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Wildfire

An Issue Paper

Lessons Learned from the 2017 to 2021 Events

American Academy of Actuaries
Extreme Events and
Property Lines Committee

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AN ISSUE PAPER

Lessons Learned from the 2017 to 2021 Events

Individuals living and property and casualty insurers operating in the Western U.S.–particularly California–have experienced widespread impacts due to wildfires far exceeding historical levels prior to 2017.

THE PURPOSE OF THIS PAPER is to identify and discuss key areas pertaining to wildfire risk after these recent events placed a spotlight on how devastating wildfires can be to the general population, as well as the impact to the insurers and reinsurers. The paper is intended to provide a source of factual information surrounding each key area. The paper is laid out in four sections:

- Section I dives into understanding the wildfire peril, the importance of mitigation methods, and the impacts of climate change.
- Section II explores the current state of modeling and pricing for the wildfire peril and potential areas for improvement.
- Section III examines changes to California law and regulations as a result of the record-breaking wildfire events.
- Section IV reviews the insurance impacts that have materialized to date from recent wildfires.

Mitigation and prevention measures have been shown to reduce wildfire risk substantially.

Executive

The past several wildfire seasons in the U.S. have been some of the most destructive and costly on record. The wildfires of 2017 and 2018 were the costliest on record, primarily as a result of wildfires in California. High wildfire activity across many Western states continued in 2020, particularly in California and Oregon, where about 11,500 and 3,800 structures were destroyed by wildfire, respectively. California also had a record year by number of acres burned. To date in 2021, activity has been similar by acres burned when compared to the prior 10 years, and historically large fires burned in California and Oregon.

Several factors have led to the increase in wildfire events over the past few years. The impacts of climate change along with population shift toward the wildland-urban interface (WUI) areas have contributed to an increase in the frequency and severity of wildfires. On the other hand, more focus is being placed on ways that consumers can prevent or mitigate damages to their homes when these events do occur. Mitigation and prevention measures, both on an individual and community basis, have been shown to reduce wildfire risk substantially.

In order to assist insurers and reinsurers in effectively pricing for and managing the risk from wildfires, catastrophe modeling firms have developed wildfire catastrophe models. These models are developed to reflect the latest science underlying the peril from the ignition point to the spread and suppression of the wildfire. These models also consider the impacts from mitigation measures and have started to contemplate the impacts of climate change. However, regulators have been generally hesitant to accept these models due to concerns such as transparency, requiring insurers to use unreliable and volatile historical experience to set rates. Insurers in California are also disallowed from including the cost of reinsurance in their rates. These issues have led to fears of rate inadequacy in areas with substantial wildfire risk for many insurers and an insurance availability crisis in California.

Summary

The goals of state insurance regulators include ensuring fair insurance practices and ensuring availability and adequacy of insurance rates, which in turn promote insurer solvency and market stability. In response to the past few wildfire seasons, many regulatory and legislative actions have been taken. Some of these measures have focused on insurance availability and coverage provided, such as ceasing insurer moratoriums, requiring insurers to renew certain policies, or broadening coverage to additional perils (e.g., mudslide). Very few proposals have provided for allowing actuaries to set rate levels based on wildfire catastrophe models, though, as discussed later in this paper, evidence suggests that California-admitted market companies are growing less confident in their ability to offer insurance under the current regulatory framework. This lack of confidence results in admitted market insurers restricting where their insurance is offered, decreasing consumer choice, and forcing consumers to turn to the surplus lines market—where wildfire catastrophe models and reinsurance costs are used for setting rates—or the California FAIR Plan—where wildfire catastrophe models are not prohibited for setting rates.[1]

The role that utility companies play in wildfire events has also gotten much more attention over the past few years. Utility companies have been found to be liable for the ignition of some of the costlier wildfires, and, as such, have become a source of subrogation for insurers. To help mitigate the financial impact to utility companies, the California Wildfire Fund was created. In addition, to help prevent potential wildfires, utility companies are required to prepare wildfire mitigation plans, which include public safety power shutoff events to minimize the risk of ignition during peak wildfire conditions. Utilities face their own challenges in obtaining insurance and reinsurance both for the wildfire peril directly and for the contractors that support their mitigation efforts as discussed below.

The recent significant wildfire seasons have highlighted the need to continue researching and understanding this peril. It is critical to the future of the insurance market that insurers and regulators find ways to work together to appropriately price and assess this risk in order to provide an insurance market with stable rates, robust coverages, incentives to mitigate, and increased consumer choice.

1 "The California Wildfire Conundrum", Milliman, Inc.; November 27, 2018.

An Overview of Wildfire Risk

In the past few decades, there have been many large catastrophes that triggered major disruptions in the insurance industry—for example, Hurricane Andrew in 1992, the Northridge earthquake in 1994, the 9/11 terrorist attacks in 2001, and the flooding resulting from Hurricane Katrina in 2005.

Each of these extreme events, and many others, resulted in losses outside of the expected range and brought about solvency concerns. Additional concerns also surfaced regarding rate adequacy and availability of insurance for consumers. These large-scale events ultimately have led to a better understanding of risk and the continued advancement of catastrophe modeling. Similarly, many of the factors that characterized these events have also been present in the recent wildfire events along the Western U.S. states (primarily California) from 2017 through 2020. Recent events continue to show the need for insurers to rethink how they provide coverage, better assess risk, and work with regulators so they can offer the coverage needed to consumers.

