

# Community Wildfire Risk and Fire Resilient Landscapes

Keynote: Dr Jack Cohen — Clean transcript with subheadings

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**Speaker:** Dr Jack Cohen, USDA Forest Service Fire Sciences Laboratory, Missoula, Montana (originator of the Home Ignition Zone concept)

*Imperial units are as spoken. Metric equivalents are added in [square brackets] for Australian readers, along with a few editor flags where the recording was unclear.*

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## About this presentation

*Wildfire resilience is twofold: landscape risk and community risk. Landscape risk relates to ecologically appropriate fire in fire-adapted areas, while community risk concerns preventing structure fires. Disastrous wildland-urban fire destruction primarily stems from ignition and spread vulnerabilities within communities, not from extreme wildfires. Preventing community destruction is achievable without controlling extreme wildfires. Restoring ecologically appropriate fire requires ignition- and fire-spread-resistant communities, while restoring fire-adapted landscapes will not reliably protect communities from extreme wildland-urban fire.*

*About the speaker: Dr Jack Cohen has worked in wildland fire since 1972 as a researcher, firefighter and fire behaviour analyst. He co-developed key US fire danger and behaviour systems and pioneered home ignition research, showing the home ignition zone is critical for reducing wildland-urban fire losses. He co-developed Firewise USA and continues advancing wildland-urban fire disaster prevention.*

## Introduction by the host

*I have the privilege of introducing our keynote speaker, who really needs no introduction, which is probably why they asked me to do it. For those of you who were here on Tuesday, you spent a day in a workshop with Jack Cohen. The rest of you got stuck with me.*

*I've known him for many years from my NFPA days, and he has given us an understanding of structural ignition from wildfires like nobody else. He designed and developed the concept of the home ignition zone. He has changed how we approach the problem, from one of wildland fire management to one of managing structural ignition. And that changes our whole approach, or it should, from policy level on down.*

*It's been a pleasure to know Jack over the years. He is not a stranger to Fort Collins. I think your master's degree was from CSU, which is why I wore my C shirt. I just want you to understand who you've got in the room here: there is no science that has been more profound or more impactful to all of us than the work that Jack Cohen has done. Many of you who know me have heard me extol the gospel according to Jack. Ladies and gentlemen, Dr Jack Cohen.*

## Defining the terms

Thank you. Oh, there are a lot of you out there. Thank you so much for the introduction. That's hard to follow, actually. Let me get going so that I can get over the introduction.

What I want to do is start with some defining terms I'm going to use, so you know what I'm referring to. Wildfire is continuous burning vegetation and then a developed landscape deemed to be a threat. So, I'm differentiating between that and wildland fire, which we might manage or desire.

Extreme wildfire is wildfire having a range of spread rates and intensities in all fuel types. I'm not looking at extreme wildfire based on intensity and big flames. I'm not talking about the big emotive kinds of fires. I'm talking about any of these fires, for any reason, that overwhelm fire suppression and control. It doesn't matter whether it's in grass and light shrubs or continuous conifers.

Wildland-urban fire is wildfire exposing, and potentially initiating, community ignitions. Urban fire is community fire spread principally determined by burning structures in high-density

developments. This leads into the idea that the wildfire does not have a direct and strong relationship to the destruction it causes.

A wildland-urban fire disaster is something that is going to impress the sociopolitical situation. It is something that adds to the push towards reducing or eliminating what is now perceived as a wildfire problem. So, this is essentially a strategic definition. And note that I'm not using the word interface, because it's a geographic classification. I'm only using the term wildland-urban, and that will become clearer later.

## **Fire as a natural disturbance**

North American landscapes, with very few exceptions, became fire adapted during the post-ice-age transition. I grew up in one, the northern Sonoran Desert. Landscapes developed with fire, primarily ignited by humans and also by lightning, when the climate and vegetation were emerging from melting ice sheets and ice caps 10 to 20,000 years ago, depending on the region. North American first peoples became indigenous peoples because they became part of the ecosystem. They were the primary source of fire as a natural selection mechanism that developed and maintained fire-adapted landscapes.

Let's visualise for a moment going from ice sheets two miles [3 km] thick just 60 miles [100 km] north of where I live now in Missoula, Montana, to no ice sheets in about 8,000 years. Missoula was 1,000 feet [300 m] underwater about two dozen times, which means none of the vegetation that's there now was there then. It all came in, whether you're in Montana or Arizona, and it all changed with people here.

Indigenous people lit wildland fires to benefit their existence. They were fire lighters, not firefighters.

Historically and currently, most fire weather conditions are not severe. All you have to do is reference the National Fire Danger Rating System climatology. That wasn't me. For thousands of years, wildland fires mostly spread during less than persistently severe fire conditions, resulting in a landscape mosaic of fire-adapted ecosystems in various post-disturbance stages. By the way, the photo on the left is post-Columbian, not 10,000 years ago. No horses.

## **The wildfire paradox**

Several hundred years of largely eliminating Native American burning practices, along with European settlement, agriculture and urban land use, has greatly reduced and changed wildland fire occurrence for all fire regimes, low and high intensity.

And over a century of roughly 96 to 98% wildfire suppression success in the western US in particular has largely eliminated wildland fire as an essential ecological factor sustaining fire-adapted landscapes in all fire regimes. Wildfire suppression success has only postponed wildfire occurrence to the 2% of wildfires that occur during severe weather and fuel conditions, when suppression fails. We are actually choosing to have ecologically significant fires during the worst-case situations. That's not our intention, of course, but that's the result. This is called the wildfire paradox.

Attempted wildfire exclusion and control has increased the potential for extreme wildfire conditions over extensive areas. Increasing emphasis on wildfire suppression produces increasing wildfire risk to both communities and our fire-adapted landscapes.

So, we need to accept wildland fire regardless of cause. And keep in mind, the cause has been dominated by humans for 20,000 years, not lightning. Lightning, yes, but humans were the main factor. Regardless of cause, we have to accept wildland fire as an inevitable, appropriate and essential ecological process at landscape scales for all fire-adapted ecosystems, low and high intensities.

## **Communities burning is not new**

Now let's look at probably why you're here: wildfire as a hazard to communities. Community wildfire risk is essentially the risk of many homes and other structures burning to total destruction during extreme wildfire conditions. This is not a new thing. There is nothing new about communities burning up during wildfires.

Look at the Great Fire of 1871 in the Lake States, the same day as the Great Chicago Fire. There were over 1,500 fatalities, over a million acres within the perimeter, and 17 towns disappeared. They had wood-chip and sawdust roads, sidewalks, boardwalks and wood construction, and the burning of slash all summer long. The smoke sustained them in a welcoming kind of environment until the big winds blew in October.

Skipping forward to wildland fire disasters that, until about 40 years ago, were considered just a California problem. Communities burning up? California problem. But in 1985, wildfires became a national issue. 1,400 destroyed homes in Florida, North Carolina and California motivated the creation of the national wildland-urban interface initiative with federal, state and local agencies. That resulted in Firewise, Fire Adapted Communities and, to some extent, Fire Safe Councils. *[Cohen also mentions federal funding cuts in 1985, particularly to the Forest Service; the recording is unclear on his point here.]*

## **Have we reduced the disasters? The numbers**

So how effective have we been at reducing wildland-urban fire disasters? In the ten years between 1985 and 1994, 9,000 houses were destroyed. We have had single events since 2017 that are greater than or equal to that ten-year period. In that first decade it was 9,000; in the decade of 2016 to 2025 it was 57,000.

