

# How Homes Ignite

*Building a better defense against wildfire*

**J**ACK COHEN COULD BE CONSIDERED the Sherlock Holmes of wildfire.

For more than 30 years, he's been working the same case.

He's been trying to unlock the mystery of wildfires—how they burn, why they burn a certain way, how they impact people, and why some structures survive a forest fire and others don't.

And he's hit upon an idea to better protect homes in the face of wildfire.

Cohen, 52, is a research physical scientist with the U.S. Forest Service in Missoula, Montana. He is a published author and nationally known expert on wildfires. He holds a bachelor of science degree in forest science with an emphasis on fire science, and a master of science in bioclimatology.

He's fought wildfires as a firefighter and, as a scientist, seen countless others in action.

He's conducted extensive experiments to better understand fire physics, fire behavior and the effects of wildland fires on forests and structures.

He's dug through the remains of hundreds of homes and buildings that have succumbed to wildfires.

What he's learned is that protecting your home from wildfire can be done—and it's the little things that count.

## Understanding fire

Before you can decide what to do, Cohen says, it helps to know something about fire and to understand what puts your house at risk.

For fire to occur, you need three elements: fuel, heat and oxygen. Take away any one of those elements, and a fire can't continue to burn.

To actually catch something on fire, it takes direct flame contact with a fuel or intense radiant heating that breaks down that fuel to the point where it ignites.

In the context of fire, "fuel" means anything that will combust, or burn.

In a wildfire setting, that fuel can be things like tree foliage, dead pine needles,



grass, wood, patio furniture cushions, even brooms.

So how do structures ignite? There are three basic ways:

- ✓ When fire creates such intense radiant heat that a nearby combustible starts burning;
- ✓ When the fire burns right to an object or right to the structure, causing the flames to directly touch and ignite something that will burn; and
- ✓ When fiery embers, also known as firebrands, fly through the air and land on the structure or one or more combustibles, starting a fire.

## Tackling misconceptions

So how do you know if your home is at risk from a wildfire?

Quite simply, if you live in or adjacent to a wooded area, you're at risk. If you live on or near grasslands or a prairie, you're at risk.

But just how big is that risk and what causes it? The answers might surprise you.

There are many misconceptions about wildfires, Cohen says. One of the most common is that houses burn down because they are overrun by fire.

"Our perception is that this great flame front comes through and it travels everywhere and incinerates everything," Cohen says. "Except that's not how it happens. You can have a very intense fire with big flames, but more often than not, it's not the big flames that burn the house down."

Here's why.

*“...what we learn...is that it doesn't take big flames to burn the house down.”*

— Jack Cohen

Crown fires — where flames spread from treetop-to-treetop—tend to consume their fuel in about 60 seconds, causing them to burn out before they can ignite most structures, Cohen has found.

For crown fires to ignite the wood wall of a house, the flames have to be within 100 feet of the structure. Though that scenario does happen, it's not as common as people think, he adds.

Another misconception is that houses burn because forest fires give off such intense heat. We assume if a fire is hot enough to burn us as people, it is also hot enough to quickly ignite wood.

But Cohen's studies have shown that it takes far less heat to cause a burn on a person than it does to catch other things, such as wood, on fire. A heat exposure that can give a person a second-degree burn in five seconds takes more than 27 minutes to ignite wood.

While intense heat can cause a wood wall to burn in less time than that, it usually has to be within 100 feet of the house to occur, Cohen says.

### **Greatest threats**

So what does pose the greatest threat to houses?

Most often, it's the firebrands — little fiery bits of burning embers, usually wood pieces, which shoot off from the main fire and get carried to other areas by fast-moving air currents.

A high-intensity fire can produce a virtual blizzard of firebrands, much like snow. And some firebrands can travel more than a mile before landing, Cohen says. When the embers do come down, they often start other fires if they land on something that can burn.

