

World On Fire

How a 2023 El Niño Will
Exacerbate Global Wildfire Risk

JULY 2023

Key findings

- 1 **Wildfires are growing in frequency and severity**, with insurers and reinsurers reassessing how they price and think about the risk.
- 2 **With an El Niño cycle now in place, some parts of the world are more at risk of major wildfires** (exacerbated by the La Niña cycle, which saw a build-up of vegetation).
- 3 **Other factors are contributing to increased wildfire risk**, including climate change, changing land use patterns, human activities encroaching on the natural environment (WUI), and increasingly stretched fire suppression resources.
- 4 **As the Canadian wildfires so far in 2023 demonstrate**, there are both direct and indirect consequences of major fires, including health and safety implications.
- 5 **Rural and semi-rural industries have a growing liability where wildfire risk is concerned**. They should prioritize wildfire risk management and mitigation best practice in terms of maintaining infrastructure, managing vegetation and complying with regulations.
- 6 **Insurers have a critical role to play**, by offering risk mitigation advice and indemnifying homeowners and businesses, so they can recover as quickly as possible post loss.

How a 2023 El Niño will exacerbate global wildfire risk

Abnormally warm and dry conditions are forecast to persist through to late summer in Canada after an unprecedented and early start to the fire season. So far in 2023, wildfires of historic size and intensity have ravaged an area larger than the Netherlands across Quebec and other provinces. They are a stark reminder of the increasing intensity of such events globally.

Climate scientists anticipate that 2023 could be one of the hottest years on record since data keeping officially began in 1850. The formation of an El Niño is an exacerbating factor, as it drives warmer land and sea surface temperatures in some parts of the world.

This report explores the significance of the El Niño-Southern Oscillation (ENSO) cycle and climate change more broadly, as the frequency and severity of wildfires grow. It considers how changing land-use patterns, in particular the encroachment of human activity into natural wildland spaces, and stretched fire suppression resources, are heightening the risk and exposure.



Direct and indirect risks

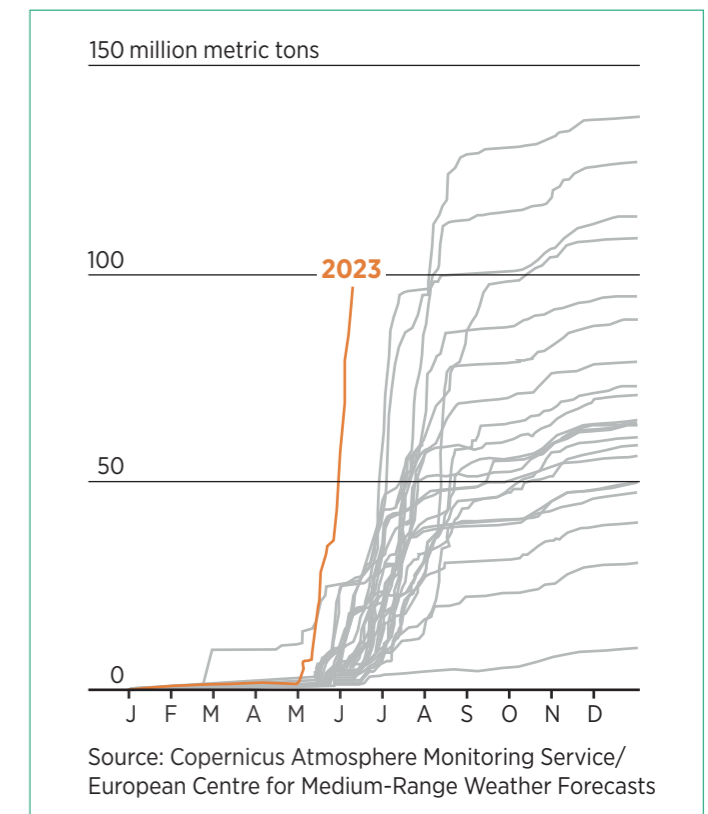
As the current blazes across Canada demonstrate, the impacts of major wildfires can reach far beyond a country's borders.