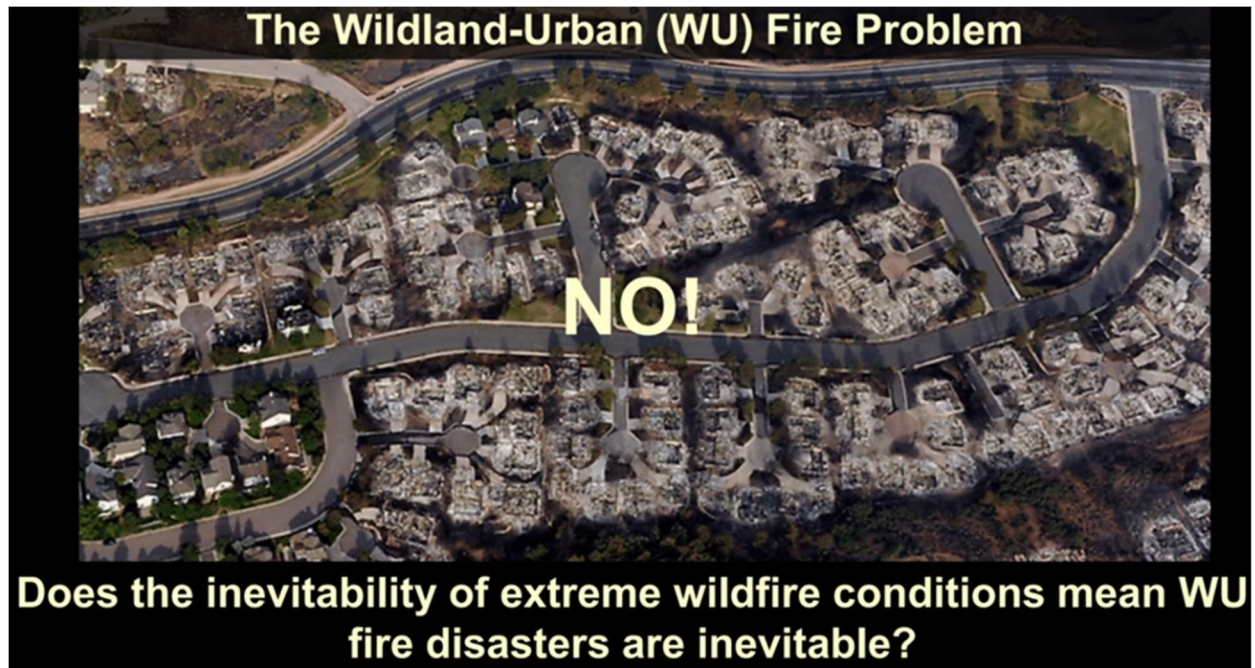
How have we reacted? With increased national attention and funding for wildfire control. There is no evidence that increasing wildfire suppression and control can reliably protect communities during inevitable extreme wildfire conditions. Given the wildfire paradox, increasing fire suppression just increases the likelihood of extensive ecosystem losses. It does not create fire-resilient landscapes, and it increases the likelihood of community exposure to extreme wildfire.

It does not create fire-adapted ecosystems or communities. It further increases wildfire risks that reduce society's benefits.

These are our problems. All problems on this planet are human problems. The planet doesn't write legal briefs *[unclear in recording: "and grief ..."]*.

## **Is disaster inevitable? Not necessarily**

Does the inevitability of extreme wildfire conditions mean wildland-urban fire disasters are inevitable? The resounding answer is no. Understanding how homes ignite during extreme wildland-urban fires reveals opportunities for preventing the disasters without necessarily controlling extreme wildfires.



But our society generally perceives these disasters as a wildfire problem. For example: "The firestorm descended like a dragon from hell on the foothill neighbourhoods and laid them to waste." "The wildfire swept through the community with a tsunami of flame." "The wildfire literally exploded houses in flames, leaving destruction in its path. It was like a war zone." Take a breath.

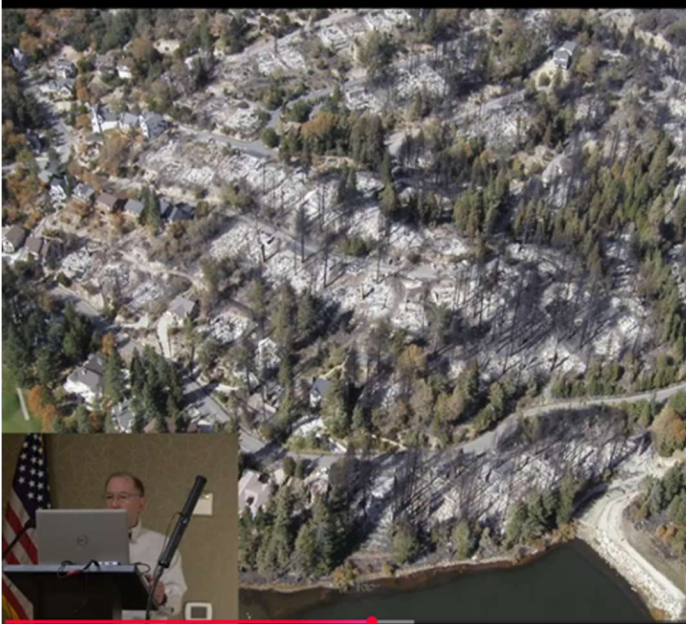
How can a wildfire sweeping through the community with a tsunami of flame not be a wildfire problem? Let's look at the patterns of destruction related to extreme wildfire so that we can test that notion.

### **What the patterns of destruction show: Paradise**

What do the patterns of wildland fire destruction tell us about how wildfire contributes to home ignitions and community destruction? Let's take a look at Paradise. These are high-definition drone photos, because about two days after this occurred, journalists called me and asked: can you explain the unusual pattern of destruction? I very quickly responded: this is the typical pattern of destruction.

When you see a scene like this, commonly people see the destruction without seeing the rest. All the rest. That's Paradise. That's where this dragon from hell came through and destroyed all the structures. Typical patterns of wildland fire destruction do not support a tsunami of flames sweeping through communities. And wildfires don't literally explode houses in flames. But what about dragons from hell?





Typical patterns of WU fire destruction do not support:

- “a tsunami of flame” sweeping through communities, and
- wildfires don’t “literally explode houses in flames;”
- But what about “dragons from hell”

...Hmm?!

These homes ignited from lofted burning embers. Wildfire flames didn't reach the community. In this particular case we see a house that survived, and this became the "miracle house." , what else didn't burn? Is that really the miracle house? Well, then this is miracle vegetation. Total home destruction next to green vegetation is extremely common.



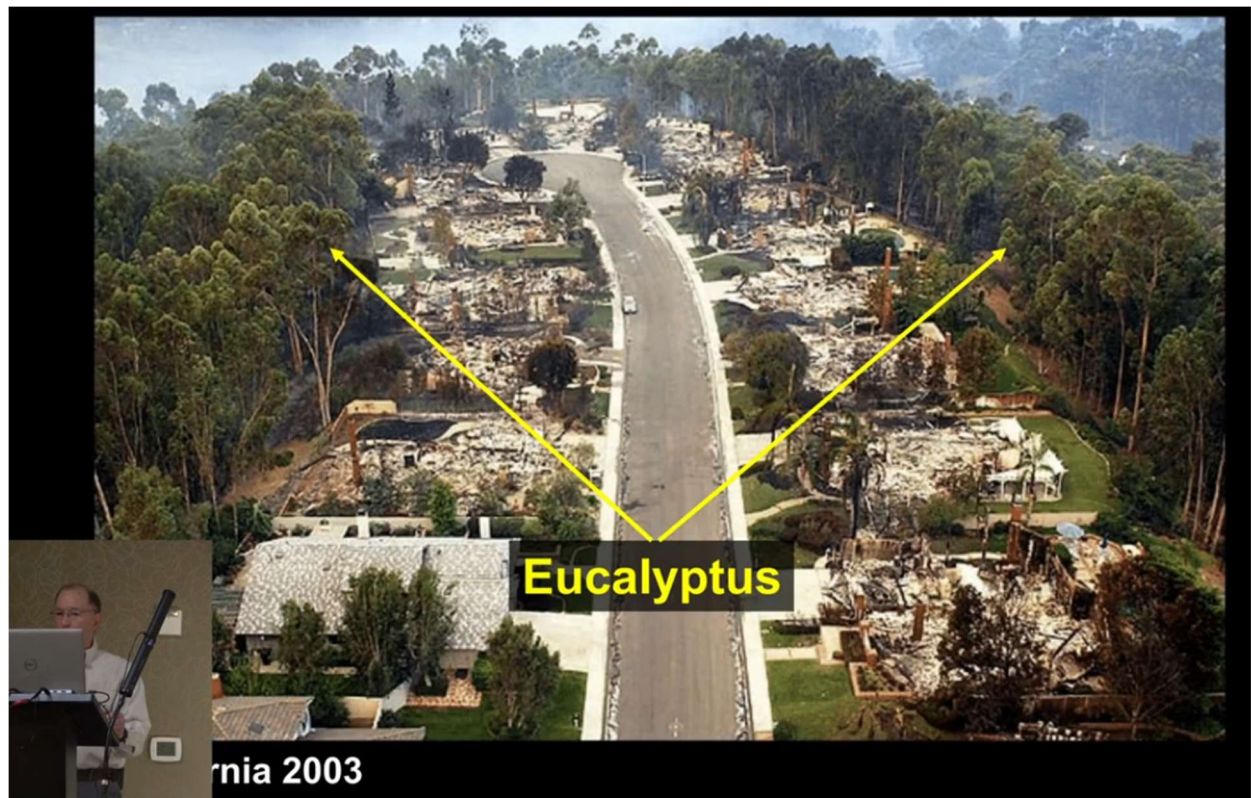
California 1993

Miracle Vegetation?!