What makes firebrands so effective in igniting fires is that there can be thousands of them, depending on what's burning in the forest, and that they can get into the smallest of spaces.

In short, a firebrand can easily start enough of a fire to burn down an entire house.

“The firebrand size that becomes effective is a quarter-inch piece of branch, one-inch to three-inches long, that's come off a burning tree,” Cohen says. “There can be a bazillion of them flying around in the air. That size is quite common and quite effective in creating ignitions. The same hot and dry conditions that foster extreme fires enhance the ability for those firebrands to ignite something.”

Cohen has seen the mark of firebrands time and again during fire investigations of burned houses from coast to coast. Some of these examples came from wildfires in Laguna Beach, California (1993); northeastern Florida (1998); Los Alamos, New Mexico (2000); the Bitterroot Valley of Montana (2000); and Durango, Colorado (2002). In each place, Cohen found structures that were completely destroyed, even though the trees and vegetation around them hadn't burned.

“In many cases, we find out that houses are totally destroyed with unconsumed vegetation surrounding the structures,” Cohen says. “The first clue is that the vegetation isn't as flammable as the houses. That means that whatever destroyed the house didn't catch the vegetation on fire. And what we learn from that is that it doesn't take big flames to burn the house down.”

Those findings, which he has seen in an estimated 70 percent to 80 percent of the cases he's investigated, just reinforced what he had already learned from studying fire behavior and other field experiments.

It's the little things that count.

This home in the Bitterroot Valley, Montana, survived a crown fire just 300 feet away



## Home Ignition Zone

In the course of Cohen's research, a pattern began to emerge. And it led him to create what he calls the "Home Ignition Zone."

Basically, the Home Ignition Zone determines how vulnerable your house is to wildfires. Cohen considers "the zone" to begin with the house and include everything within 100 feet of the home. By reducing the flammability of your house and everything else within the zone, you can greatly lessen the chance that your home will catch fire, even with a raging crown fire nearby.

"The Home Ignition Zone principally determines vulnerability to all the things that can ignite the house—the flames and the firebrands," Cohen says. "At a very minimum, you want to make sure that there is no fire within 100 feet of your house and then no big flames within 100 feet."

Anyone can create "the zone." In fact, it will be your principal defense against an extreme wildfire.

To begin, Cohen recommends starting with the house and working your way out. Keep in mind the "little things" that can contribute to fire ignition and spread.

First, assess the roof. The right roof covering is essential to protecting your home because the top of the house is so vulnerable to firebrands.

"A flammable roof will make the difference of your house being destroyed and not being destroyed, regardless of what else you do," Cohen says.



A firebrand this small can ignite a house

The most common flammable roof covering is wood shake shingles. If the shingles don't have a *pressure-treated* fire retardant, they could be a hotbed for fire, Cohen says.

Merely applying a fire retardant to the outside of the shingle generally isn't good enough in the long run, he adds. Sun and rain can cause the retardant to break down, leaving your shingles unprotected long before your roof wears out.