In addition to the direct threat of being in the path of a wildfire, secondary and tertiary impacts may include health side-effects and environmental consequences. Carbon released by the fires in Canada since May had reached 160 million tons at the time of writing, contributing to the climate crisis¹.

For rural and semi-rural industries such as agriculture, forestry, sawmills, propane storage facilities, utilities and real estate, the exposures are growing and risk mitigation is becoming a more pressing concern.

Meanwhile, the increased cost of wildfire events is prompting re/insurers to reassess the peril. In some areas, coverage is being withdrawn, raising the issue of insurability.

Cumulative daily carbon emissions from Canadian wildfires for the last 20 years²



El Niño warming phase begins

The target of keeping long-term global warming within 1.5 degrees Celsius (2.7 Fahrenheit) of a pre-industrial era baseline to meet the ambitious goal set in the 2009 Paris Agreement is becoming less likely to occur but not yet impossible, climate experts say, with nations failing to set more ambitious goals despite months of record-breaking heat on land and sea³.

The formation of an El Niño weather pattern during 2023 holds significant implications for global temperatures more broadly, as well as for regions prone to wildfires. The ENSO influences weather patterns globally, contributing to weather extremes such as heat waves, droughts and wildfires.

The occurrence of an El Niño increases the likelihood of prolonged dry spells in specific regions, and enhances the potential for wildfire ignition and spread.

According to the NOAA,⁴ the warmer-than-average tropical Pacific Sea has triggered the development of El Niño conditions, which is anticipated to persist into the Northern hemisphere winter. There is a better than 50-50 chance that it will become a

strong event at its peak, which is defined as being at least 1.5 degrees Celsius (2.7 Fahrenheit) above average.

Climate change further exacerbates the risks associated with wildfires. Rising temperatures, altered precipitation patterns and more frequent extreme weather events create conditions conducive to wildfire outbreaks. The increasing severity and duration of droughts intensifies wildfire risk.

Meanwhile, warmer, wetter periods promote the growth and buildup of vegetation. When it dries, this acts as tinder, fueling the spread of fires during hotter, drought-prone periods.

It is a dangerous cycle because if more precipitation falls, that translates to new vegetative growth. As that vegetation grows and we then enter another drier cycle, or a particularly strong localized Santa Ana or Diablo wind event arrives, that can quickly enhance the fire risk as the vegetation dries out and becomes highly flammable.

An important point is that not all El Niños are alike however, and there are no obvious correlations between the phase of ENSO and whether the loss potential will go up or down. There are a lot of competing influences that can help drive the local risk from a fire damage potential standpoint.

— **Steve Bowen**, Chief Scientist, Gallagher Re



ENSO explained

El Niño

During El Niño, trade winds weaken, pushing warm water east towards the west coast of the South America. El Niño, meaning “little boy” in Spanish, was first observed by South American fishermen in the 1600s when they noticed periods of hot water in the Pacific Ocean.

The warmer waters during an El Niño cause the Pacific jet stream to shift south of its neutral position. As a result, the northern US and Canada experience drier and warmer conditions than usual, while the US Gulf Coast and southeast encounter increased rainfall and heightened flood risk.

La Niña

La Niña, meaning “little girl” in Spanish, is also known as El Viejo, anti-El Niño, or simply a cold event. Unlike El Niño, La Niña has the opposite effect. Trade winds are stronger than usual during La Niña events, pushing warmer water towards Asia.

The cold water in the Pacific pushes the jet stream northward during La Niña, resulting in drought conditions in the southern US and heavy rainfall and flooding in the Pacific Northwest and Canada.

Winter temperatures during La Niña years are warmer than usual in the south and cooler than expected in the north. Additionally, La Niña can contribute to a more severe hurricane season as Atlantic Ocean sea surface temperatures tend to be above normal.

Australia braces for summer bush fires⁵

Australia’s Bureau of Meteorology has warned about the elevated fire risk expected this summer, following several wetter seasons that have led to significant vegetation growth⁶.

Weather forecasters predict that some regions of Australia may experience drought after a year of record rainfall and extreme temperatures that promoted vegetative growth.

The heat and dried-out vegetation create favorable conditions for increased bush and grass fires during Australia’s spring and summer, with the eastern coast of Queensland and New South Wales among the most vulnerable.