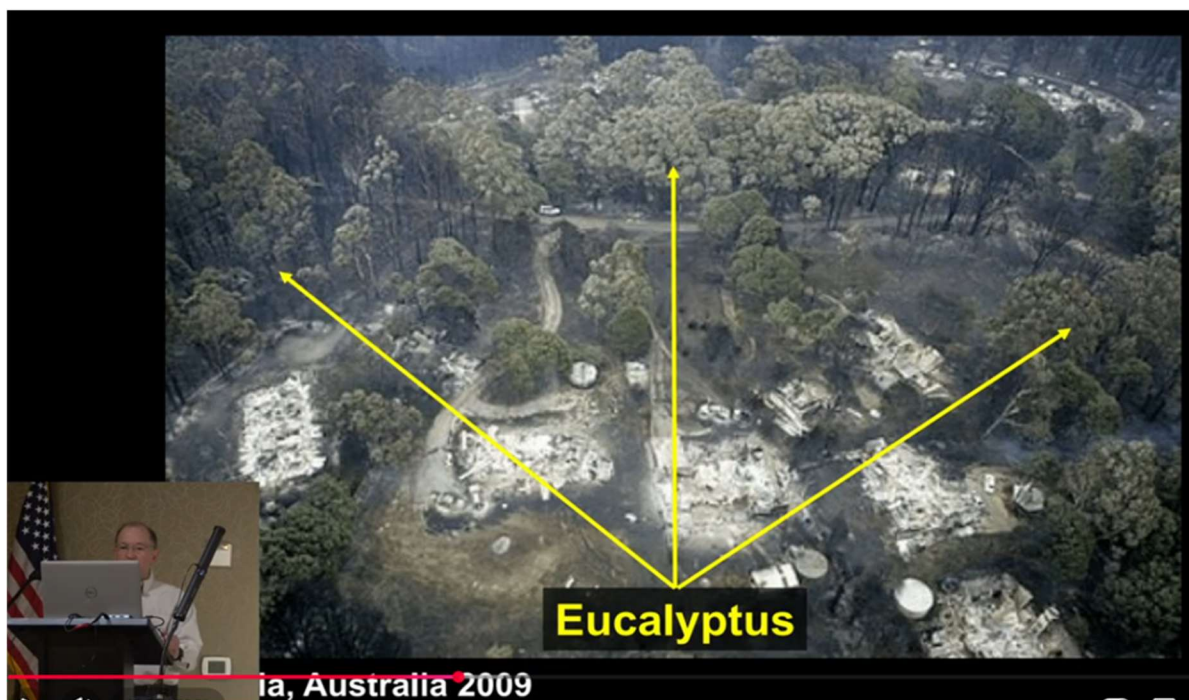
This house survived  
What else didn't burn?!

### Tree canopies: the same pattern worldwide

Let's look at this particular line of houses when they were burning. These homes are burning hours after the Cerro Grande crown fire passed by, not through, not even next to, this particular part of Los Alamos. Intense wildfire never spread to this residential area. That is extremely common. What you're seeing is houses burning but not the tree canopies. And as it turns out, on this street, standing looking out at the wildland, all but three houses are totally destroyed. You turn around and you wouldn't know there was a wildfire.



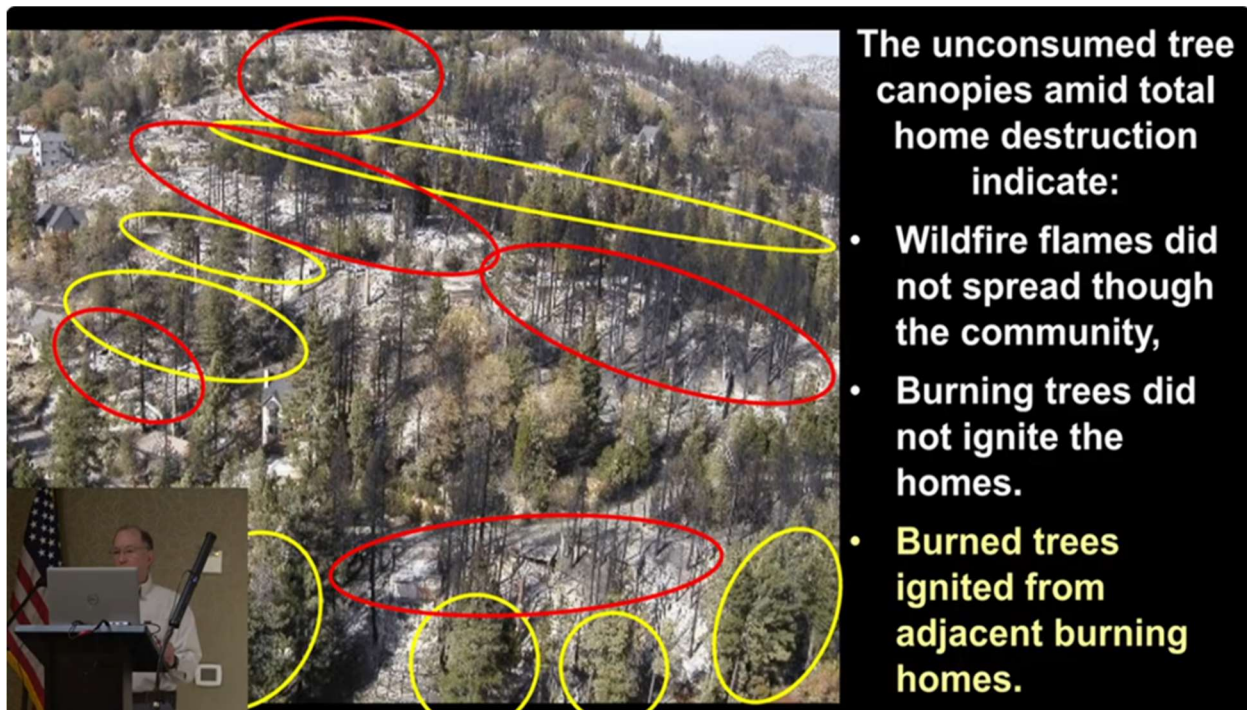
this scene the houses destroyed had flammable wood roofs, and this is eucalyptus, the big problem, right? Totally unconsumed. And all we have to do six years later is go to Australia, up inland from Melbourne, and we see totally destroyed houses in Kinglake and unconsumed eucalyptus canopies.



Or in 2017, Napa. Or in 2018, the Carr Fire. Or in Greece in 2018. And in 2020, no different: Oregon and Northern California. And a little over a year ago in Southern California, Altadena: same pattern. These aren't cherry-picked; I just select them for their photo quality.



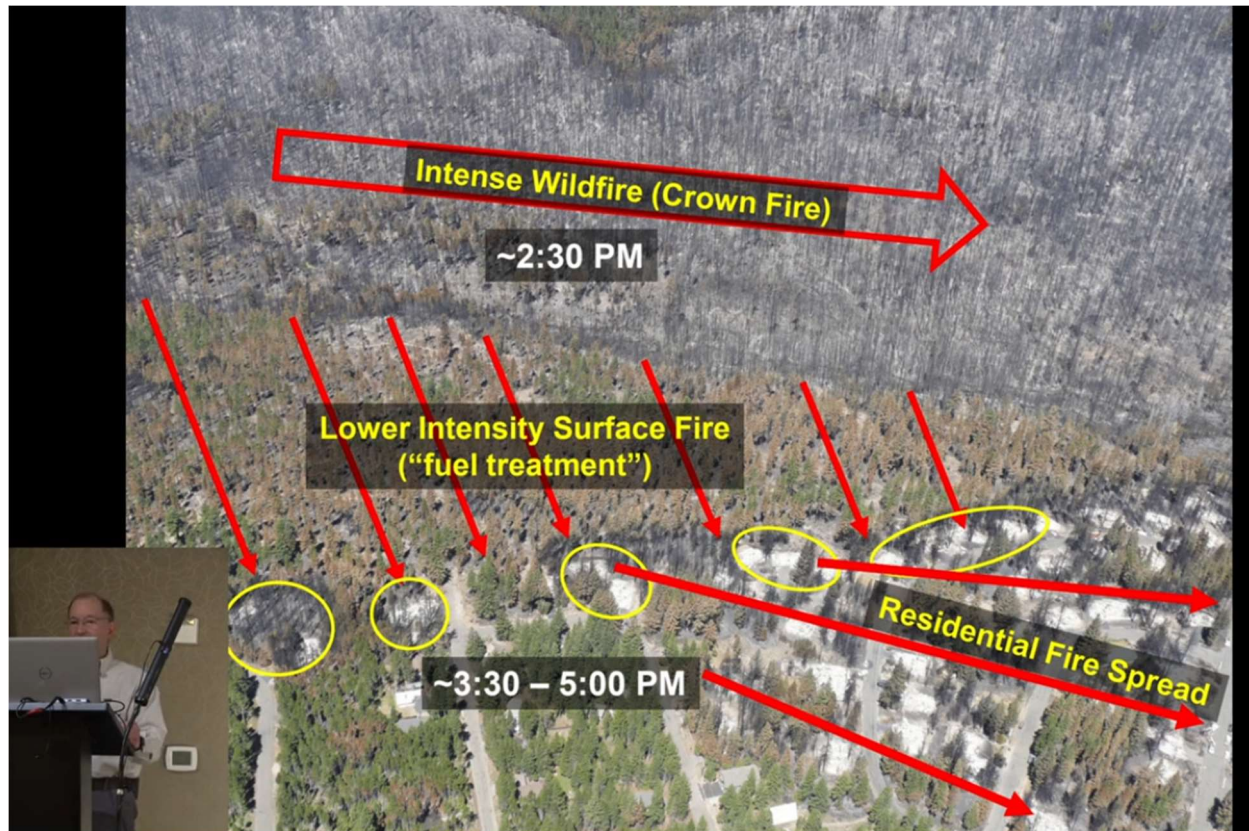
Unconsumed tree canopies amid total home destruction indicate that wildfire flames did not spread through the community. Burning trees did not ignite the homes. The burned trees ignited from the adjacent houses. *So, if you're a self-respecting tree, get the hell away from a house.*



## Communities burn after the wildfire has passed

Commonly, communities burn by fire spreading through residential fuels: the vegetation and structures within the community. Homes ignite and burn hours after significant wildfire activity has ceased at the community edge. The wildfire initiates ignitions, and then the community burns without the wildfire.