While the Western U.S. has experienced bad wildfire seasons in the past, 2017 was the start of what has been observed to be the most active few years on record. Coming off six consecutive years of increasingly intense drought, the winter/spring of 2016/17 had record precipitation in California, spurring new fuel growth. Dry conditions returned later in the spring and remained through the fall. The buildup of dead vegetation from the drought increased the fuel load and the new growth dried out over the year, further increasing the fuel load. Ignitions of the 2017 fires were in a typical form, with instances related to the electrical grid, as well as common accidental ignitions that occur every year. But 2017 also saw the confluence of high fuel loads, dry fuels, dry daily weather conditions (low humidity with high temperatures), and exceptionally high winds in many places. The drought (ongoing and current) combined with the winds and the continual ignitions created the fall firestorm and the record fires it brought. Statistics from the National Interagency Fire Center (NIFC.com) show there were around 71,500 fires across the United States in 2017, with approximately 10 million acres burned and 12,300 structures destroyed (see Table 1). California accounted for almost 90% of structures destroyed in the U.S. (11,000 structures, including 7,800 residences).

Table 1. U.S. Wildfire Statistics 2011–2020

Year	Grouping	# Fires	Acres (millions)	# Structures Destroyed
2011	**US Total**	**74,100**	**8.7**	**5,250**
2012	**US Total**	**67,800**	**9.3**	**4,250**
2013	**US Total**	**47,600**	**4.3**	**2,150**
2014	**US Total**	**63,600**	**3.6**	**1,950**
2015	**US Total**	**68,200**	**10.1**	**4,600**
2016	**US Total**	**67,700**	**5.5**	**4,300**
2017	**US Total**	**71,500**	**10**	**12,300**
	TX	9,800	0.7	
	CA	9,600	1.3	11,000
	NC	5,100	0	
	MT	2,400	1.4	
	OR	2,000	0.7	
	OK	1,900	0.5	
	ID	1,600	0.7	
	NV	800	1.3	
	all others	38,300	3.3	
2018	**US Total**	**58,000**	**8.8**	**26,000**
	TX	10,500	0.6	
	CA	8,100	1.8	23,600
	OR	2,000	0.9	
	OK	1,700	0.7	
	ID	1,100	0.6	
	NV	600	1	
	all others	34,000	3.2	
2019	**US Total**	**50,000**	**4.7**	**963**
	CA	8,200	0.3	569
	TX	6,900	0.2	
	AZ	1,900	0.4	
	AK	700	2.5	
	all others	32,300	1.3	
2020	**US Total**	**58,000**	**10.3**	**18,000**
	CA	10,400	4.2	11,500
	TX	6,700	0.3	
	AZ	2,500	1	
	MT	2,400	0.4	
	OR	2,200	1.1	3,800
	WA	1,600	0.8	
	CO	1,100	0.6	
	all others	11,000	1.9	

Even with normal precipitation in 2018, prior years of ongoing drought created a buildup of fuel. These fuel loads, combined with the typical seasonal drying patterns, created a perfect environment for more frequent and/or intense fires. Areas that didn't burn in 2017 but were equally affected by the drought conditions in prior years were able to burn in 2018 with similar ferocity. Wind continued to be a factor in 2018, as increased maximum wind gusts were similar to 2017 and some fires recorded winds near the 80+ mph range. Sustained winds of 30-40+ mph also were a major factor in moving the fire and pushing embers. When they occurred continually throughout a single day or across multiple days, the winds: a) pushed embers farther, creating spot fires ahead of the primary burn, b) restricted aircraft from combatting the fire, and c) made ground crews' work more difficult in containing the fire. Similar conditions as in 2017 resulted in resetting the records again. In 2018 there were approximately 58,000 fires across the United States, with approximately 8.8 million acres burned, and nearly 26,000 structures destroyed. California again accounted for approximately 90% of structures destroyed in the U.S. (23,600 structures, including over 17,000 residences).

Conditions continued into 2019, albeit with a modest reduction in risk factors. The drought eased a bit in the West, which meant that less fuel volume was in prime condition to carry a fire. In 2019 there were approximately 50,000 fires across the U.S., with approximately 4.7 million acres burned, and only 963 structures were destroyed. The exceptionally steep drop in structures destroyed relative to acres burned could also have been related to a reduction in ignitions in vulnerable areas. Fuel, wind, and drought are all relatively easy to model compared

to ignitions, nearly 85%of which are the result of human activity (most of them accidental).[2] In other words, there is less ability to determine where, when, and how wildfire ignitions will occur in any given year. Alaska accounted for the highest number of acres (2.5 million), but California once again accounted for the largest number of structures destroyed (569 structures, including 315 residences).

The same characteristics present in 2017 and 2018 were present in 2020: high winds, along with continuing drought conditions that impacted close to 100% of the Western U.S. at some point over the year. In August 2020, hundreds of wildfires began nearly simultaneously as lightning strikes caused mass ignitions. Dry conditions and winds played a role in causing the fires to expand rapidly. The primary problem was that so many fires were burning at the same time and with great speed and intensity that fire crews were spread very thin and resources for containing the fires were less than optimal. Per the National Interagency Fire Center, in 2020 there were approximately 58,000 fires across the U.S., with approximately 10.3 million acres burned, and over 18,000 structures destroyed. California again accounted for the highest number of acres (4.2 million) and number of structures destroyed (11,500).