Australia is a unique example of how shifts in ENSO phase can bring dramatically different impacts. The country dealt with record-breaking bush fires during the 2019/20 fire season, which saw weak El Niño conditions, before the pendulum swung towards La Niña and to considerable flooding the following three years. This shift from one extreme to another is often referred to as “weather whiplash”.

— **Steve Bowen**, Chief Scientist, Gallagher Re



Chilean fires hit new records

Previous El Niño years have brought extreme weather to Latin American countries, ranging from flooding to severe drought conditions.

Flood patterns are more common on South America's west coast, while the Amazon and northeast Brazil are more drought prone during such a cycle. Although central Chile typically receives more rain during an El Niño, the impact can be reversed due to climate change-related rainfall reductions.

The 2022/2023 wildfire season has already concluded during Chile's summer months, and it was one of the most significant fire seasons on record, with over 1.1 million acres (400,000 hectares) burned.

The Amazon is another potential hot spot during an El Niño. The Amazon basin, home to over 10% of the world's biodiversity, experienced over 40,000 fires in 2019 at the height of the last El Niño. At least 906,000 hectares were burned, which led to the release of roughly 400 million tons of carbon. Slash-and-burn deforestation practices were blamed for the majority of blazes.

Scientists warn that seasons like 2019 reduce the Amazon's ability to store and absorb CO₂, destabilizing its precious ecosystem with the result that it is now emitting more carbon than it absorbs⁷.

A decade of major fires

The last decade has seen an alarming increase in the frequency and intensity of wildfires around the world. Notable events include the California wildfire seasons of 2017⁸ and 2018⁹, the Australian bush fires of Black Summer 2019–2020, and Southern European wildfires of 2022.

California's wildfires¹⁰ stand out for their frequency, scale and financial impact. The Department of Forestry and Fire Protection (Cal Fire¹¹) reports that the state has experienced the eight largest wildfires in its history within the past four years.

According to data from Gallagher Re, there have been 21 individual billion-dollar insured wildfire events on record. Sixteen of these have occurred since 2015, including 14 alone in the United States.

The list of the most severe wildfires in terms of fatalities worldwide between 1900 and 2021 includes three events within the last decade, with the 2021 fires in Kabylia, Algeria, being the deadliest wildfire event in history.

Wildfires are increasingly likely to result in damage to property and infrastructure¹². They destroy homes, infrastructure and commercial buildings, causing significant economic and insurance losses. Infrastructure such as power lines, roads and bridges can also be damaged, resulting in power outages, business interruption and supply chain disruption, as well as presenting challenges for emergency services.

Much of this increase in damage is due to continued population growth into known fire risk locations—referred to as the Wildland Urban Interface (WUI).

Changing land use practices are contributing to the escalation of wildfires and contribute significantly to the losses resulting from wildfire events. Factors such as urban sprawl, deforestation and the expansion of agricultural activities into fire-prone areas can increase the exposure and impede effective fire management strategies.

Over the past decade, wildfires have resulted in growing property damage and business interruption claims, particularly in parts of the world where insurance penetration is high.