One example is South Lake Tahoe. An intense crown fire is burning down Angora Creek at about 2:30 when it passes by this part of the community. A flank fire of lower intensity burns through a fuel treatment and gets to the first five houses on the wildland side. Then between 3:30 and 5:00, the rest of the community burns.



Another example, from Southern California in the San Bernardino Mountains. *[The recording is garbled here; check the slides for the year and fire name.]* The wildfire, from an electric fault, reaches the community at about 9:30 to 10 in the morning. Roughly two and a half hours later, at this photo time, we see houses that take about 40 minutes, once flame-involved, to become a glowing debris pile. We see houses completing their combustion, with houses destroyed and unconsumed tree canopies.



Same position; we're just turning in the helicopter and looking inland about half a mile [800 m], and we see other structures burning. Let's take a closer look. There's a ring of burning structures, with structures still unconsumed inside it. If you look closely in the yellow ovals, you can just begin to see those houses becoming flame-involved. By the end, they were all destroyed in this scene.



So where was the fire department? Southern California can consume 1.2 million gallons of water and still be overwhelmed and not be able to protect. There were more houses burning than the initial attack of structure protection could handle. They were totally overwhelmed.

### **An urban fire, ignited by wildfire**

Wildfire does not spread through the community like a tsunami of flame leaving total destruction in its wake. Extreme wildfires initiate community ignitions, and burning homes primarily continue fire spread, with continuous high-density community development, without the wildfire. That makes this an urban fire disaster.



What I'm showing you are not individual homes on separate plots long distances from one another. For example, in 2000, when I was on the complexes in south-western Montana and

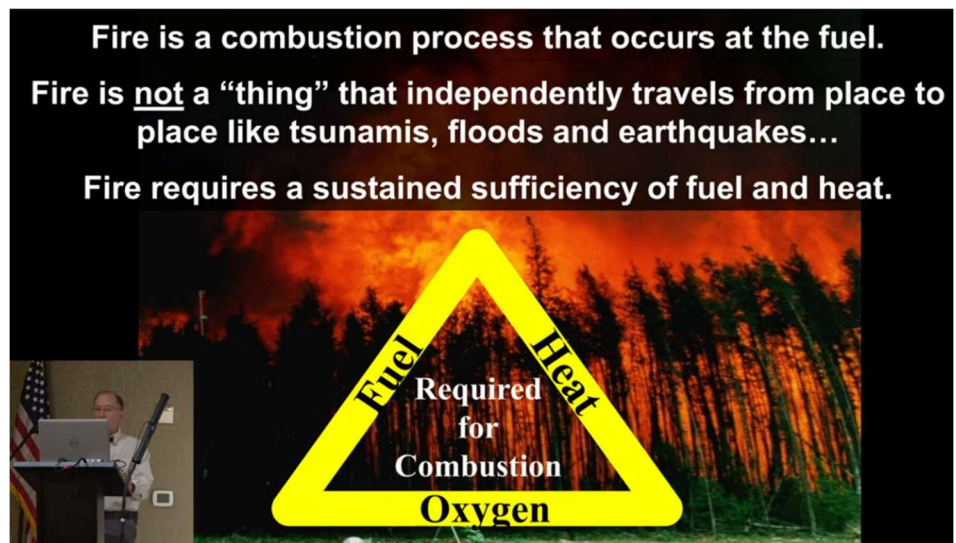
Idaho, there were only 73 houses destroyed across three complexes covering on the order of 600,000 acres.

Local conditions determine structure ignitions. Total destruction does not indicate high-intensity wildfire exposure. The wildfire did not ignite these homes. The burning community was the ignition source, and homes ignited from low intensities and burned without available structure protection.

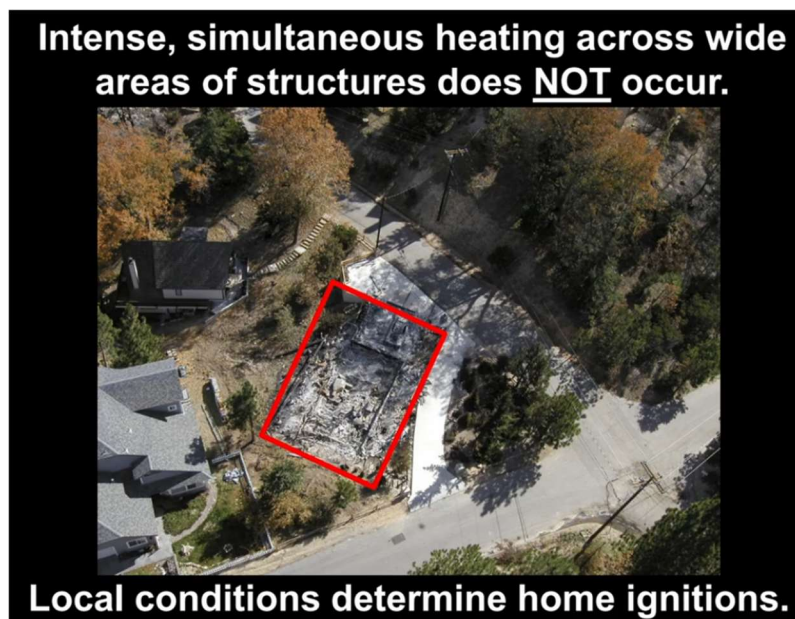
Counter to our human perception, the big flames of intense wildfires do not heat objects to ignition over large distances. Our perspective needs grounding in how fires ignite and spread by meeting combustion requirements: fuel, heat and oxygen. In this context, oxygen is always available, always sufficient. Maybe not efficient, but sufficient.

### Fire is not a travelling thing: it needs fuel and heat

Fire is a combustion process that occurs at the fuel surface. At the fuel surface. Fire is not a thing that independently travels from place to place like tsunamis, floods and earthquakes. There is no hurricane that depends on homes in order to keep spreading. But that is not the case with homes in wildfire. The wildfire continues because the homes become the fuel.



Fire requires a sustained sufficiency of fuel and heat. Fire spread occurs when ignition requirements are met locally at adjacent fuels in a stepwise ignition process, including in extreme wildfire. Because of fuel discontinuities, intense wildfire flame fronts cannot meet those combustion requirements to continue spreading into and through communities.



This is probably the best example of local conditions that I can get: intense, simultaneous heating across wide areas of structures does not occur. Local conditions determine home ignitions.

So, wildland-urban fire determined by local conditions means that the fuel is not the vegetation. The fuel we care about is the homes. The heat sources are the burning materials on and adjacent to homes, including burning embers from all sources. Without sufficient fuel and heat,

home ignitions and the resulting wildland-urban fire disasters will not occur. That makes wildland-urban fire a structure ignition problem, not a wildfire problem. Home ignitions are determined by meeting local combustion requirements, not by geographic location. Hence "interface" and "intermix" do not determine combustion.

## **The geographic classifications, “interface” and “intermix” do not determine combustion requirements!**



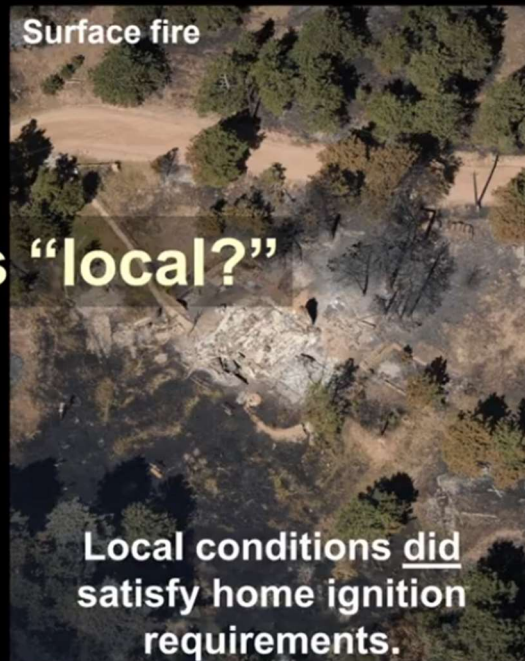
Local conditions, not wildfire intensity, determined whether these two homes would ignite. In this case, local conditions did not satisfy home ignition requirements, even surrounded by intense wildfire. In the other case, local conditions did satisfy home ignition requirements, and there was nothing but surface fire, and not even continuous surface fire.