Altogether, the last four years of the decade from 2017 to 2020 had slightly fewer fires, about 20% more acres burned, and substantially more structures destroyed per year relative to the prior six years. Table 2 shows these statistics by period; the change in annual structures destroyed represents about a 280% increase for 2017–2020 relative to the remainder of the decade. Put another way, three of the last four full fire seasons have seen at least twice as many structures burned compared to any other year of the decade.

Table 2. U.S. Wildfire Statistics, Annual Averages

Years	Average Fires	Average Acres Burned (Millions)	Average Structures Destroyed
2011 to 2016	64,833	6.9	3,750
2017 to 2020	59,375	8.5	14,316

As of October 2021, high-risk wildfire conditions have continued. Persistent drought conditions exist in the West and many of the High Plains states.[3] 2021 initially saw high wildfire activity earlier in the season. The Dixie fire burned almost 1 million acres in California, making it the second largest in state history by acres burned. In Oregon, the Bootleg fire was one of the largest in its state history, with over 400,000 acres burned. Wildfire activity did slow somewhat later in the season, to the point that 2021 has seen about the same acres burned to date compared to the prior 10 years—6.4 million acres in October 2021 compared to 6.7 million acres on average as of October for the prior 10 years.

2 "Wildfire Causes and Evaluations"; National Park Service; November 27, 2018.
3 "U.S. Drought Monitor"; National Drought Mitigation Center; August 3, 2021.

A wildland-urban interface (WUI) refers to an area where human development is adjacent to or mixed in with undeveloped wildland.

Section I–

Understanding wildfire, the importance of mitigation, and the impacts from climate change

Wildfires are uncontrolled fires burning in natural areas such as forests, grasslands, or prairies that can be caused by lightning or by people, either accidentally or intentionally.4 In the U.S., approximately 85% of wildfires are caused by people: the result of leaving campfires unattended, negligently discarding cigarettes, burning debris, or intentional arson.5 The ignition of wildfires can also be caused by man-made infrastructure, such as power lines that come into contact with trees under windy conditions.6 Furthermore, suppression of naturally occurring fires—another human activity—allows vegetation to grow and provides more fuel for eventual uncontrolled fires. The consequences of wildfires are wide-ranging, from personal injuries and death, economic loss, and changing the local ecosystem and biodiversity to forest degradation and air pollution.7

Lightning strikes randomly, so when it does start a wildfire, more often than not the fire would burn in the middle of a forest or grassland, away from populated areas. When a wildfire does not pose a threat to humans, firefighters will occasionally let the area burn, as it will often benefit the ecosystem.[8] On the other hand, when a wildfire originates or moves close to a populated area, it can cause massive destruction to human life and property as the fire spreads from the natural areas to developed lands.

A wildland-urban interface (WUI) refers to an area where human development is adjacent to or mixed in with undeveloped wildland. A WUI is not a static or fixed area, but can change over time when urban development expands or wildland vegetation spreads. WUI may refer to two different concepts: interface and intermix. The former refers to a zone where continuous wildland is adjacent to a developed area, while the latter refers to an area where residential and commercial structures are intermixed with the wildland. However, "wildland-urban interface" is often used to refer to both types, and unless otherwise specified, it is this general interpretation that will be used in this paper.[9]

4 "Wildfires"; Ready.gov.
5 "Wildfire Causes and Evaluations"; National Park Service website; November 27, 2018.
6 "The Link Between Power Lines and Wildfires"; *Electrical Contractor*; November 2018.
7 "Causes and Effects of Wildfires"; *Earth Eclipse.*
8 "Human-started wildfires expand the fire niche across the United States"; *Proceedings of the National Academy of Sciences of the United States of America;* February 27, 2017.
9 "Wildland-Urban Interface (WUI) Change 1990-2010"; University of Wisconsin-Madison Silvis Lab Spatial Analysis For Conservation and Sustainability.