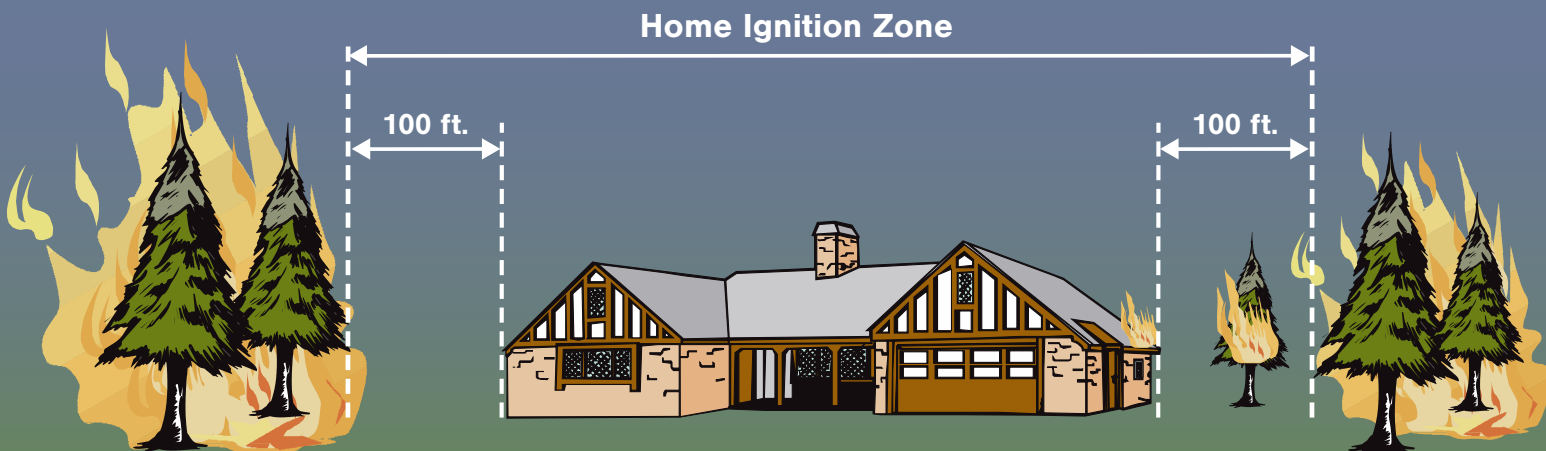
To know whether your shake shingles are fire retardant, Cohen suggests this experiment:

"Go find the edge of a shingle and take a pocket knife and cut a strip of wood off that edge," he says. "Holding the splint vertically, ignite the bottom edge. If it won't sustain flaming without a match or lighter on it, then very likely the fire retardant treatment is still working. And that's good news because it will inhibit firebrands."

Ultimately, he says, you want a non-flammable roof, which is any covering other than flammable wood shake shingles or thatch.

Roofs covered with composition shingles, metal, slate, clay tile or terra cotta tile fit this bill. If you have terra cotta tile, make sure the open spaces around the tile are filled. Otherwise, firebrands can fly into those gaps and ignite the house from the inside.

Cohen considers "the zone" to begin with the house and include everything within 100 feet of it





Jack Cohen explains how firewood stored beside a structure can be a serious problem

### Survey the house design

Look at the architectural features of your house. Are there areas where firebrands can collect and start a fire?

Dormers, split-level roofs and lots of nooks and crannies create the perfect nest for burning embers. Pay particular attention to any and all inside corners. That's where firebrands can easily pile up, Cohen says.

Wherever possible, cover those corners. Metal flashing, like that used to redirect water on roofs, is very effective because the firebrands will land on the metal rather than a surface that readily burns.

Check your gutters to ensure they are clear. They can be a haven for pine needles, leaves and other flammable debris.

While you're at it, eyeball the eaves. They're a favorite place for birds to build a nest. And that could be a heyday for a firebrand.

Remember, too, that vents provide the perfect opening for a firebrand. So add a one-eighth-inch metal screen over the vent opening to create a barrier.

At ground level, the rule is the same — corners, corners, corners.

"Think about where snow accumulates in the wintertime, where leaves accumulate on a day-to-day basis, where trash blows," Cohen says. "Those are the locations where you can start accumulating things that will catch on fire and also where the firebrands will collect."

In those corners, make sure other combustibles, such as grass or leaves, don't pile in an inside corner — especially on a flammable surface.

### Take a walk around

Next, walk around your house. Stop and look at each side. Visualize if there is anything there that can or will easily burn. Look for the little things.

For example, is there dry grass growing up against or leading right to the foundation that could then ignite a nearby wood wall? Are there pine needles or leaves lying around that lead to the house? Is there dead vegetation underneath bushes and shrubs? Is there a woodpile next to the house or on the home's deck?

