Verisk™

Fuel to the flame:

A review and analysis of wildfire risk in 2021 and beyond

Another year of intense wildfire activity

It's a testament to how catastrophic wildfires have become that the 2021 season—where nearly 59,000 fires scorched over 7.1 million acres and caused billions in losses—has been viewed as something of a "reprieve" from a punishing 2020.[1]

While the 2021 season may not have eclipsed the scope of 2020's record-shattering devastation, Verisk's analysis shows it was no less notable:

- **For the first time ever, a wildfire burned its way from one side of the Sierra Nevada mountain range to the other—and not once, but twice.**
- **The massive Bootleg Fire in Oregon was credited with creating dangerous new weather patterns all the way on the East Coast.**
- **The Caldor Fire surged close enough to the popular tourist destination of Lake Tahoe to cause tens of thousands to evacuate and businesses to shutter during the busy tourist season.**
- **Finally, the Marshall Fire, which burned into the new year, set a dangerous new example of damages resulting from the movement of fires through concentrated urban areas.**

The impact of 2021's fires were visible across the country, as the jet stream captured western plumes and carried them to New York City. East Coast residents experienced murky, hazy skies, while residents closer to the fires felt an acute degradation of air quality. Indeed, research published in late 2021 suggests that exposure to fine particulate matter produced by wildfires is responsible for 35,000 deaths a year globally, including an estimated 3,200 annually in the United States.[2]

For many insurers, wildfires continued to be a costly peril, resulting in an estimated $4 billion in losses, according to Property Claims Services®, a Verisk business. And, for many insurers, the scope of that exposure may be growing. According to Verisk's analysis of permit data, building continues to march upward in areas that are at a high risk of wildfire, including Riverside County, CA, where new construction was up 85% from the second half of 2019 to the second half of 2021.

The culmination of these factors illustrates that the need for mitigation activities to promote preparedness and resiliency are more essential than ever. As insurers, firefighters, communities, and homeowners at large seek greater insight into this space, Verisk continues to invest in research and education on this topic at both the parcel and community levels.

The Marshall Fire

All wildfire risk is local: How Verisk analyzes wildfire risk

Wildfires may sometimes be unpredictable once unleashed, but there are multiple, quantifiable factors that can contribute to wildfire risk. Fireline®, Verisk's wildfire risk management tool, considers these factors closely. They include:

Fuel: Fire needs something to burn. Trees, shrubs, and other vegetation are fire's food. Dense vegetation, or vegetation that's close to a structure, can be a significant risk factor. Conversely, the risk can be mitigated by clearing away this vegetation and creating defensible perimeters around property.

Terrain: Topography can help determine how fire spreads. Characteristics such as slope (the incline of a hillside) can shape the movement of winds and the speed and direction of fires, while natural barriers (lakes, rocks, etc.) can limit or slow the spread of wildfire.

Roads: Can firefighters reach the blaze quickly? Road access can sometimes mean the difference between widespread destruction or more limited damage.

Wind patterns: Recurring wind patterns with benign names like Santa Ana and Sundowner can carry embers aloft and potentially spark new fires. Heated by fire, these winds can also act like an atmospheric blast furnace, making firefighting more difficult. Understanding those wind patterns and the geographical areas influenced by them is a key factor we consider when analyzing wildfire risk.

Special hazard zones: Wildfire may pose a direct threat of physical damage, but even areas outside of a blaze can suffer a range of disruptions. Verisk defines special hazard zones as areas that may have relatively lower risk of fire but may still experience the effects of smoke and ash and business interruption from evacuations and business closures.

Weather patterns and climate: As the Earth's surface temperature continues its march upward, many areas of the U.S. are becoming hotter and drier. Prolonged droughts can create ideal conditions for fires to start and spread. As can the early arrival of spring: According to one study, spring in the North Hemisphere is arriving an average of ten days earlier than it did in the 1950s.[3] The early spring snowmelts can set off a chain reaction: Reservoirs swell with snow-melt and are released sooner, leaving vegetation to dry out faster ahead of the summer heat.[4]

Fire begets fire: How climate change is fueling a global risk

Destructive wildfires aren't a uniquely American burden. Driven by extreme heat—July 2021 was the hottest month ever recorded globally and the second hottest July in European history—the European Union saw between 1.2–1.6 million acres burned last year.[5] Wildfires in Russia also belched up so much smoke that it wafted into the North Pole (a first). In fact, fires in Siberia grew so large that at one point they were bigger than all the fires raging in the world, combined.[6] Turkey, Italy, Greece, and Lebanon all experienced catastrophic blazes in 2021 as well.

It's become increasingly obvious that wildfires and climate change are locked into a dangerous feedback loop.[7] In several countries in 2021, wildfires spewed records amount of heat-trapping carbon and methane into the atmosphere.[8] This carbon contributes to rising temperatures and, in turn, drought conditions. At the same time, forest acreage lost to fire can't act as a carbon sink to pull those emissions from the atmosphere. It's a lose-lose scenario: A warming, drought-prone planet produces the conditions for further droughts and more fires.