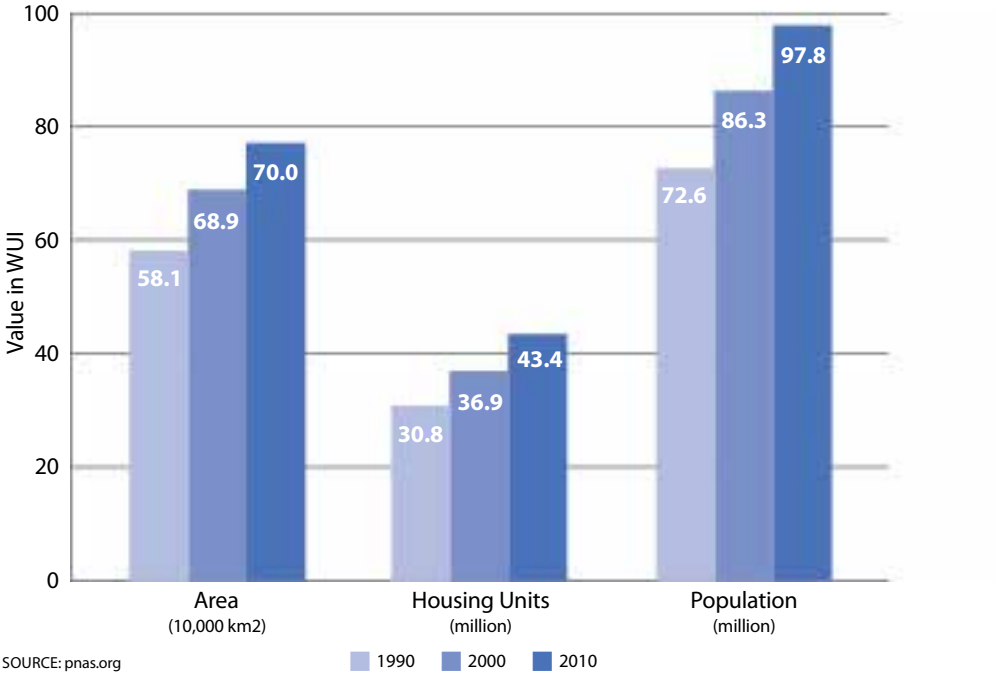
In the context of insurance, changes and growth in the wildland-urban interfaces have made a significant impact on wildfire risk. The WUI is directly related to the exposure of property to wildfires and the resulting insurance loss. As mentioned above, the majority of wildfires are caused by people, and furthermore, most wildfire ignitions occur in the WUI.[10] As WUI areas continue to expand, the number of ignitions caused by humans will increase, and the number of wildfires that occur will rise as well.

In some respect, the simplest solution to the problem of wildfires threatening life and property in WUIs would be the prohibition of development in WUIs. However, that might not be likely to happen, as people will seek out the beauty and solitude of living in and around these areas. And despite the risk of wildfires that is associated with WUIs, all aspects of them have grown over the years: the amount of land area, population, and number of homes. Based on a 2018 study using Census data, the geographical area of WUIs has grown from 7.2% of the contiguous U.S. in 1990 to 8.5% in 2000 and 9.5% in 2010. Over those two decades, WUI land area grew approximately 32%. In absolute terms, new WUI area in 2010 was about 189,000 square kilometers, or about the size of Washington state. While less than a tenth of the contiguous U.S. is WUI in terms of land area, about a third of houses and people in the U.S. reside in the WUI. Over those two decades, the number of houses within a WUI area increased by 12.7 million (from 30.3% to 33.2%), and the number of people living in WUIs increased by 25 million (from 29.4% to 31.9%). Approximately 43% of all new houses were built in WUIs during the period 1990 to 2010, so the density of houses in WUIs has increased as well. This information from the *Proceedings of the National Sciences Foundation* is displayed on a countrywide and individual state basis in Figures 1 and 2, respectively.

New maps would provide a real undertanding of wildfire risk in California.

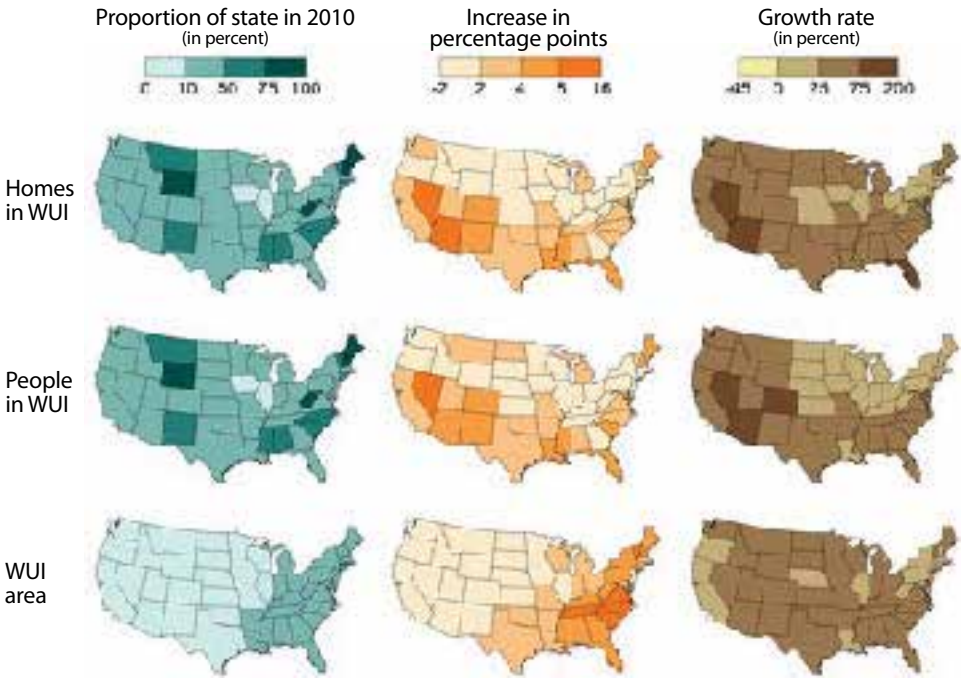
10 "Rapid growth of the US wildland-urban interface raises wildfire risk"; *Proceedings of the National Academy of Sciences of the United States of America*; February 6, 2018.