## **Local conditions, not wildfire intensity, determined whether these 2 homes would ignite.**

Crown fire



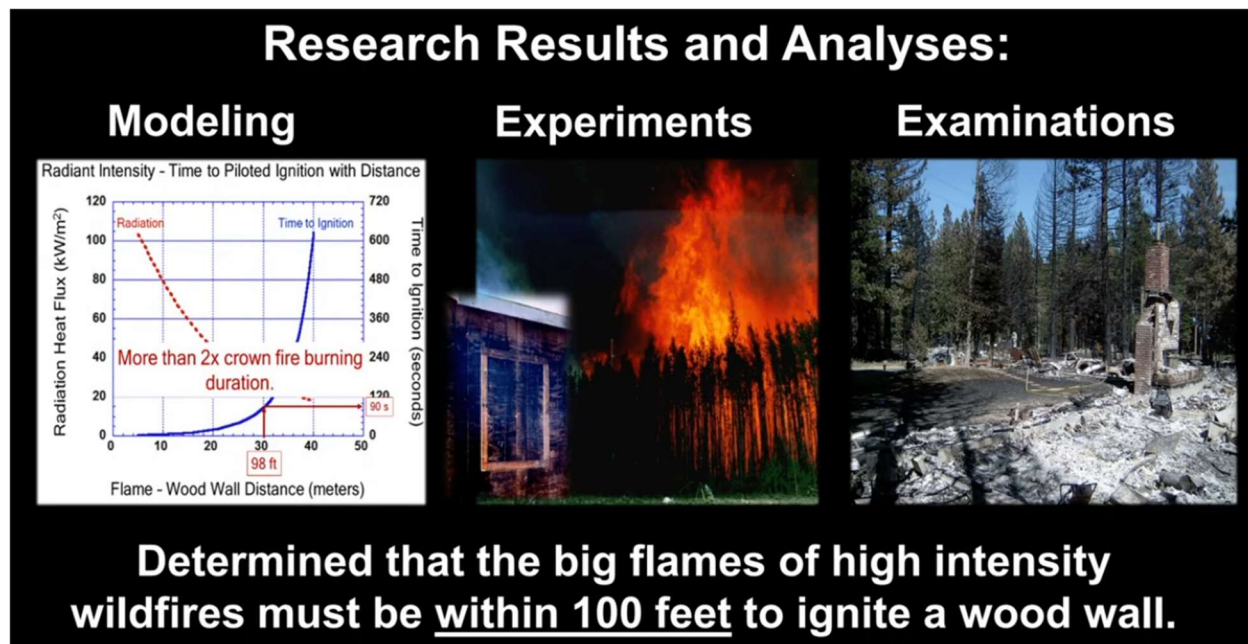
Surface fire



## How far is "local"? The research behind 100 feet (30m)

So how far is local? Before starting my formal wildland fire research, I had experienced considerable community destruction as a fire behaviour analyst and as a fire scientist with curiosity. Those observations and some examinations led me to ask questions using computational modelling experiments, laboratory and field work, and examinations of fire disasters. The examinations then led back to modelling and experiments with better research questions and verification.

The research determined that the big flames of high-intensity wildfires must be within 100 feet [30 m] to ignite a wood wall. That doesn't mean there's flame contact, because the flames are 100 feet away or so. So, crown fires must be closer than 100 feet.



Does that strike you as very reasonable? It struck me as a computational error, or a conceptual error in how I put together the model.

But I was working on safety zones for firefighters at the same time, and I suddenly realised: how would I know if that was reasonable or not? Human perceptions are based on our senses, and human skin sensitivity to thermal pain and injury is much greater than the heating requirements for wood ignition. For example, a flame radiative exposure that produces a second-degree burn on my exposed skin in 5 seconds takes over 27 minutes to ignite a wood wall. That means I'm a crispy critter and the wall hasn't even charred. So human perception of heating is irrelevant and unreliable for determining wood ignition requirements.

### Defensible space: a definition that misleads

Here is an example of a concern I have. This is the 2024 International Wildland-Urban Interface Code from the ICC, which defines defensible space as an area, either natural or man-made, treated, cleared or modified to create an area for fire suppression operations to occur. By the way, this is an old definition that has been maintained; as I recall, it started out of California in the early 1980s.

What does this imply? It implies that defensible space has to be a firefighter safety zone, and that requires several times the modelled, overestimated maximum distance for wood ignition. When I'm in the Northwest Territories doing crown fire experiments, my wood wall section at 66 feet [20 m] isn't even charring, and I'm backing off to over 200 feet [60 m]. I'm not so much worried about a second-degree burn as I can't deal with the pain on my exposed face.

## Evidence from real fires

Modelling and experiments, even full-scale field experiments, are not the same thing as a wildland-urban fire disaster situation. So how about doing the examinations? Examinations confirm the modelling and experimental results: 100 feet (30m) overestimates the maximum distance of flame wall ignition. Now I'm just talking about the flame's relationship to the structure.

Here's an example from a fire in California, the best bad example I can use. A strike team of engines was staged here to protect a line of structures, and they disengaged because of the intense fire, which you can see on the left. They perceived that intense fire was what destroyed the houses across the street. But at that particular time, those houses were not burning. The



Destroyed Structure:  
> 100 feet from large  
flames

Surviving wood  
fence: ~45 feet

closest house to the trees, which would have had the greatest radiation exposure, was about 100 feet [30 m] from those flames. But a wooden fence that survived was only about 45 feet [14 m] away.

Let's take a closer look. We see no char on the post. What we do see are rose

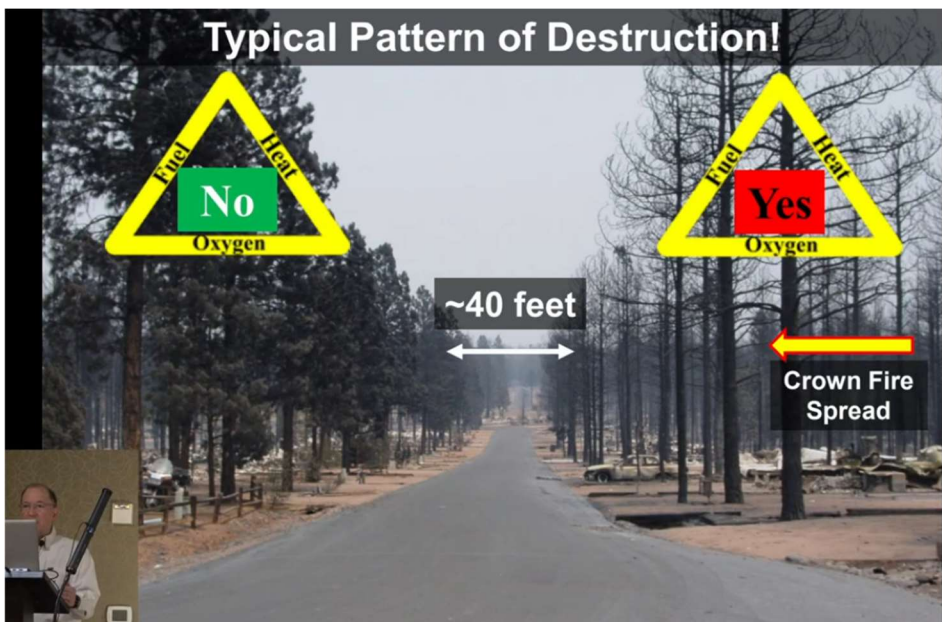
leaves that have wilted. That scorch of the leaves is the same exposure as a second-degree burn on my exposed skin, which is how we get the scorch and wilt and no char on the fence.



## The home ignition zone, and burning embers

So, what are the local conditions that determine home ignition potential during extreme wildland-urban fires? A home's ignition vulnerabilities in relation to burning embers accumulating on the home, and the flames of burning materials within 100 feet [30 m]. This local area is called the **home ignition zone**.

Here's a typical pattern of destruction. The crown fire comes in from the right in our scene. Indeed, it met the requirements for combustion, including all of the structures in that canopy. But on the left side it didn't, at least in the canopy, across about a 40-foot [12 m] gap. Does that mean fuel breaks work? Well, there was total home destruction for another three blocks without wildfire spread to the community. And structure ignitions were occurring before the crown fire ever got to the first perimeter road. So, what's going on here? Burning embers, right?