A similar loop can occur at the local level, as was seen last year in California when massive wildfires created their own mini weather systems.[9] These systems generated powerful 100 mile- per-hour winds, lightning, and even fire tornadoes that could ignite new blazes in their wake.[10]

In the summer of 2021, the United Nations Intergovernmental Panel on Climate Change released its Sixth Assessment Report on climate change, its first update since 2014. The report noted that a warming planet is likely to produce more droughts, more variable rainfalls, higher land temperatures, and more storms that produce lightning—collectively, many of the ingredients to spark more and more severe wildfires.[11] Under even the most optimistic scenario—where the world achieves net zero greenhouse gas emissions by 2050—global surface temperatures would continue to rise until the middle of the century, if not longer.[12] As temperatures rise, so does the risk of wildfire.

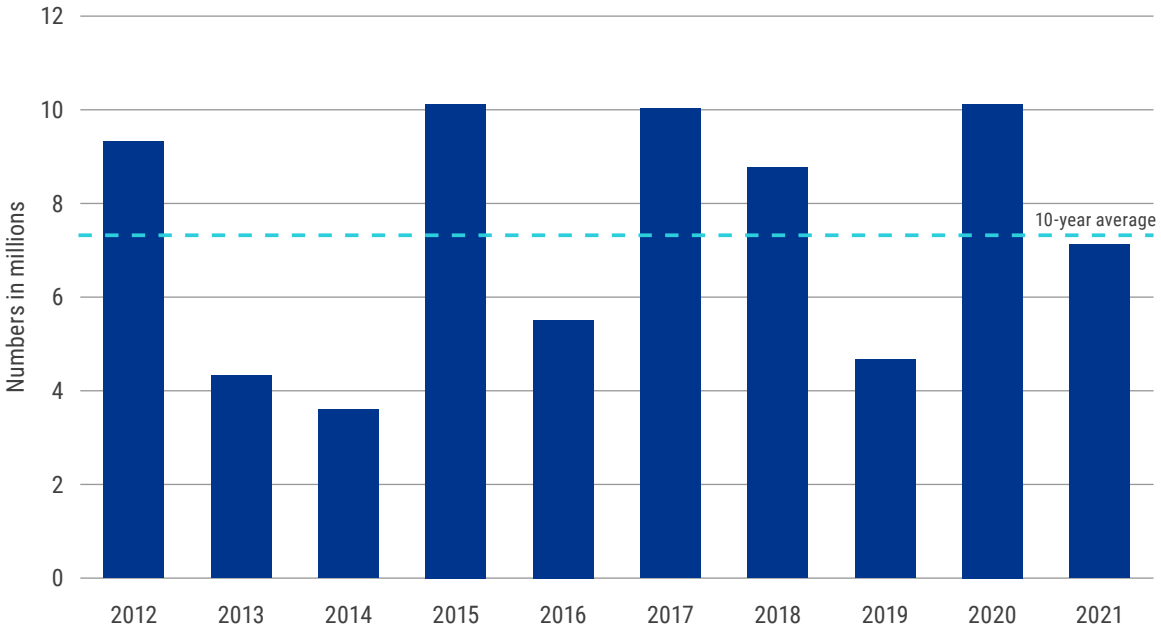
What could that mean in practice? Data from Verisk's extreme event solutions suggests an upward trend in insured losses over the last two decades, despite the fact that the frequency of wildfires in the United States has been relatively steady. The trend indicates that the rise in insured losses from wildfires is driven primarily by an increase in the number and value of exposed properties in high-risk areas.

One way to prepare is to use a probabilistic approach that considers today's environment and conditions to provide a realistic view of wildfire risk not achievable with historical experience alone.

2021 wildfires in review

In 2021, much of the American West was plagued with some of the most intense drought conditions of the past century, which, compounded by lightning activity and frequently above-normal temperatures, helped to fuel approximately 59,000 wildfires, according to the National Interagency Fire Center. These wildfires burned over 7.1 million acres—slightly under the 10-year average of 7.3 million acres burned, and nearly 3 million fewer than the 10.1 million acres torched in 2021.[13]