Figure 1. WUI Statistics



SOURCE: pnas.org

Figure 2. WUI Maps



SOURCE: pnas.org

When considering wildfire risk exposure, many other factors besides the WUI come into play. Environmental conditions such as low humidity, high temperatures, and strong winds can increase the probability of ignition, and exacerbate and spread the wildfire. Most properties are not destroyed by the actual fire front, but rather by embers carried by the wind, starting new fires.[11] There is also evidence that urban development increases air temperatures, as the natural environment is replaced with impervious surfaces, such as roads, sidewalks, and parking lots.[12] While California is not one of the leading states in terms of actual WUI growth, its dry weather combined with the opportunity for high winds and high temperatures create an environment for wildfires to ignite and persist. There has also been massive tree mortality in the forests of the Sierra Nevada, driven both by persistent drought conditions and by warming temperatures, which increased the populations of bark beetles, capable of landscape-wide tree mortality.[13] In California, the scale of this mortality is so large that there is a greater potential for "mass fire" in the coming decades due to the amount of dry, combustible, woody material that can produce large, severe fires.[14]

11 "What is the Wildland-Urban Interface?"; Ready, Set, Go! Program.
12 "California's Forests and Rangelands 2017 Assessment"; California Department of Forestry and Fire Protection.
13 "Bark Beetles and Climate Change in the United States"; United States Department of Agriculture.
14 "Drought, Tree Mortality, and Wildfire in Forests Adapted to Frequent Fire"; American Institute of Biological Sciences; January 17, 2018.

Because wildfire is a recurring threat, the California state government has dedicated agencies such as Cal Fire to educate people, help to protect their property, and develop strategic plans to fight fires across the state. The 2019 Cal Fire Strategic Fire Plan[15] includes goals such as identifying wildfire hazards, supporting local plans that address fire protection, increasing fire prevention awareness, and determining resources necessary for fire prevention and suppression. Among the resources offered are Fire Hazard Severity Zone Maps for each county, in which districts are color-coded to indicate the degree of risk. The development of these different zones is based on a fire hazard model that takes into account the wildland fuels, topography, and weather of an area. Many cities have their own local agencies that may have more detailed maps and indications for Fire Hazard Severity Zones. In these cities, before a new building can be built within a Severity Zone, an application for a building permit in compliance with building codes needs to be submitted. Generally, these building codes call for removing flammable materials from around the building (creating a defensible space), and using fire-resistant material in the construction of the building.[16] Besides building construction standards, other applications of these maps include city and county land use plans, property development standards, and natural hazard disclosure at the time of sale.

As of the date of this publication, the most up-to-date maps are as of November 2020. Other states where WUIs are large or growing may want to consider the pros and cons of legislation and regulations implemented in California.

From a federal government perspective, the Federal Emergency Management Agency (FEMA) recognizes the expansion of the wildland-urban interface and the increased exposure of buildings to wildfire risk. FEMA provides a guide to building homes in the WUI, in which it offers detailed recommendations for building design and construction methods to improve the chances of a building's survival in the event of a wildfire. The agency also emphasizes community infrastructure, such as local water resources and emergency vehicle access.[22] Town planning and building departments should be encouraged to review FEMA's latest WUI building recommendations.

15 "Strategic Plan 2019 (ca.gov)"; California Department of Forestry and Fire Protection.
16 "Home Builder's Guide to Construction in Wildfire Zones"; Federal Emergency Management Agency (FEMA) U.S. Department of Homeland Security; September 2008.

As wildfire risk exposure continues to grow through increased WUI area and changing climate, there is an increasing importance placed on recognizing and implementing ways to prevent and mitigate the risk. There are many actions that individuals can take to reduce their exposure to wildfire risk. Some of the most effective mitigation efforts at the individual level involve creating defensible space (removing vegetation, branches, and other combustible materials from the perimeter of the home), regularly clearing debris from roofs and gutters, and maintaining other outdoor spaces close to the home, such as decks and patios. When building a new home, consideration should be given to using fire-resistive siding and roofing, limiting the use of debris-collecting features such as dormers, and utilizing mesh screens or wildfire-resistant vents to prevent embers from reaching the attic or crawlspace. [17]

Perhaps equally important as individual mitigation efforts are community mitigation efforts. Because embers can travel long distances, homeowners cannot fully mitigate wildfire risk on their own. Wildfire community mitigation standards such as Firewise USA® can help ensure that properties are protected from both an individual and community standpoint. Towns and cities can take steps to educate homeowners, train firefighters, implement stricter building codes, and establish strategic fire plans. Builders of new developments could be required to supply town planning departments with a hazard assessment that reports the history of wildfires, subsequent flooding and debris flows, and what is in the WUI now and what will be in the WUI after development. States could allocate additional resources for combating fires, supporting local fire plans, and fostering research on how to establish fire-resistant communities. All of these types of measures would help build safer and more resistant communities across the nation by substantially reducing wildfire risk.18

The insurance community can also play a role in wildfire risk reduction by performing regular inspections of homes in wildfire-prone areas and offering mitigation credits where appropriate. The insurance industry has a long history of supporting research for risk reduction techniques and quantification of those techniques. Wildfire risk reduction research continues in the insurance space. For example, data vendors are currently working to provide insurers with updates of local vegetation conditions that could be used to reward individual and community mitigation activities.