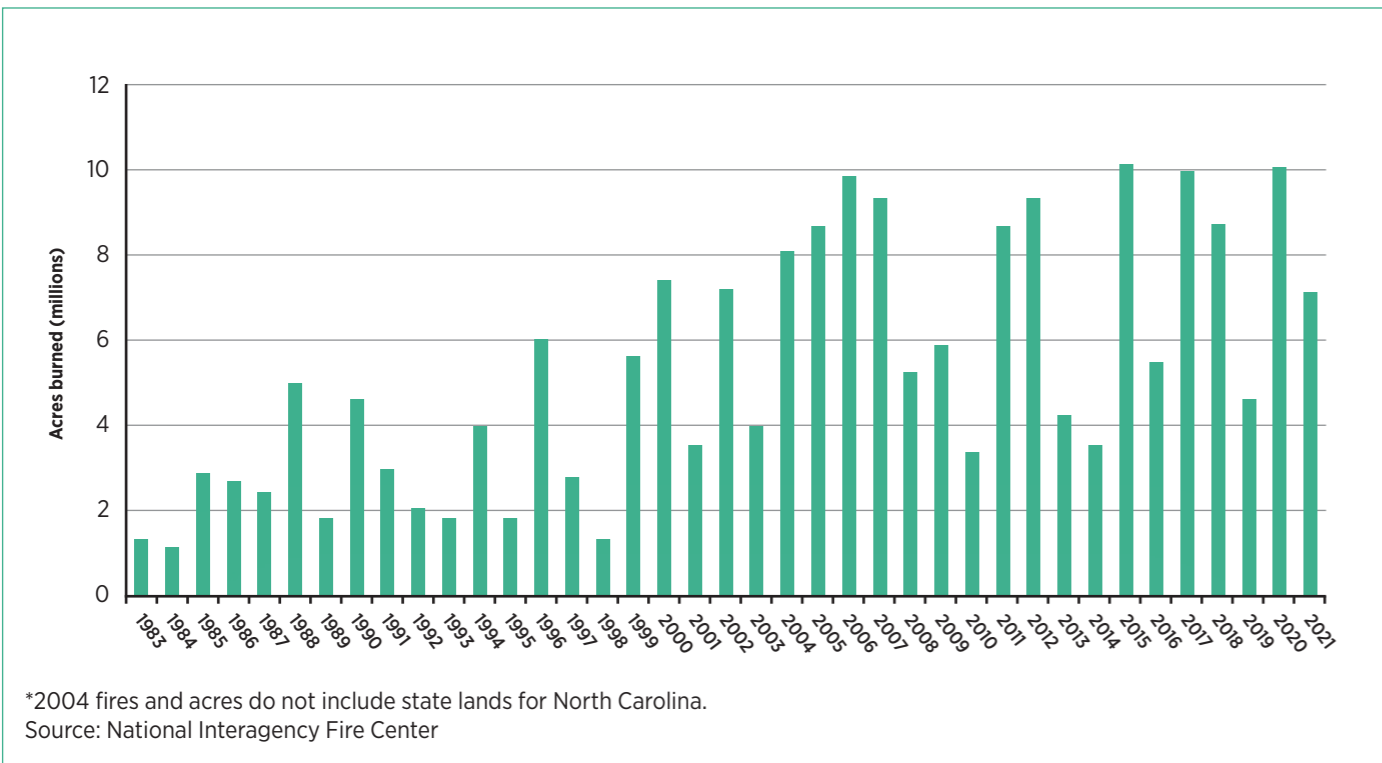
The environmental damage caused by wildfires can be substantial. Ecosystems, wildlife and water quality suffer both immediate and long-term effects. Plant and animal populations, soil quality, and biodiversity can be permanently altered, affecting the natural environment and communities, and impacting industries such as forestry, mining and fishing.

The Wildland Urban Interface

The Wildland Urban Interface (WUI) is the area where human development meets or intermingles with the natural environment. Over time, our communities and lifestyles increasingly extend further into forested areas and, as a result, we find more and more interface communities, in both remote rural locations and urban centers.

The more communities encroach upon WUI zones, the more they become exposed to the danger of wildfire¹³. The activities of rural industries and communities also contribute to the risk of fires starting and spreading.

Annual number of acres burned in wildland fires, 1983–2021¹⁴



Top human-made causes of wildfire

The leading cause of wildfires can be natural or human-induced, with natural causes including lightning strikes, volcanic eruptions and spontaneous combustion in peatlands. However, human activities are the primary contributor, including the following.

- **Unattended campfires:** Leaving a campfire unattended can allow it to spread and ignite surrounding vegetation.
- **Discarded cigarettes:** Improperly discarded cigarette butts can ignite dry grass or other flammable materials.
- **Arson:** Deliberately setting fires is a significant cause of wildfires, either for malicious intent or as an act of arson.
- **Equipment sparks:** Malfunctioning or improperly used equipment like power tools, machinery or electrical lines can generate sparks that ignite nearby vegetation.
- **Spontaneous combustion:** This is a common occurrence within waste and recycling plants.

- **Intentional burning:** Controlled agricultural or land-clearing burns (including slash and burn) can escape and develop into wildfires.