Remove anything that will burn, especially if it's close enough to the structure to catch it on fire. Then make a point to keep those areas cleaned out at all times.

Take notice of your everyday "stuff" as well — patio furniture cushions, hemp doormats, brooms, recycling bags. Consider alternative locations to keep firebrands from reaching them.

Treat attachments to your house as though they are part of the house when looking at the fire danger — and your risk.

That means paying attention to things like attached garages, breezeways, wooden fences, wooden decks, and walkways made of wood planking or covered with wood chips — especially if those paths trail right to your house or to an adjacent outbuilding.

"If it's attached to your house and it's flammable, consider it part of your house," Cohen advises. "You don't want fire to be touching it because it can lead the flames right to your house."

Consider replacing a flammable walkway with stepping stones or crushed rock. If you have a wooden fence touching the house, break the connection with a metal gate.

Scout out openings like exterior crawl spaces or the critter zone under wooden porches and decks. If there's flammable debris, such as leaves and pine needles underneath there, remove it. Then screen the open area using one-eighth-inch metal mesh to create a barrier for firebrands.

Consider building a bin for firewood, again, to keep firebrands from landing on top of or in between pieces of stacked firewood.

### Vegetation counts

Vegetation is part of the fire risk, too. So focus on what's growing around your house.

"Flame contact with the structure is a bad idea, so let's not have anything burning within ten feet," Cohen says.

Remove any dead plant material. Think about creating a buffer zone of rock around the base of the house with non-flammable plants, such as irises and pruned shrubs—all of which can help keep fire away from your structure.

If you have trees, figure out what kind they are and how close they are to any structures. If you need to, consult a forester or landscaper for help in identifying the tree species. It's a little thing you'll need to know to assess your risk.

By and large, Cohen says, live deciduous trees do not support high-intensity fire in the treetops. But conifers or evergreen broad-leaves—such as live oak—can. If those trees are in a dense-enough patch, they can support *a lot* of high-intensity fire.

If you have high-risk trees, it doesn't mean you're doomed.

"You don't have to cut all the trees down around your house," Cohen notes. "You don't have to live in a parking lot to succeed. But you do need to recognize that you may have to thin out the trees."

Single trees or small clusters of three to four trees can be OK as long as the tree canopies have a 20- to 30-foot separation from other clusters of trees. You want that spacing to keep fire from jumping among the treetops and possibly to your house.

If the trees within your 100-foot zone are denser than that, thin them out to avoid problems during extreme wildfire conditions.

Prune all trees so that the lowest branch material is approximately eight feet off the ground, Cohen advises. That helps to keep a low-intensity surface (ground) fire from



igniting the branches and spreading to the rest of the tree.

If the area around your house is not wooded, but surrounded by grasslands or prairie, you can and should create "a zone" as well by cutting your grass.

"Mowing the grass 30 to 60 feet from our structures significantly reduces the intensity of a prairie fire to the point where you won't be igniting your home or outbuildings as long as you don't have dead grass leading right to the structures," Cohen says.

"You don't need as large a zone for a prairie as you do for a conifer forest because a grass fire doesn't produce as high-intensity of a fire as we see in the forest," he adds. "Grass and prairie fires tend to burn at a lower intensity and for shorter durations."

Though burning grass also can produce flying sparks that can touch off other fires, Cohen says, the problem isn't as prevalent as firebrands from a forest fire.

Lastly, if a neighbor's house is within 100 feet of yours, it can be a fuel source for your structure. So get together and create overlapping Home Ignition Zones.

"The neighborhood that doesn't work together to reduce their vulnerability to fire will surely burn together," Cohen says.

The bottom line is that you can defend yourself against wildfire. And "the zone" can help you do it.

"You don't have to live in a concrete-block house with stainless steel garage doors and a metal deck all the way around it," Cohen says.

You just have to remember—it's the little things that count. ■

If flammable materials are not removed, an overhang can provide an easy way for fire to spread to a house