17 "Vulnerability of Vents to Wind-Blown Embers: Executive Summary"; Insurance Institute for Business and Home Safety; August 2017.
18 *Application of Wildfire Mitigation to Insured Property Exposure*; Center for Insurance Policy Research, NAIC et al.; November 2020.

The U.S. experienced frequent wildfires of various sizes long before human settlement, and before human intervention in the natural resources. Any long-term changes to the severity, frequency, and intensity of wildfires in a region have significant consequences in changing the patterns of a landscape. These changes may be linked to land-use history or changing climate.

Even with effective mitigation strategies, ignitions will occur. Early fire detection is critical to mitigating wildfire damage; states with significant WUI could benefit from implementing wildfire monitoring and detection systems using remote sensing technologies and unmanned aerial vehicles to quickly deploy resources to suppress and extinguish the fire.

Even with effective mitigation strategies, ignitions will occur. Early fire detection is critical to mitigating wildfire damage.

The fire suppression and management costs of wildfires are increasing, with U.S. Forest Service costs often exceeding $1 billion in annual expenditures since 2000. The risk to property owners due to wildland-urban interface fire is projected to increase in California. This is due to population growth and development in southern coastal California, the Bay Area, and north of Sacramento—increasing wildfires near these areas.

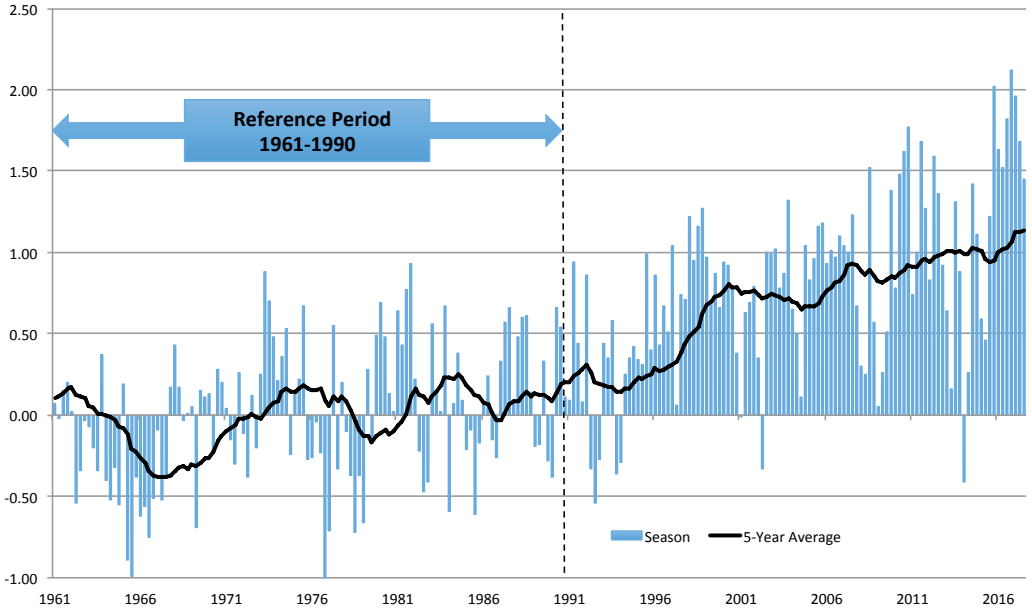
Continued research into wildfire, both from a hazard and vulnerability perspective, is critical to understanding and protecting ourselves and our communities from this peril. Wildfire risk is not static, sometimes changing very rapidly based on surrounding fuels and vegetation, but it is also changing with the climate. Climate change is thought to impact annual rainfall patterns, making winters wetter and summers hotter and drier.[19] This generally leads to a growth in healthy vegetation, followed by a drought that turns the vegetation into potential wildfire fuel. Ignitions from natural sources (such as lightning strikes) may also see an increase, which will result in a higher frequency of wildfires. Some of the most impactful wildfires of 2020, such as the LNU and CZU lightning complex fires were ignited by lightning. Wildfire severity risk may further be exacerbated as wind speeds are expected to increase during high-risk wind events, providing more oxygen to fires and enabling quicker spread. Combining all of this with the warming climate means that wildfire season will continue to expand, contributing to a greater risk of more frequent and severe wildfires.

An impartial national-level review of models may be the most efficient way to increase confidence in wildfire models.

More research still needs to be conducted to better understand and quantify the potential impacts that climate change has on wildfire risk. As one example sponsored by several actuarial organizations, the Actuaries Climate Index® (ACI) monitors several components related to climate change, combining them into a single index that can be used to better understand how various extreme weather scenarios are trending. Many of the components of the ACI are directly or indirectly related to wildfire risk, such as heavy rainfall, drought, and high wind. When looking at values of the ACI from 1961 to 2020 as shown in Figure 3,[20] there is a clear increasing trend that further supports not only the existence of a changing climate, but also the potential impact on wildfire risk.

19 "A Drier Future Sets the Stage for More Wildfires"; NASA; July 9, 2019.
20 "Actuaries Climate Index"; June 2021.