Let's look more closely at burning embers as a principal mechanism of ignition. Burning embers are inevitable during extreme wildfires. I'm showing you a worst case, but it can also be grass and light shrubs, just not quite as far. Burning embers from extreme wildfires come from beyond the home ignition zone. How does that relate to the 100 feet? Regardless of the

wildfire lofting distance, burning embers only generate ignitions when they land and accumulate on the house.

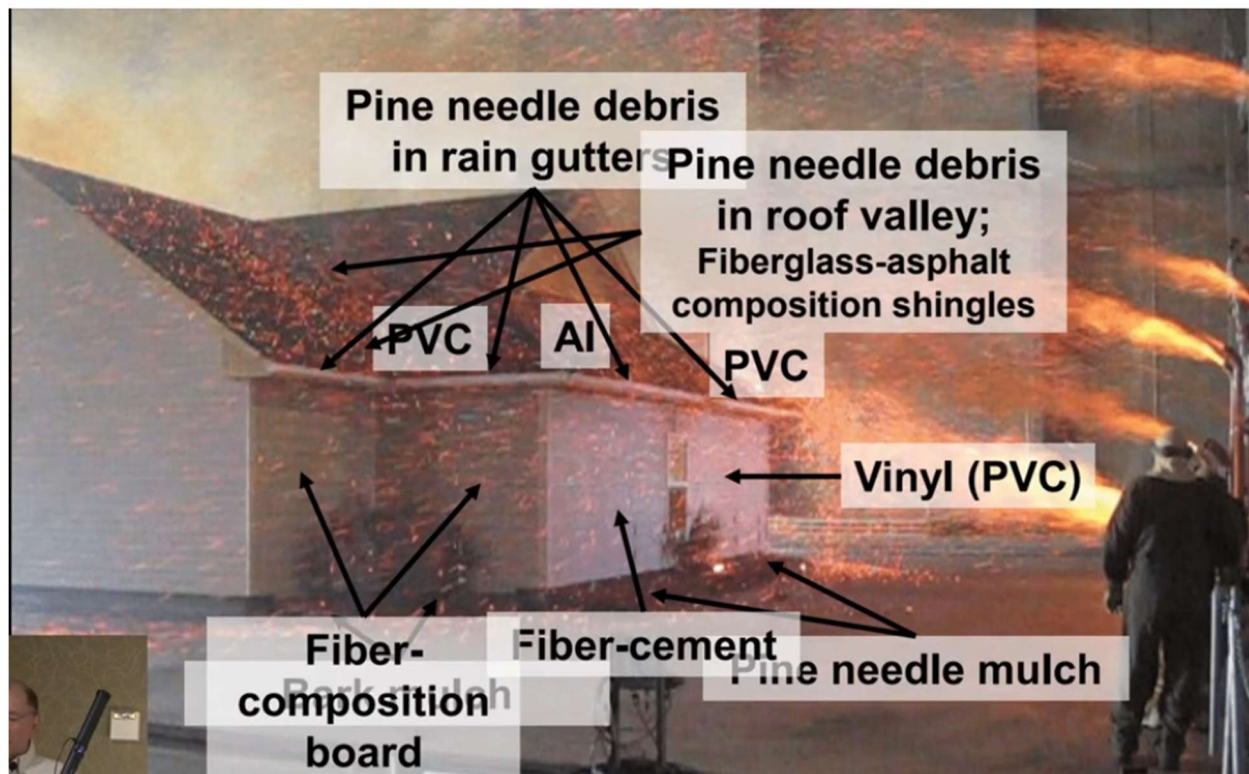
This problem is about ignition, not burning embers. Burning embers are a mechanism, but they are not effective in igniting anything unless they are accumulating on your structure. For home ignitions, that is within the home ignition zone.



### Ember experiments at the IBHS research centre

Let's look at some experiments we did a number of years ago, at the beginning of these experiments at the Insurance Institute for Business and Home Safety (IBHS) research centre. We have a full-size house. We have rain gutters: PVC, aluminium and PVC again, filled with pine needles. We have pine needles in the roof valley, on a composition shingle roof. We have pine-needle mulch within the 5-foot [1.5 m] zone, as well as bark mulch in the inside corner. Vinyl siding on one-part, non-combustible fibre cement on another, and manufactured wood-fibre board on the other.

As it turns out from recent data, these exposures are quite realistic for the short-range spotting blizzard, the burning ember blizzard. Notice that within about 15 seconds we started flame contact on the structure from spot ignitions of the burning embers in the pine needles at the base of the wall. The base of the wall is where you would expect the highest accumulation of burning embers, because they're flying in, hitting the wall and falling down to the base.



In this particular case the house is on a turntable, and they turned it about 30 degrees to the wind stream, which generated a significant constant eddy in that inside corner. You can begin to see that. Notice also that the token shrubs we put in there didn't burn until they were in flame contact with the dead material burning underneath. The PVC gutters fail and fall off. Now we only have partial flame on the eave line, but it's burning at the base. You can see how vinyl fails; in that case it's hanging there and swinging in the wind. You can expect that from other houses with siding. And we did ignite the house, which we extinguished.

### Burning houses become the ember source

Now let's look at residential fuels burning adjacent to vegetation, and sources of embers that continue community fire spread after wildfire influence has ceased. This is the end of the 2003 Cedar Fire in San Diego County, where two houses are burning, lofting burning embers out of



the burning houses. With this level of cast, the fire has penetrated through the roof and is intensifying its consumption rate. You can see the size of the embers as they hit the *[tank in the foreground; unclear in recording]* where they split up and fall to the ground.

This is an example of an ignition-resistant home ignition zone. Community wildfire risk can be reduced independently from wildfires. We can separate communities from wildfire.

## The three zones of the home ignition zone

Let's look at the organisation and dimensions of this thing called the home ignition zone. That is a home in relation to its immediate surroundings within 100 feet [30 m].

First there is what I call the no-combustion zone, not necessarily the non-combustible zone. Those two terms are very different. No combustion means you're not igniting anything from burning embers, and that means you don't have flames contacting either the house or anything else in that zone. Then there are zones one and two.



First attention needs to go to the home and flammable attachments, in relation to burning embers and combustion within 5 feet [1.5 m] of combustible building materials. A close second is no burning materials in Zone 1, from 5 to 30 feet [1.5 to 9 m] from the home, that could produce flame contact on the home or long durations of burning. And lastly, beyond 30 feet [9 m] out to 100 feet [30 m], we don't want any high-intensity burning. Notice that this also means not burning up

the trees and shrubs you value so highly around the house. So, it's not just about the house; it's also about preserving the vegetation you care about.

This home survived extreme wildfire with an ignition-resistant home ignition zone, without wildfire control. Ignition-resistant zones eliminate home ignitions from flames within the zone, that is, within 100 feet, and reduce burning-ember ignitions through building materials and design. If you have combustible building materials, you can mitigate that through the design and use of those materials where embers accumulate. The most effective wildfire risk reduction for homes and communities is creating ignition resistance within the home ignition zone.

### This home survived extreme wildfire with an ignition resistant HIZ, without wildfire control.



#### An ignition resistant HIZ:

- Eliminates home ignitions from flames within the HIZ (generally within 100 feet),
- Reduces burning ember ignitions with building materials and design.

## Shared zones and your neighbours

What about overlapped, shared home ignition zones? The urban fire part. **The physics of ignition and combustion do not change. But the social dynamics of creating and maintaining ignition resistance become extremely critical.**

The bottom line: your neighbour's home ignition potential can become yours, regardless of what you do, unless you create a bunker, an underground bunker. By the way, I worked with the Corps of Engineers at the Blue Grass arsenal in Kentucky. These arsenals, if you've ever seen one, are all bunkers, earth-burned (?) with steel doors and steel vents. That's an example of a house where your neighbour won't affect you.

High-density residential development greatly increases the potential for a disastrous urban fire conflagration. Initial home ignition zone ignitions resulting in home ignition are one part of ignition resistance. But then, in high-density development with close neighbouring homes, burning homes become a source of ignition in overlapping zones. That is a second ignition that you don't control. But it's all an ignition potential problem, not a fire spread problem. Fire spread is the result of our ignition vulnerabilities.

Uncontrollable extreme wildfire initiates numerous simultaneous ignitions in a high-density community. The community continues to burn without further wildfire influence, from structure-to-structure ignitions and community-generated burning embers: urban conflagration. High-density development requires community ignition resistance, and community structure-to-structure flame ignition resistance, to prevent that urban conflagration.

- **Uncontrollable extreme wildfire initiates numerous, simultaneous ignitions in a high- density community...**
- **The community continues to burn without further wildfire influence from ...**
  - ✓ **Structure-to-structure ignitions, and**
  - ✓ **Community generated burning embers.**

### **An Urban Conflagration**



Community ignition and fire spread resistance, however, is not fireproof. I don't ever want to hear that term again when I read the newspaper or listen to a news report. Fireproof is not reality. Sustained structure ignitions must be expected. Effective community fire protection remains necessary. This isn't about doing away with the fire department. It's about enabling fire protection. Wouldn't it be nice if we were effective when we showed up?