Reported acres burned

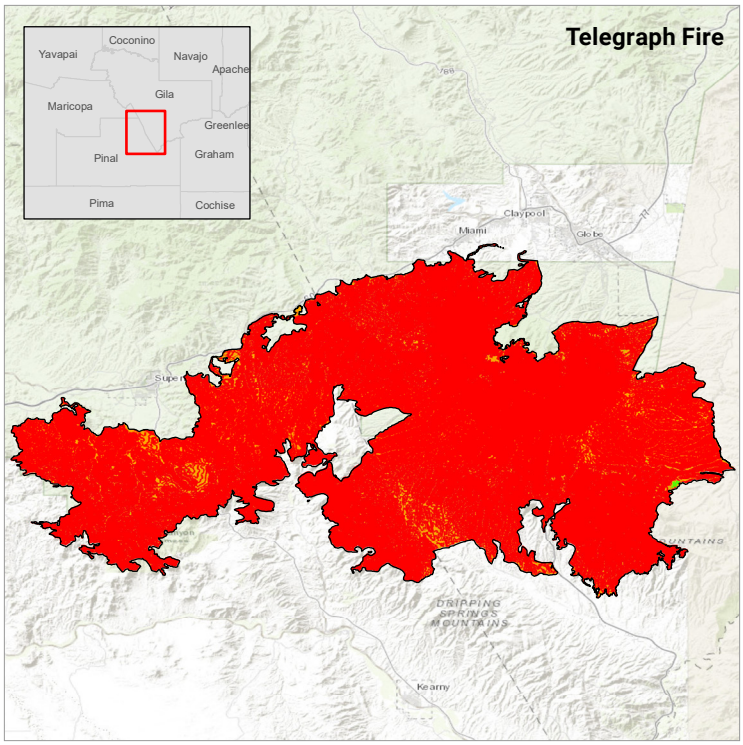


Although fewer acres burned in 2021 compared to the record-breaking 2020, there was still a modest year-over-year increase in the number of wildfires (35). California also had a notable 2021. In addition to two fires crossing the Sierra Nevada mountain range, four of the top 20 largest fires in California history occurred last year.[14]

Other areas of the United States also experienced large and destructive wildfires, particularly Arizona, Oregon, and Colorado.

Telegraph Fire

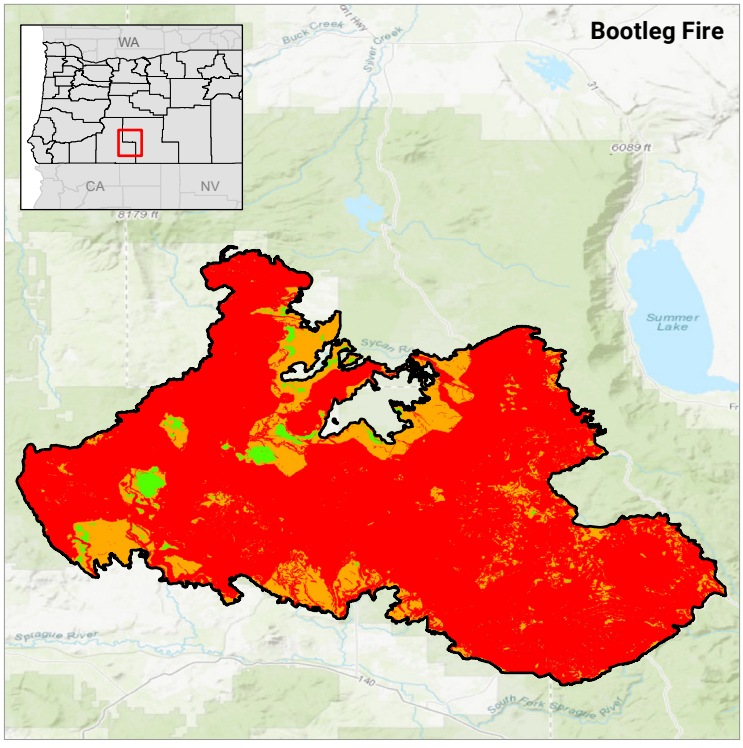
For the first half of the year, the largest fire was the Telegraph Fire, which burned over 180,000 acres in south-central Arizona, damaging over 50 structures and prompting evacuations across multiple jurisdictions. Efforts to fight the Telegraph Fire were, at times, hindered by high temperatures, which impeded the performance of firefighting equipment. After burning for four weeks, the Telegraph Fire was contained on July 2, 2021.[15] According to FireLine, over 95% of the area affected by the Telegraph Fire was at high to extreme risk.



Bootleg Fire

Oregon's largest fire was also the second largest of the year, torching over 410,000 acres in Klamath and Lake Counties. And it was a long one: The blaze sparked in early July and was not fully contained until October. According to the most recent FireLine risk reports, Klamath County was in the top five counties in Oregon at high-to-extreme risk of wildfire, and over 80% of the areas affected by the fire were at high and extreme risk of wildfire. Affected areas saw over 400 structures burned and several thousand residents evacuated.

The Bootleg Fire inspired numerous headlines about the impact of wildfire on weather patterns both near and far from the site of the fire.[16] Nearby, the Bootleg Fire's clouds of hot smoke spawned fire tornadoes, intensifying the fire's strength and complicating firefighting efforts. And roughly 3,000 miles away, smoke pushed into the atmosphere by the massive fire caused murky, smog-like conditions in cities across the East Coast.



Monument Fire

Also among the most severe wildfires of the 2021 season was the Monument Fire, which cracked the top 20 largest California wildfires of all time, at number 14, after burning over 220,000 acres, primarily in Trinity County, California. Caused by lightning in July, the Monument Fire was not fully contained until early November.[17]

According to FireLine, approximately 98% of the area impacted by the Monument Fire was at high to extreme risk of wildfire. In addition, Trinity County was the number two county in California with the highest concentration of housing units in high to extreme wildfire risk categories, with over 82% of those properties falling into those categories.