Once a fire starts, it spreads through a combination of factors. The critical ingredients for a wildfire to rage out of control are known as the fire triangle of fuel, oxygen and heat.

- **Fuel:** Dry, combustible vegetation, such as trees, shrubs, grass and dead leaves, fuel the fire. The amount and arrangement of fuel affect the intensity and speed of the fire's spread.
- **Oxygen:** Fires require oxygen to sustain combustion. Sufficient oxygen levels in the air provide the necessary supply for fire to grow.
- **Heat:** An initial ignition source provides the heat to start the fire. Once ignited, the fire generates heat, allowing it to spread and sustain itself.



Fanning the flames

The strong, dry winds known as Santa Ana winds are a weather phenomenon specific to Southern California, particularly during the fall and winter months. These winds originate from high-pressure systems over the Great Basin region and flow towards the coast.

The Santa Ana winds can be powerful, with gusts reaching 40–60 mph (64–97 km/h) or even higher. They can significantly impact wildfire behavior, making fire suppression efforts more challenging.

The reality is, if you get a strong Santa Ana or Diablo wind event which can instantaneously dry out vegetation, you can get a significant fire very quickly, regardless of the current phase of ENSO.

— Steve Bowen, Chief Scientist, Gallagher Re

Insurers and re/insurers reassess secondary perils

In some wildfire-exposed regions, insurance companies are responding to the increasing cost of claims by raising premiums for high-risk areas and potentially excluding coverage for wildfire damage¹⁵.

Across the US, appetite for catastrophe risk more generally is being reassessed, as detailed in Gallagher's June 2023 US Market Report¹⁶. Some carriers have ceased writing new homeowner policies or pulled out of certain markets entirely.

In California, a record 4.4 million acres and 2.6 million acres were burned in 2020 and 2021, according to Gallagher Re's 2023 US Wildfire State of the Market report¹⁷. Growing losses from such events, exacerbated by inflationary trends, have led to a shifting view of the risk and changes in how insurers manage and price wildfires.

Several insurance carriers have reduced their California exposure or pulled out of the market altogether over the past 12 to 24 months. California has more than 1.2 million homes at risk for extreme wildfire, far more than any other state, according to data from the Insurance Information Institute.

Re/insurers are paying more attention to wildfires as a major driver of natural catastrophe loss. Previously seen as 'secondary perils', wildfires are increasingly considered a significant regular driver of insured catastrophe losses¹⁸.

Some carriers are reacting proactively and building fire prevention measures into coverage stipulations. Property owners who have taken a proactive approach to risk management, for instance by retrofitting their homes and/or facilities, are more likely to benefit from continuity of coverage if they are in a high-risk zone.

The property market is challenging across the US, with hurricane and wildfire being two of the most challenging perils to insure.

The number, size and cost of wildfires in California have increased significantly, and wildfire coverage is no longer considered a secondary peril for many insurers and reinsurers, with 11 of the most destructive fires in history occurring in the past seven years.

— **Martha Bane**, Managing Director, Property, Arthur J. Gallagher

Paradise lost

One of the costliest fires for the insurance industry was the Camp Fire, which occurred in November 2018 in Butte County, California. Over the course of 17 days, the inferno all but obliterated the town of Paradise and its surrounding areas.

It burned more than 153,000 acres of land and destroyed a state record 18,804 structures, including homes, businesses and infrastructure. It caused 85 deaths and cost \$10 billion in nominal insured losses, or \$12.5 billion in today's dollars, making it the costliest wildfire in US history (refer to PG&E and California Wildfire Fund section on page 14).



The cost of individual secondary peril events have been on the rise across the last decade. With the wildfire peril, there are now examples of singular fires causing \$10 billion-plus industry claims payouts.

As more of these secondary perils drive hurricane-levels of loss, it is further shifting the narrative of how we view these risks. The reality is that on an aggregate cost basis, secondary perils already typically result in more annual losses than primary perils.