High density development requires community ignition resistance AND community structure-to-structure flame ignition resistance to prevent urban conflagration.



Community ignition and fire spread resistance is not a “fire proof” community!

### How the disasters occur

So how do the disasters occur? Let's start with severe fire conditions which, given an ignition, produce extreme wildland fire. Remember I defined extreme wildfire as rapid fire spread and high intensity, regardless of the fuel. Wildfire suppression is overwhelmed. It is unreliable to think that fire suppression is going to stop this problem.

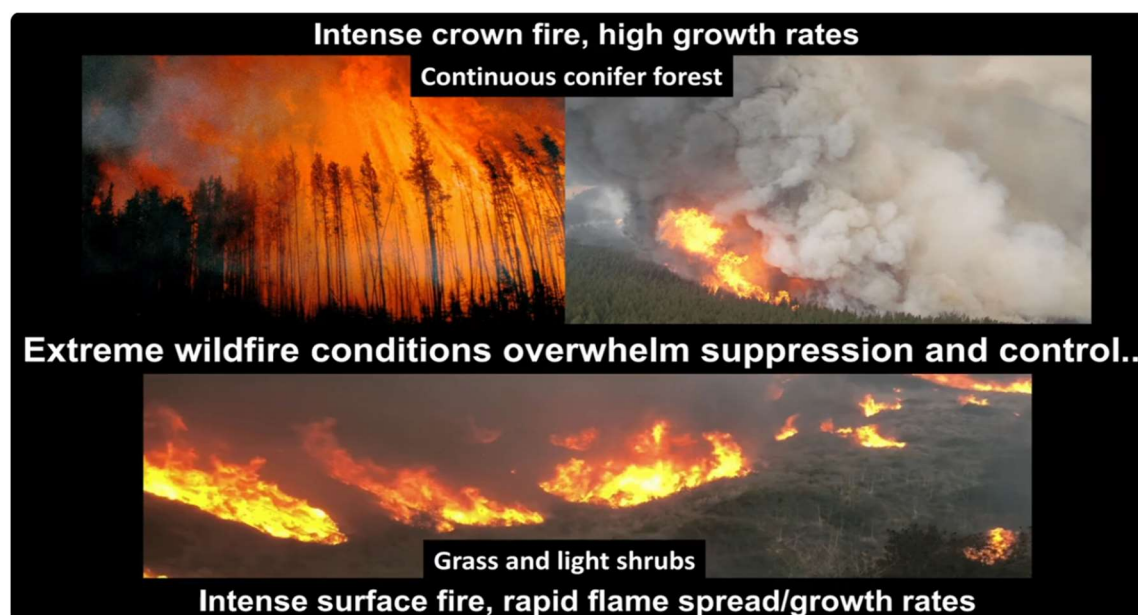


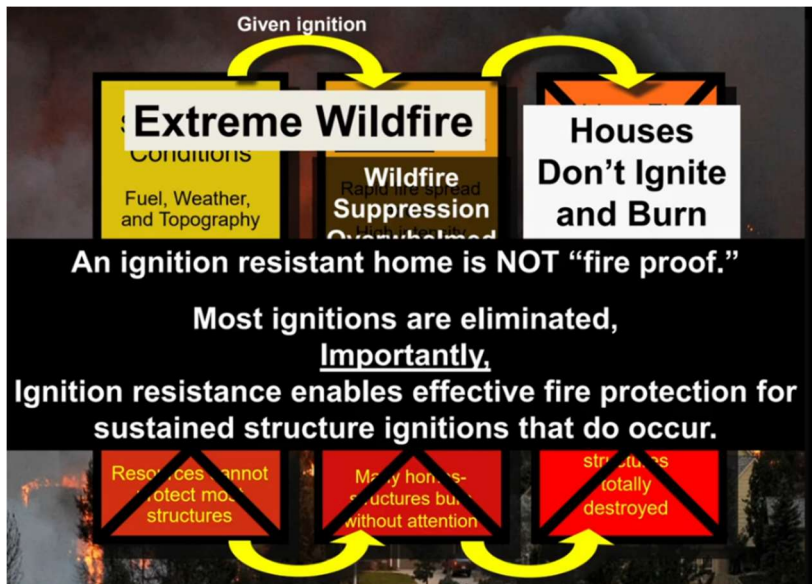
Given a vulnerable community exposed to it, we get simultaneous structure ignitions that overwhelm structure fire protection. Many homes go absolutely unattended. They free-burn to destruction, creating the disaster. Wildland-urban fire disasters have only occurred during extreme wildfire conditions when wildfire suppression was ineffective and structure fire protection was overwhelmed.

How do we attempt to prevent wildland-urban fire disasters? As a wildfire control problem. That approach has failed to prevent them.



Let's go back and look at the sequence. Extreme wildfire conditions overwhelm suppression and control, whether it's an intense crown fire with high growth rates in continuous conifer forest, or the Woolsey Fire [spelling to check], grass and light shrubs, with intense surface fire and rapid flame spread and growth rates. This is about one minute into this scene, after the initial spot fires. So, wildfire suppression is totally overwhelmed.





But if houses don't ignite and burn, then we don't have overwhelmed structure protection or community protection, we don't have free-burning houses, and we don't have total destruction and disaster.

An ignition-resistant home is not fireproof. Again, most ignitions are indeed eliminated, but importantly, ignition resistance enables effective fire protection for the sustained structure ignitions that do occur.

### Summary of the argument

Let's take a look at a summary. Extreme wildfires are inevitable. Wildland-urban fire disasters only occur during extreme wildfires, when wildfire suppression and control fails. Extreme wildfires initiate home and community ignitions but do not spread through developed communities. Community fire destruction largely occurs after the wildfire influence ceases. Home and structure ignitions are determined within the home ignition zone. Ignition-resistant homes, and collectively communities, can significantly reduce community wildfire risk without necessarily controlling extreme wildfires.

### Wildland-Urban Fire Summary

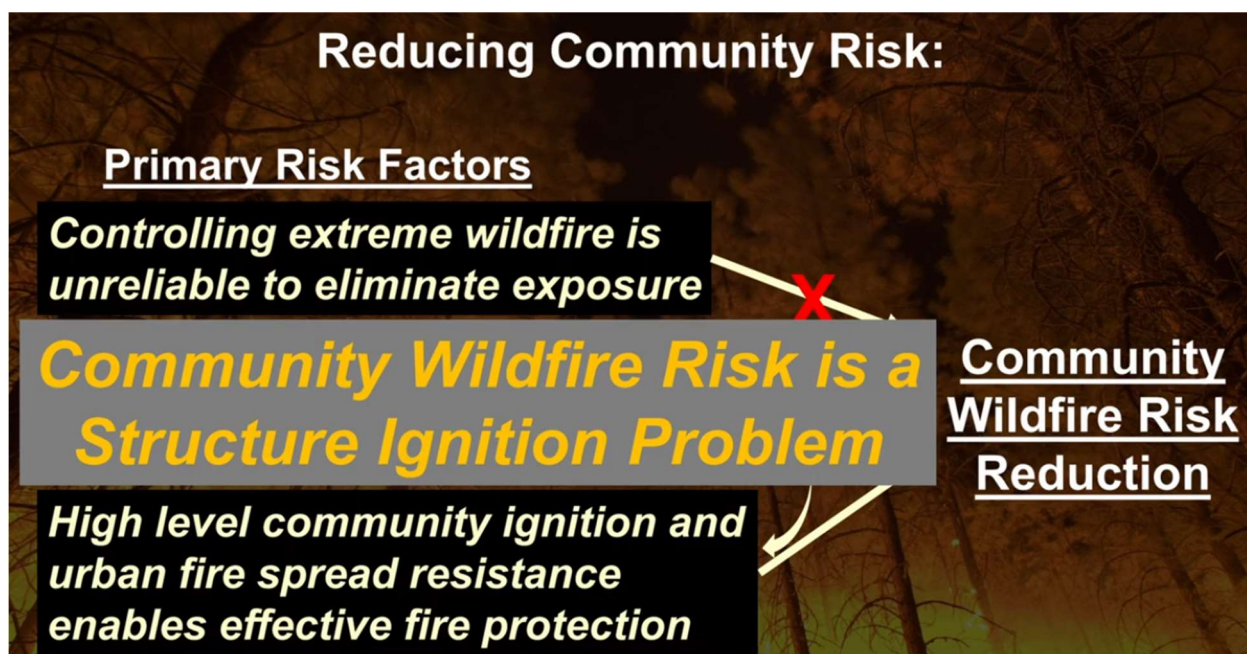
- Extreme wildfires are inevitable;
- WU fire disasters only occur during extreme wildfires when wildfire suppression and control fails;
- Extreme wildfires initiate home and community ignitions but do not spread through developed communities;
- Community fire destruction largely occurs after wildfire influence ceases;
- Home-structure ignitions are determined within the HIZ;
- Ignition resistant homes (HIZs), and collectively, communities can significantly reduce community wildfire risk without necessarily controlling extreme wildfires.