Jumping the Sierra Nevada

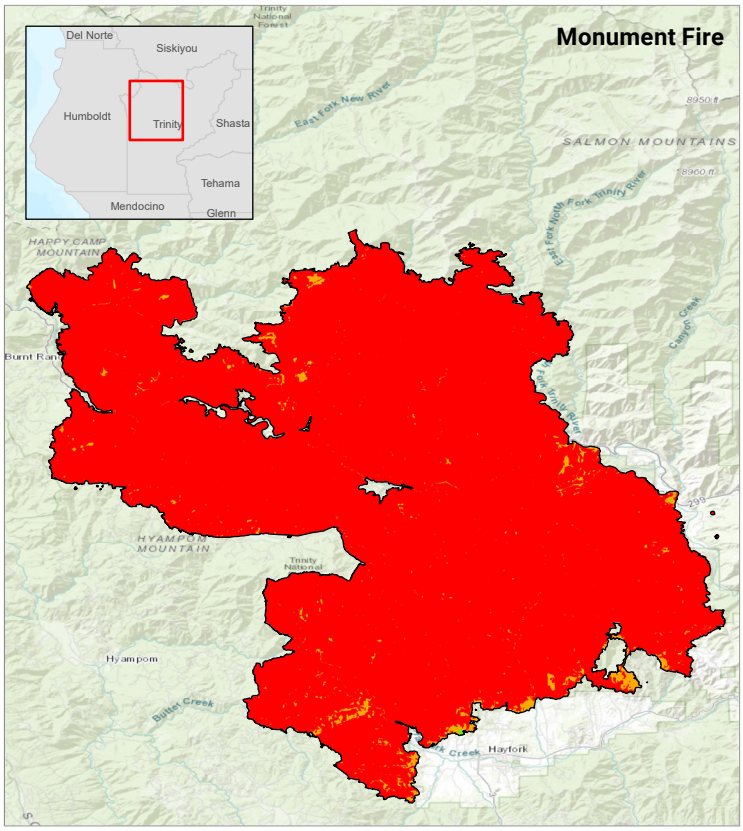
The danger of fire encroaching on densely populated locations and business districts was brought into sharp focus in 2021, as wildfire crossed the Sierra Nevada for the first time during the Dixie Fire, and again shortly after during the Caldor Fire, which threatened the vacation community of South Lake Tahoe.

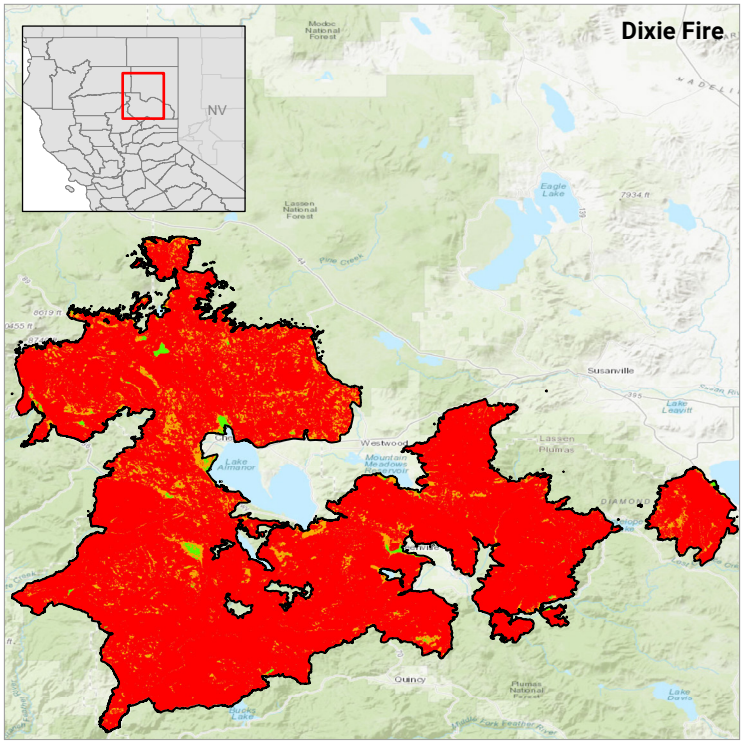
According to our analysis of residential permitting data, there were more residential building permits issued in wildfire prone areas of California in 2021 than in 2019. Driven, perhaps, by a pandemic-fueled desire to relocate outside of urban centers to more natural surroundings and increasing opportunities to work remotely, homeowners appear drawn to high-risk areas—a trend highlighted in sharp relief by two of the most destructive wildfires in 2021: Dixie and Caldor.