— **Steve Bowen**, Chief Scientist, Gallagher Re

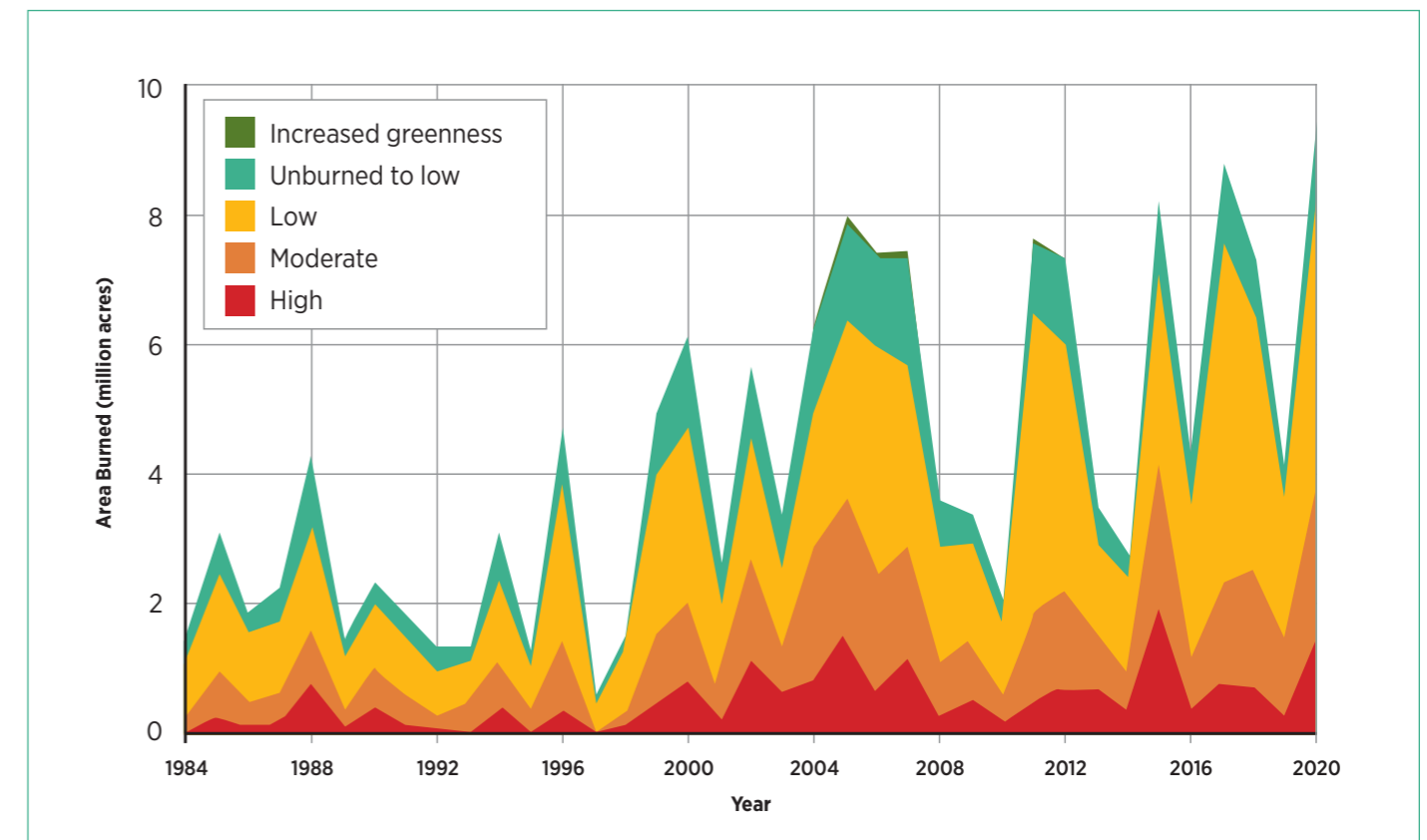
Population displaced

Evacuated residents can experience substantial loss and disruption. Even after wildfires are extinguished, rebuilding or relocation can lead to long-term economic displacement and community instability.

One example is the Fort McMurray¹⁹ fire in May 2016 in Alberta, Canada. A devastating wildfire burned approximately 590,000 hectares, destroying over 2,400 structures, and causing the largest wildfire evacuation in Canada's history, with over 90,000 people forced to leave their homes²⁰.

