similar practices that contributed to the destruction caused during the Tubbs Fire with small home-to-home spaces, use of combustible fences attached directly to homes, etc., all of which are factors known to make homes more vulnerable to wildfire and create paths for fire to ignite fences attached directly to homes, etc.

With the growing threat of wildfires spreading into neighborhoods we must begin to adapt by building our homes and businesses to resist this threat.



Figure 5: Google street view image of newly built homes in the Coffey Park neighborhood of Santa Rosa, California. Note the use of combustible wood fencing directly attached to homes spaced less than 10 feet apart. This is a path for fire to ignite these homes.

## SUMMARY OF KEY FINDINGS:

- The most devastating fires have two common factors. They exhibit weather-driven extreme fire behavior, and they spread from the wildlands, through the wildland-urban interface and into suburban neighborhoods.
- An IBHS post-event study of the Camp Fire shows:
  - Rapid structure-to-structure fire spread occurred due to closely spaced homes.
  - Building damage levels after the Camp Fire were almost always either undamaged or destroyed, similar to past devastating fires.
  - Defensible space was an important characteristic of homes that survived, although rapid fire spread defeats even well-maintained defensible space.
  - Testing at the IBHS Research Center has since accurately reproduced some of the scenarios observed.
- IBHS has identified eight components of a home that are vulnerable to fire, but research shows risks can be reduced by making better material and building choices for each component.
- Communities continue to rebuild in ways known to increase wildfire risks., Coffey Park in Santa Rosa, California is an example. There, homes have been built back close together and combustible materials, such as wooden fencing and mulch are used within what should be the defensible space zone.