Figure 3: Actuaries Climate Index USA & Canada



In January of 2020, the Academy released the Actuaries Climate Risk Index (ACRI) to provide objective and independent analysis to assist in answering the question: Are the extreme weather conditions that result from a changing climate producing increased property losses?


Effective wildfire models capture a variety of ignition sources, both man-made and from natural causes.

Section II–

Exploring the current state of wildfire modeling, pricing for the wildfire peril, and potential areas for improvement

Current state of wildfire modeling and pricing

Similar to hurricane and earthquake simulation models used by insurers for over two decades, wildfire models are complex. In some ways, wildfire modeling is more difficult due to the localized nature of wildfire exposure and losses. Identifying broad areas that could be exposed to wildfire potential can be done, but understanding why specific exposed properties burn while others avoid damage has challenged modelers. Human contribution to ignitions further complicates the ability to model the hazard. Many factors and conditions impact the magnitude of insured losses caused by a wildfire. Typically, a wildfire model will consider factors such as ignition, fuel source, temperature, humidity, seasonal wind, land use and land cover, wildland-urban interface, impact of embers and smoke, fire detection and suppression capabilities, building construction and materials, and insurance policy terms and conditions.

Wildfire catastrophe models are generally structured similarly to models for other perils, with hazard, vulnerability, and financial components. The financial component (used to estimate financial impacts to insurers through application of policy and reinsurance terms) is generally the same across all perils, leaving the bulk of the wildfire-specific analysis to the hazard and vulnerability components. For wildfire hazard, most models use a three-pronged approach, separately considering the ignition, spread, and suppression efforts for potential wildfires.

Effective wildfire models capture a variety of ignition sources, both man-made and from natural causes. The frequency of ignition is generally largely informed by historical data, though perturbations to weather patterns and fuel states are needed to accurately represent the full range of possible wildfire activity. Additional data sources, such as satellite technology, are also used to ensure that vegetation and moisture levels are accurately represented. These variables are not static, but rather are again adjusted through various weather patterns to allow for a longer-term view of wildfire risk as opposed to an immediate outlook based on current conditions. Wildfire models also consider the various types of

fire spread, including radiant heat, direct flame contact, and firespotting (ignition from wind-blown embers). Some wildfires may transition into urban conflagrations. The Tubbs Fire in 2017 illustrated a need for measuring the risk of urban conflagrations. Prior to the Tubbs Fire, urban conflagration originated by wildfire had not been seen to that level. Appropriately accounting for spread is critical to accurately assessing wildfire risk.

The final component of wildfire hazard is the consideration of suppression efforts. The effectiveness of suppression efforts often depends on the location of the fire, as well as the intensity and speed of spreading. Fire suppression simulation within catastrophe models depends on factors such as the type of location and the time. Consideration is given to modeling factors such as firefighting capabilities, mutual aid, and the level of response. These factors include aerial fire suppression and the use of tankers, and the times of day that these methods are used. Knowing how these factors interact and the resulting level of suppression is key to modeling suppression within the model.

Fire suppression covers a range of tactics used to subdue or eliminate wildfires. The fire suppression practice of state and federal agencies is to prevent loss of life, property, and timber resources. Natural fire suppression agents include bodies of water and steep descending topography. As population expands in the WUI, natural patterns are overridden by forced fire suppression.

A negative impact of fire suppression is an increase in the top duff layer. This layer contains dead leaves and other shed vegetation in the forest that allow smoldering of dead fuel for long duration, even after fire fronts move forward. This results in a devastating effect on the forest ecosystem due to the destruction of the tree roots and trees in national forests and other wooded areas. However, recent studies show that controlled wildfire management—not suppression—makes wilderness areas more resilient to fire. An added management benefit is increased water availability and resistance to drought. Fire suppression and fire exclusion policies[21] by government agencies, transportation facilities, and fire-control infrastructures have had a major impact on fire management regimes.

Fire suppression efforts have evolved significantly over the past 15 years or so. Aerial suppression now includes airtankers, helicopters, and tactical aircraft to transport firefighters or deliver supplies. Chemical suppression uses retardants, supplementing water drops. Drone use has also increased. Drones can fly into smoke, can fly at night, and can fly into challenging terrain—without risking human safety. These evolving strategies have

21 "Fire Exclusion"; Forest Service, U.S. Department of Agriculture; May 2010.

effectively suppressed major fires and reduced property damage, especially since 2007. Wildfires are now often allowed to spread over wildlands to reduce the buildup of fuel in the already overgrown forests, while the suppression efforts are focused on saving human lives and structures in urban areas.

In addition to accounting for wildfire hazard as it exists today, forward-looking models that consider or allow for adjustments from climate change are becoming more important. As discussed earlier, there is a significant amount of evidence not only that the climate is changing, but also that it will have a substantial impact on wildfire risk. Wildfire catastrophe models will need to consider these impacts more explicitly to appropriately assess wildfire risk in the future.

Another major component of wildfire catastrophe models is the vulnerability or engineering module. As previously discussed, individual and community mitigation efforts are becoming more and more common and can have a significant reduction on a property's exposure to wildfire risk. Wildfire models generally consider characteristics such as location, construction, and occupancy, as well as a handful of mitigation features, often at both the individual and community level. An effective wildfire model will allow and adjust for the

presence of these mitigation features. Further research to expand the mitigation features available to be modeled and assessed is needed. Organizations such as the Insurance Institute for Business & Home Safety can help develop data to support the potential impact of current and future mitigation efforts.