Firefighters and resources were deployed to combat the fire, but it posed significant challenges due to its size and rugged terrain. Fort McMurray suffered extensive fire and smoke damage, including the loss of entire neighborhoods and critical infrastructure. Recovery and rebuilding efforts were still ongoing three years on from the disaster, and some residents never returned.

Damage caused by wildfires in the US, 1984–2020^{21, 22}



Fire suppression resource constraints

The resources needed for firefighting efforts and disaster relief, including equipment, personnel and resources, can be significant. In areas where the frequency, intensity and cost of fires has gone up, the costs are rising, exacerbated by inflation.

In the US, federal assistance for fire suppression kicks in once conditions meet disaster thresholds, as determined by Federal Emergency Management Agency (FEMA) criteria.

Top 20 most costly US wildfires

		Economic Loss (USD)	Acres Burned	Structures Destroyed
1	Camp Fire (2018)	\$16.50 billion	153,336	18,804
2	Tubbs Fire (2017)	\$14.92 billion	36,807	5,636
3	Woolsey Fire (2018)	\$6.71 billion	96,949	1,643
4	Atlas Fire (2017)	\$4.97 billion	51,057	781
5	Glass Fire (2020)	\$4.79 billion	67,484	1,528
6	CZU Lightning Complex Fire (2020)	\$4.31 billion	86,509	1,490
7	LNU Lightning Complex Fire (2020)	\$4.08 billion	363,220	1,491
8	Marshall Fire (2021)	\$4.07 billion	6,026	1,084
9	Thomas Fire (2017)	\$3.74 billion	281,893	1,063
10	Dixie Fire (2021)	\$3.41 billion	963,309	1,311
11	Carr Fire (2018)	\$2.20 billion	229,651	1,614
12	Beachie Creek Fire (2020)	\$2.16 billion	193,573	1,323
13	Valley Fire (2015)	\$1.95 billion	76,067	1,958
14	Chimney Tops 2 Fire (2016)	\$1.79 billion	17,000	2,500
15	Caldor Fire (2021)	\$1.69 billion	221,835	1,005
16	North Complex Fire (2020)	\$1.51 billion	318,935	2,352
17	Alameda Drive Fire (2020)	\$1.38 billion	3,200	3,000
18	Mendocino/Lake Complex Fire (2017)	\$1.21 billion	410,203	246
19	Kincade Fire (2019)	\$1.20 billion	77,758	374
20	East Troublesome Fire (2020)	\$920 million	193,812	580

Commercial risk exposures

Smog, pollution and carbon emissions

Smoke from wildfires significantly contributes to air pollution, affecting the health of nearby residents. Depending on the size of the fires and prevailing weather and wind patterns, the smoke can disperse over extremely wide areas and into the upper atmosphere.

Predicting the ultimate size of wildfires, the amount of smoke produced and the direction of travel is challenging. And there are cross-border implications as the gases and particles can be transported hundreds and even thousands of kilometers from the fire zone, causing impacts in other parts of the world.

Wildfire smoke consists of a mixture of gases, particles and water vapor, containing pollutants such as sulphur dioxide, nitrogen dioxide, carbon monoxide, fine particle matter and ozone²³. It is important to note that air pollution may persist even when smoke is not visible or detectable by smell.



Health and safety

The fine particles from wildfire smoke can prompt several potential health issues²⁴. These include higher rates of heart attacks, strokes and respiratory conditions, and an increased risk of developing certain cancers²⁵.

There is no known safe level of exposure to these pollutants, meaning that even minimal levels of smoke can have adverse effects on health. As smoke levels increase, the associated health risks also escalate. The impact of wildfires can go beyond physical health problems to impact mental health and wellbeing²⁶.

During wildfire season, employers should take necessary steps to protect the health and wellbeing of their staff. This includes checking the daily air quality in affected communities and reducing exposure by distributing masks, installing air purifiers in indoor workspaces, and/or allowing employees to work from home when air quality is compromised.

Corporate liability

Wildfires are an emerging risk for companies which operate in the WUI, in particular those whose activities and/or poor approach to risk management could see them held to account for losses sustained as a result of a wildfire.

Organizations with rural or semi-rural operations should consider their liability by maintaining infrastructure, managing vegetation, incorporating fire-resistant design, developing emergency response plans, complying with regulations, and implementing insurance and risk management strategies.