Dixie Fire

The Dixie Fire was the largest fire of 2021 by a wide margin; it burned over 960,000 acres, making it the second largest wildfire in California history, trumped only by the August Complex Fire in 2020. The Dixie Fire burned in Butte, Plumas, Lassen, Shasta, and Tehama Counties, damaging over 1,300 structures from July to October 2021.[18]

The Dixie Fire was the first ever fire known to jump the Sierra Nevada, a historic feat that occurred a month into its duration.





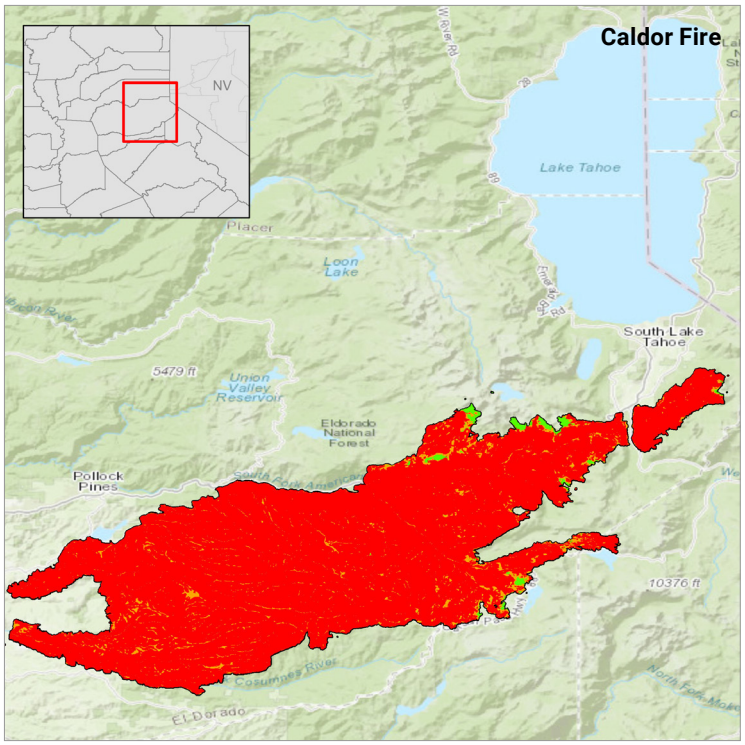
Caldor Fire

The Caldor Fire quickly followed the Dixie Fire's ascent into unprecedented territory. The fire, which burned 221,000 acres and damaged over 1,000 structures, was particularly notable for two reasons. First, it became the second fire ever known to cross the Sierra Nevada only a couple of weeks after the Dixie Fire. Second, its proximity to South Lake Tahoe prompted tens of thousands of residents to evacuate and threatened millions of dollars in real estate before the fire was fought away from the resort community.[19]

The Caldor Fire burned in Alpine, Amador, and El Dorado counties. Alpine County is the top county in California by highest concentration of housing units in high to extreme wildfire risk categories, according to the most recent FireLine Risk Reports, at 89%.

According to FireLine, 90 and 95% of the areas in which the Dixie and Caldor fires occurred, respectively, were at high to extreme risk of wildfire.

Sophisticated and innovative new technology from Verisk's Atmospheric and Environmental Research division was able to continuously monitor active wildfires in the United States, capturing the Caldor Fire's very rapid growth as it more than doubled in size within the first 24 hours. FireLine continually incorporates technological advancements from Verisk's Atmospheric and Environmental Research division, which benefit from ongoing work with NASA and the U.S. Department of Defense.