### Framing it as a risk analysis

Let's frame this problem as a risk analysis. There are three primary risk factors. First, the ignition hazard: the extreme wildfire exposure. Second, the ignition response of the structures: the ignition vulnerability. Third, ignition intervention: the structure protection capability. Together they produce the community wildfire risk.



How do we reduce community wildfire risk? What about the ignition hazard? Controlling extreme wildfire is unreliable for eliminating the exposure to the community. On ignition response, community ignition and urban fire spread resistance can eliminate most ignitions.



And high-level community ignition and urban fire spread resistance enables effective fire protection, and that reduces wildfire risk.

Community wildfire risk is a structure ignition problem. But I also want to address the fire protection issue. Community ignition resistance does enable community fire protection.

**However, effective community fire protection requires tactics appropriate for numerous simultaneous, small, sustained home ignitions across a community area. That's the context of this fire issue. If we don't match that context, we fail.**

## What effective fire protection looks like

### Community Fire Protection Effectiveness

» Enabled by community ignition resistance; however,...

**Effective community fire protection requires tactics appropriate for numerous, simultaneous, small sustained home ignitions across a community area.**

**The WU fire protection context requires:**

- ✓ Numerous, small, highly mobile firefighter units,
- ✓ Widely distributed,
- ✓ Smaller amounts of water,

**To find and extinguish community-wide home ignitions.**

**Urban engines provide backup for flaming homes.**

The wildland-urban fire protection context requires numerous small, highly mobile firefighter units, widely distributed, with smaller amounts of water. This is not a fire inundation issue, which is the typical structure fire response. If a structure is highly involved in fire under extreme conditions, it's triaged as gone, and attempted exposure protection will fail because of the reduced fire protection effectiveness. You simply can't deliver water in a 70 mph [113 km/h] wind.

To find and extinguish community-wide home ignitions, we have urban engines provide a backup, rather than half a mile of staged engine strike teams.

In summary, wildland-urban fire disasters are most effectively defined as a home and structure ignition problem, not a wildfire control problem. An effective approach for preventing them is to create ignition-resistant home ignition zones and, collectively, ignition- and urban-fire-spread-resistant communities.

### **Risk Analysis Summary:**

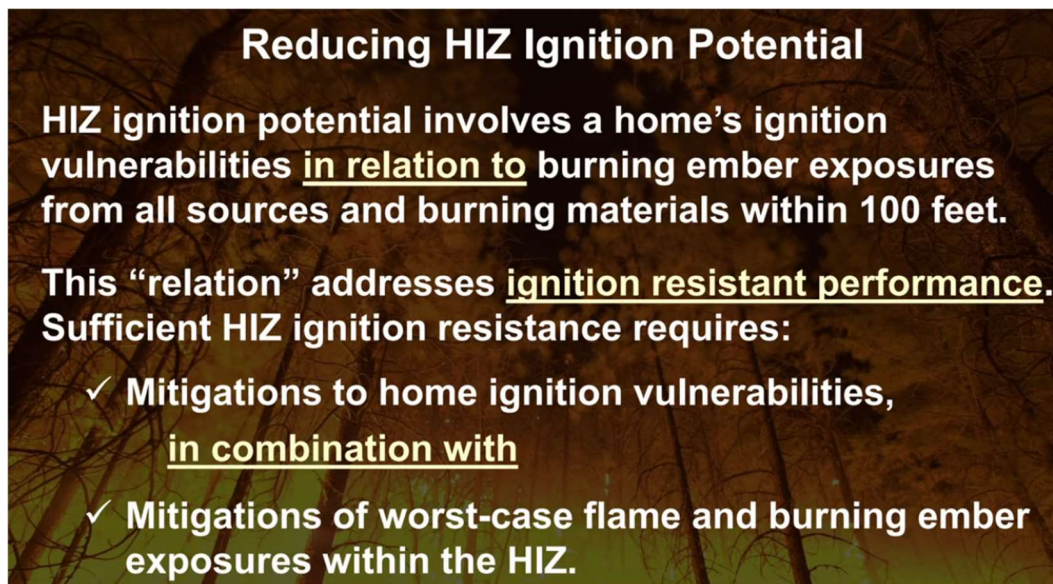
- ✓ **WU fire disasters most effectively defined as...**
  - **A home-structure ignition problem, not a wildfire control problem.**
- ✓ **Effective approach for preventing WU fire disasters...**
  - **Create ignition resistant HIZs, and collectively, ignition and urban fire spread resistant communities;**
- ✓ **Wildland fuel treatments do not reliably prevent extreme wildfires from spreading to communities.**
  - **The greatest fuel treatment effect on ignition and fire behavior is within the fuel treatment – within the HIZ.**

## Fuel treatments: where they work

Wildland fuel treatments do not reliably prevent extreme wildfires from spreading to communities. The greatest fuel treatment effect on fire behaviour, ignition and fire behaviour is within the fuel treatment. Everybody in wildland fire knows that when they do a fuel treatment, it's to do something in there that gives them a chance to do something out there. In this particular case, the most effective treatment is within the community.

Home ignition potential involves a home's ignition vulnerabilities in relation to burning ember exposures from all sources and burning materials within 100 feet [30 m]. This relationship addresses ignition-resistant performance. Sufficient home ignition resistance requires mitigation of home ignition vulnerabilities in combination with mitigation of worst-case flame and burning-ember exposures within the home ignition zone.

Here is an example of removing vegetation that might reduce wildfire intensity. The result: a resilient forest and a destroyed structure. We don't know explicitly how this cabin ignited. However, here is what wasn't done to reduce ignition risk: a stack of firewood under the porch, a stack of firewood next to the porch, and continuous cured grass all the way up to the structure. So, mitigating the cabin and the adjacent ignition factors would have been very important.



**Reducing HIZ Ignition Potential**

**HIZ ignition potential involves a home's ignition vulnerabilities in relation to burning ember exposures from all sources and burning materials within 100 feet.**

**This "relation" addresses ignition resistant performance.**

**Sufficient HIZ ignition resistance requires:**

- ✓ **Mitigations to home ignition vulnerabilities, in combination with**
- ✓ **Mitigations of worst-case flame and burning ember exposures within the HIZ.**

A fuel treatment appropriate for fire-resilient landscapes does not reliably create an ignition-resistant home ignition zone.

And let me emphasise that ignition resistance in the home ignition zone is a very small

location compared to the wildland. Many of the mitigations we do are permanent with maintenance, like materials and design. A sufficiently ignition-resistant home ignition zone can physically separate a home, and collectively a community, from wildland fire, which is required for restoring and sustaining fire-adapted landscapes.

## Closing: two problems, one connected solution

These homes survive without wildfire control. Wildland-urban fire disasters can most effectively and practically be prevented by creating ignition- and urban-fire-spread-resistant communities.

So, we've got two separable wildland fire problems. Community ignition and urban fire spread resistance most effectively creates fire-adapted communities. But eliminating the wildfire paradox, by restoring and maintaining appropriate ecological wildland fire in all fire-adapted regimes, most effectively creates fire-resilient landscapes.

But ironically, and profoundly important, is that reducing wildfire suppression to avoid the wildfire paradox, and restoring wildland fire as an appropriate natural disturbance in fire-adapted landscapes, will require ignition- and fire-spread-resistant communities.

**These homes survived without wildfire control.**



**WU fire disasters can be most effectively and practically prevented by creating ignition and urban fire spread resistant communities ...**

***Ironically & Profoundly Important***

**Reducing wildfire suppression to avoid the “wildfire paradox” and restore wildland fire as an appropriate *natural disturbance* in fire-adapted landscapes...**



**Will require ignition and fire spread resistant communities.**

Basically, this is the invert of what we do. We think we do wildland treatment in order to protect communities, when in fact, in order to restore wildland fire as an appropriate ecological process, we have to have ignition-resistant communities. Why?

Because we've got, let's say, 300 million acres of fire-adapted ecosystems, and we're not going to restore wildfire as an appropriate ecological process 100 acres at a time in explicitly controlled prescribed fire.

That means that at some point in the transition we're going to have wildland fires that freely burn during moderate conditions, mostly over weeks at a time. And right now, we aren't there. So, making our homes and communities ignition resistant means having wildfires without wildland-urban fire disasters. Thank you.

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Source: CWFC 2026 Keynote, Community Wildfire Risk and Fire Resilient Landscapes, Dr Jack Cohen. Fire Adapted Colorado Network, YouTube, 20 May 2026. Cleaned for readability (filler words and false starts removed, speech-to-text errors corrected); content otherwise as spoken. Prepared for the Brown Hill FireAware Network, not for publication in this form.