PG&E and the California Wildfire Fund

Following California's devastating Camp Fire, utility giant Pacific Gas & Electric Company (PG&E) admitted its equipment was likely to have ignited the wildfire. It led to a criminal investigation, which revealed that faulty power lines and poor safety standards were to blame.

In January 2019, the company declared bankruptcy due to anticipated lawsuits and liabilities, at an estimated cost of around \$30 billion. Its directors were also implicated.

In June 2020, the firm was found guilty of 84 counts of involuntary manslaughter, a verdict which marked the deadliest US corporate crime ever successfully prosecuted. The firm was instructed to pay \$13.5 billion to the families affected.

Following the Camp Fire, the California Wildfire Fund was established in 2019 with \$21 billion to help utility companies compensate future wildfire victims. The state-run backstop was championed by Governor Gavin Newsom and partly funded by California's investor-owned utility firms.

For their \$10.5 billion, the companies are able to recover wildfire damages that exceed their insurance threshold (but they must pay this back to the fund if later found to have been at fault). The law shifts the burden of proof in regulatory proceedings onto prosecutors.



Building resilience

Mitigation efforts are taken to prevent events from becoming disasters and prevent disasters from occurring altogether. Crucially, it limits the potential for loss of life and damage to property and infrastructure.

Regions at risk from wildfires employ various strategies to improve their resilience and mitigate the risks associated with wildfires through prevention, preparedness and response measures.

These are typically led by local and national governments. They manage fuel, enforce building codes, educate the public, create firebreaks, establish early warning systems and form mutual aid agreements.

They also make crucial decisions on where to allocate funds for firefighting, suppression and emergency response. These considerations evolve over time, depending on the latest scientific threat information, assets at risk and budgetary considerations. Coordination between different departments and dedicated resources will become more essential.

There is an important role for the insurance industry in sharing information on health and safety, risk mitigation and best practice. The Insurance Institute for Business and Home Safety

(IBHS) in the US and Canada's Institute for Catastrophic Loss Reduction (ICLR) are examples of industry-led organizations promoting risk mitigation.

Business owners and risk managers should factor both direct and indirect wildfire risks into their business continuity plans and crisis management response. Depending on the location of facilities, this may include the need for evacuation planning.

Education is essential to protecting people and property, with nearly nine out of ten wildfires in the US currently caused by human activity. Behavioral change can be encouraged through information shared via public service announcements, brochures, social media campaigns and presentations.

Regulations are essential and include appropriate penalties for non-adherence. These include strict rules for farmers around controlled burning and for high-risk rural industries, such as sawmills and fuel storage facilities.

One of the challenges in trying to mitigate wildfire risk involves fire suppression. Controlled burns used to burn and clear brush across broad swaths of forested lands, but today, those lands are increasingly populated by homes. This has led to a change in firefighting strategies and broader planning measures.

On top of the suppression issue remains persistent strains on federal, state and local governments from a budgetary standpoint. There just isn't enough money to fully account for both suppression and firefighting in a budget year.

The 2023 fires in Canada provide a clear example of the shifting firefighting tactics. Due to increasingly constrained resources, several Canadian provinces have shifted their firefighting tactics to a primarily 'let it burn' strategy if there is no imminent risk to life and property. That has led to fires burning out of control, sending dangerous plumes of smoke into the atmosphere which filter into densely-populated cities.

— **Steve Bowen**, Chief Scientist, Gallagher Re

Conclusion

Mitigating the threat of wildfires is crucial for businesses and communities residing in high-risk regions, particularly as the latest warming phase of the ENSO cycle develops.

Taking proactive measures to reduce fire risk, safeguard people and property, and ensure adequate insurance coverage is essential. This includes implementing fire-resistant building materials, developing effective evacuation plans²⁷, and supporting initiatives that promote responsible land use and fire prevention strategies.

The insurance industry continues to play an essential role in mitigating the financial impact of wildfire events, and helping businesses and communities recover as quickly as possible.

As the threat evolves, public and private sectors must continue to collaborate to reduce the risk to both the natural and built environment.



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Spotlight



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