The Caldor Fire

Insurers cope with volatile reconstruction costs with current data

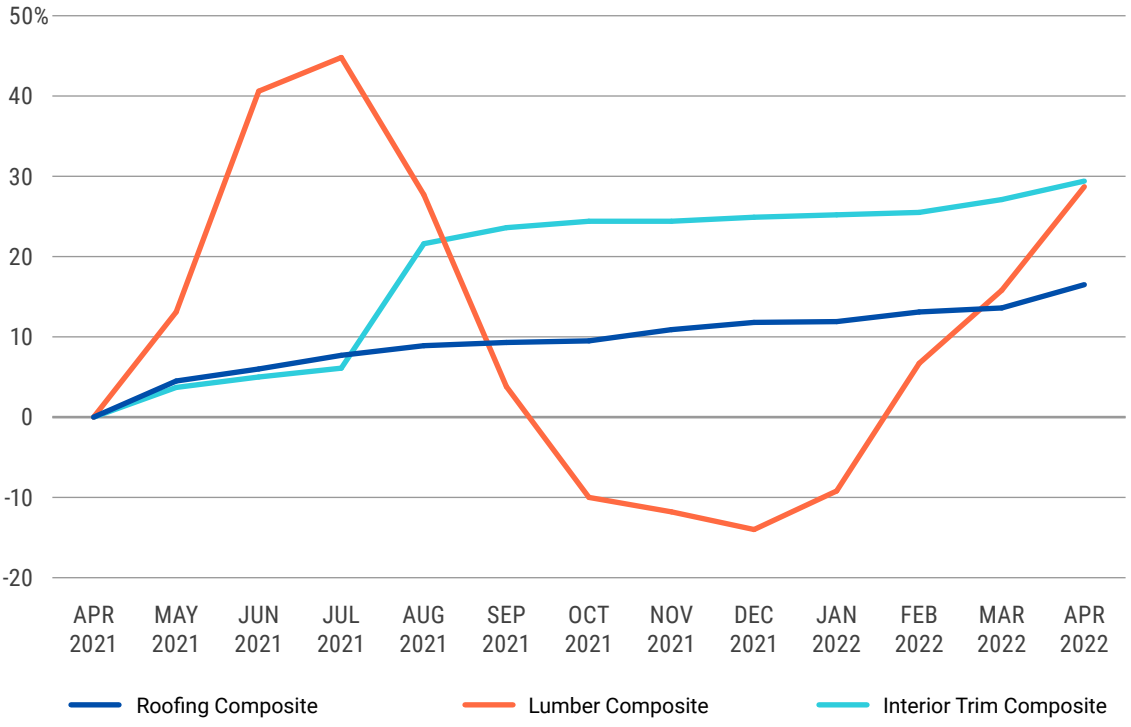
As the Dixie and Caldor Fires underscore, the percentage of at-risk properties introduces another consideration for many insurers: Reconstruction costs. If a property is destroyed or damaged by wildfire, it's important for insurers to understand the full costs associated with repair or replacement. Reconstruction costs can change over time and at different rates, down to a very localized level.

For insurers evaluating wildfire risk, the challenge of the 2021 wildfire season was compounded by pandemic-induced supply chain disruptions and volatile reconstruction costs.

According to Verisk data, materials specifically experienced a large spike driven partially by lumber prices, which peaked in July 2021. Where wood-frame structures must be rebuilt from the ground up, lumber becomes the largest component of materials costs. While rising more moderately now, prices are still above prior-year levels.

Supply-chain issues may have contributed to spikes in prices. Lumber-derived goods, such as interior trim, also have seen significant jumps, adding to the increases in the material category. Roofing material composite costs rose steadily from April 2021 to April 2022, up 16.5 %year-over-year, and recent volatility in oil prices could also affect the cost of petroleum-derived asphalt shingles. Roofing, lumber, and interior trim are key components in building a property.

Percentage change in costs



Labor costs also have grown steadily over time. And in the event of a wildfire creating a dense concentration of damaged or destroyed properties, meeting the highly localized demand for labor can be difficult. Workers may need to come from a greater distance, adding significant costs. Numerous specialists also may be involved in rebuilding. Shortages have expanded to labor as well as materials, with the resulting cost increases most acutely affecting plumbers, general framing carpenters, and electricians.

These escalating costs underscore just how important mitigation and loss control efforts continue to be in an era of heightened wildfire risk. For insurers, understanding what steps communities are taking to enhance their wildfire defenses can be critical underwriting intelligence and encouraging these efforts

can help reduce future wildfire losses. For communities in the crosshairs, educating themselves on best practices for fire presentation and mitigation can save lives and property. These efforts become doubly important when you consider that, despite the well-publicized threat of fire, people continue to flock to at-risk areas.

This trend, of escalating building costs in conjunction with high population density in at-risk areas, converged with the Marshall Fire.

The Marshall Fire

The Marshall Fire burned more than 1,000 structures across 6,000 acres in Boulder County, CO, during a brief period spanning late 2021 and early 2022.[20]

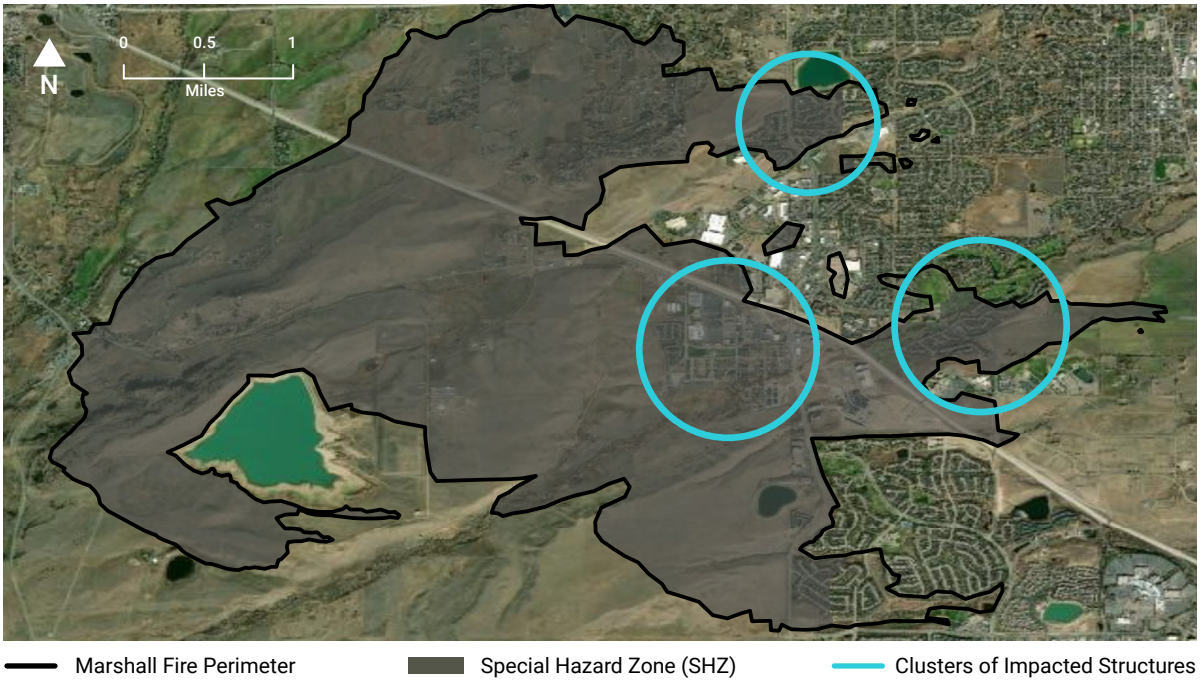
The event wasn't a traditional wildfire but an urban conflagration—a fire that spreads across natural or artificial barriers. Still, evaluating natural factors that contributed to the fire's spread, especially wind patterns, helps illuminate which parts of the Boulder area bore especially high risk.

The FireLine Risk Report for Colorado identified Boulder County among the top three in the state for number of housing units at high or extreme wildfire risk (24,600). Damage caused by the Marshall Fire occurred primarily within FireLine Special Hazard Zones—areas adjacent to wildlands with exposure to urban conflagrations and other types of fire-related loss that can occur when high winds spread fire quickly among structures built in close proximity to one another.

Analysis of the Marshall Fire shows structural damage within FireLine Special Hazard Zones 3 and 4, indicating that the sites affected were within 0.5 or 0.25 miles of wildlands.

Verisk's data shows more than 1,000 structures with over $880 million of reconstruction cost value were reported destroyed or damaged in the Marshall Fire. Damage spanned both commercial and residential structures, with an estimated $630 million for homes and around $250 million in damage for commercial properties, based on Verisk's reconstruction cost data.

Marshall Fire damage locations within FireLine Special Hazard Zones (SHZ)



Raising resiliency: Spotlight on mitigation

Confronted with the prospect of more frequent and severe wildfires, mitigation is of critical importance to homeowners, communities, and insurers alike. Verisk's FireLine solution includes both community-level mitigation and parcel-level mitigation analytics.

Parcel-level insights

Verisk supports a wide range of research on wildfire mitigation at both the property and community levels, including the promotion of defensible space and structure hardening. Structure hardening refers to the strengthening of a home or building itself, including the retrofitting of an existing structure with fire-resistant materials, or the building of new properties with less flammable materials.

Outside of the structure itself, property-level mitigation can be practiced through the use and development of defensible space. Defensible space refers to a buffer zone anywhere from 0 to 100 feet around a structure that's cleared of potential fuels. It's space that can provide an area for first responders to operate safely to protect structures.

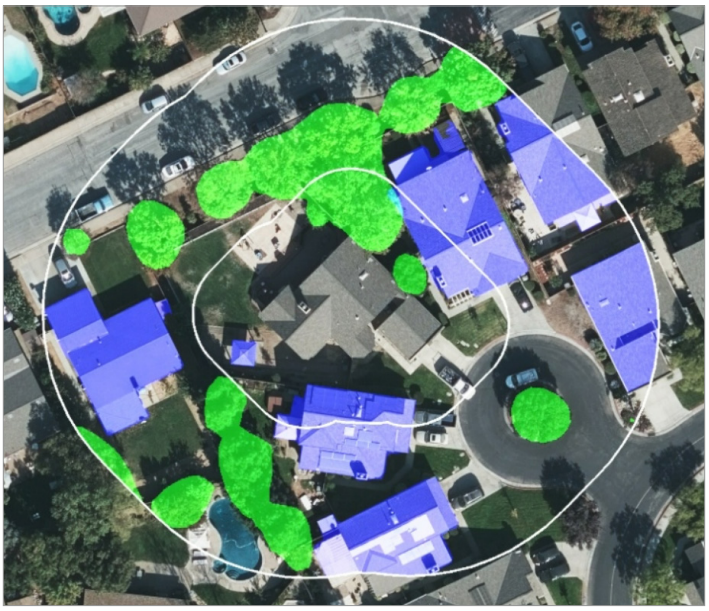
FireLine includes analytics on defensible space and structure hardening, based on Verisk's aerial imagery capabilities, which have 100% coverage of the United States using high-resolution aerial imagery. These analytics can help insurers manage/mitigate exposures to wildfire (and other perils like wind/hail) by:

Detecting the location and proximity of trees to a structure at 5-, 30-, and 100-foot defensible space zones, as well as the location and proximity between structures. Additional coverage available on the density of trees and buildings.

Identifying tree overhang. Dead trees and loose branches may pose a danger to roofs. Studies have shown that areas closest to the home are most important to reducing home ignitions. Therefore, one of the most effective actions is to ensure that vegetation does not overhang or touch the home.

Providing parcel tree coverage. In the event of a wildfire, trees can become combustible material. They may also contain dead branches that pose a danger to the property.

Identifying presence of fire-resistant materials and fire hazards. Some roofs can contain fire-resistant materials, and solar panels, decks, and trampolines can increase the potential for fire damage.



Defensible space assessment in Morgan Hill, CA (Santa Clara County)

Community-level mitigation

When it comes to wildfire mitigation, it takes a village.

Property owners can create all the defensible space they want, but it could come to naught if their neighbors pile up dried firewood on their decks or leave dead vegetation scattered throughout their yards.

To better understand and promote the important work being done to mitigate wildfire risk at the community level, Verisk has developed strategic partnerships with leaders in this space.

Verisk is a proud partner of the International Association of Fire Chiefs and their Ready, Set, Go! (RSG) Program to provide insurers with data on property-level mitigation efforts related to wildland and wildland-urban interface fire hazards.

Ready, Set, Go! fosters efforts to cultivate improved communications between the fire protection community and the residents they serve to promote mitigation activities and preparedness. Verisk is able to deliver data on RSG properties for 11 Western U.S. states to help insurers better understand mitigation efforts underway in these states.

In addition, Verisk works with the National Fire Protection Association (NFPA)'s Firewise USA® Program, which educates property owners and communities on how to reduce wildfire risks. Verisk is now able to deliver robust information on FireWise USA communities, which are engaging in critical mitigation activities, through FireLine. These insights include:

- Granular data on over 500 active communities throughout California
- In-depth historical data: In California, NFPA has 15 years' worth of data on hundreds of active communities—and counting

Communities participating in Firewise USA are required to report on their mitigation activities annually to remain in good standing. NFPA provides bi-annual updates on the status of Firewise USA sites, so the data is continuously refreshed.

Sites of Excellence

Recent research sponsored by NFPA reveals that community-wide wildfire mitigation across adjacent parcels is something that small communities can successfully achieve. Not only is such community-wide mitigation critically necessary to end wildfire disasters, but it can also bring about improved community cohesion and better communication among residents, emergency responders, and land managers.

In this latest research, ***NFPA Firewise USA® Sites of Excellence Report,*** NFPA highlights the design and successes of its Sites of Excellence pilot with communities in seven states. This 24-month pilot program was designed to discover how more ambitious wildfire mitigation goals could be achieved in select Firewise sites. At each site, community leaders identified up to 100 co-located, adjacent homes and asked homeowners them to complete mitigation tasks based on individual risk assessments. The goal was to get 100 percent participation from homeowners.

Mitigation tasks focused on the "home ignition zone"—the structure and its immediate surroundings out to 30 feet. Recent wildfires have revealed the dangers of inadequate protection in this zone, further promoting the importance of defensible space.

According to NFPA, sites reported that participating in the Sites of Excellence pilot program resulted in higher levels of engagement and interest in the Firewise program and wildfire mitigation efforts; in six of the seven sites, more than 80 percent of adjacent households achieved the goal of mitigation in the home ignition zone.

Taking the measure of mitigation activity

Verisk is actively engaged with insurers, firefighters, and homeowners in the field to help raise awareness about the role mitigation can play in reducing wildfire risk and gain a deeper awareness of local efforts.

In the past year, Verisk has surveyed the fire protection and building code enforcement communities in California on their mitigation initiatives, including the data these communities have on the structures in their jurisdictions.

Over 400 community fire and building code officials responded to the survey. Using FireLine, we then identified a subset of 90 high-risk communities that had mitigation plans and structural data in place and followed up with these communities to learn more about their wildfire efforts. This data will continue to inform research on mitigation activities and their efficacy, as well as provide information on areas where Verisk and its partner organizations can continue to educate and advocate for these protective measures.

Verisk's Building Code Effectiveness Grading Schedule (BCEGS®) team, which collects information on what communities adopt and enforce wildfire codes, has also been working in collaboration with FireLine and the Insurance Institute for Business & Home Safety and NFPA in 14 Western states to assess wildfire preparedness by analyzing best practices in county-level wildfire planning, use of building codes, and fire department readiness for effective response in wildland/urban interface fires.

Verisk's continued work with the mitigation community, along with our robust data suite across aerial imagery, reconstruction costs, and wildfire risk data seeks to provide the insurance industry with the increased support it needs.

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Authors

Dr. Arindam Samanta
Director, Product Management, Verisk

Alina Schulz
Geospatial Analyst

Kami Ford
Senior GIS Specialist

+1.800.888.4476 / **underwriting@verisk.com** / **verisk.com/fireline**