Compared to hurricane and earthquake simulation models, acceptance and widespread usage of wildfire models are in an early stage. The 2017 and 2018 wildfire seasons in California have been a wake-up call for insurers, reinsurers, regulators, and property owners. The 2017–2018 events heightened the awareness of wildfire risk and raised strong interest from stakeholders to understand and assess wildfire risks holistically using all available tools, including stochastic models. The focus on wildfire models has continued to increase as events from the 2020 wildfire season have challenged insurer stability and financial health, as well as the general availability of insurance. The 2020 wildfire season has also shown the importance of assessing wildfire risk outside of California, and as a response, many vendors have begun to expand the domains of their wildfire models to include much of the western U.S.

Several commercial wildfire stochastic models have been available in the marketplace for years including but not limited to AIR Worldwide, a subsidiary of Verisk; Impact Forecasting (IF), a subsidiary of Aon; and CoreLogic. Risk Management Solutions (RMS) and Karen Clark & Company (KCC) have also released wildfire models over the past few years. These wildfire models attempt to assess wildfire risk in multiple U.S. states in which significant loss-causing wildfires have historically occurred, enabling contiguous modeling of wildfire activity across state boundaries. Recently released updates build on research showing that climate and weather are some of the major influences affecting annual area burned in the U.S.—particularly relationships between temperature, precipitation, and drought. The most recent updates of the wildfire models also have improved resolutions, providing a more realistic representation of fire behavior and variations across different regions, and enabling model users to develop loss metrics from the portfolio level down to individual locations.

Compared to hurricane and earthquake simulation models, acceptance and widespread usage of wildfire models are in an early stage.

Insurers have been somewhat limited in their use of wildfire models for pricing insurance in the admitted market. A major factor in this limited use is regulatory acceptance of wildfire models and catastrophe models in general. Insurers in California—with the exception of the California FAIR Plan—are still largely required to rely on historical loss experience for determining wildfire rates. Another reason for the limited use of wildfire models is that they are relatively immature in comparison to models for other perils like earthquake and hurricane and are not as well understood.

More mature models such as hurricane have been reviewed and accepted by regulators. The Florida Commission on Hurricane Loss Projection Methodology (FCHLPM) set consistent and understandable standards for hurricane model review, and more recently for flood models. That process promoted the transparency and rigor of modeling development, and increased users' confidence in hurricane model results. Florida regulators have been at the forefront of developing comprehensive catastrophe model reviews.Though there are clear benefits to a comprehensive model review process, it comes at the cost of increased expertise and resources needed to perform such a review. The FCHLPM process requires substantial investments from regulators, modelers, and other industry participants. This cost is directly financed in part by the insurance industry and policyholders.

The FCHLPM has provided benefits to Florida and for regulators outside of Florida that can leverage the review's findings. South Carolina is another example of a state that conducted a hurricane model review and determined acceptable models for use by insurers in pricing, even that process leverages some of the findings of the FCHLPM to determine whether a hurricane model is acceptable.

In 2010 the NAIC published a *Catastrophe Modeling Handbook*[22] that provides regulators a general overview of models and a number of questions and items to consider in the review of hurricane and earthquake model usage. This handbook is currently under review and expected to be updated to include discussion on issues related to both wildfire and flood catastrophe loss models. Actuarial standards of practice (ASOPs) such as ASOP No. 38, *Using Models Outside the Actuary's Area of Expertise*, and ASOP No. 56, *Modeling*, provide guidance in the review and use of any type of catastrophe model. Of course, this guidance applies only to actuaries.

22 *Catastrophe Computer Modeling Handbook*; NAIC; 2011.

The vast majority of states provide ad-hoc model review, requiring insurers to file information pertaining to the model and answer questions either on behalf of, or in coordination with, the modeler. This can result in regulators, insurers, and modelers performing duplicate work across states, without necessarily increasing the total depth of the review. Costs of inefficient reviews may be indirectly passed to the policyholder through increased insurer expenses and state tax expenditures. Lawmakers and regulators in states impacted by wildfires and other catastrophic perils may want to consider joining together to develop common a model review process to defray the cost and provide for an efficient review process.

Another benefit of a formal model review process is that companies may hesitate to invest in pricing refinement if there is uncertainty around the regulatory acceptance of their methodology. To the extent that individual states could provide clarity on which models are accepted models for use in their state, regulatory uncertainty may decrease which could promote insurance availability through more confident insurer pricing.

All stakeholders of catastrophe models—including modeling vendors, consumers, regulators, and insurance and reinsurance companies and actuaries—could potentially benefit from a rigorous and standardized catastrophe model review process. Such a review could increase regulator and insurer confidence in the models, promoting insurance availability through better matching of price to risk in the admitted market.

Major barriers for accurately projecting wildfire losses

Similar to other modeled catastrophic perils, there are significant uncertainties around model estimates and large ranges of output values among different wildfire models. Many assumptions are involved in creating catastrophe models. Below is a list of some barriers that create challenges in accurately pricing for this peril, some of which are recent factors:

- Accurately modeling the local impacts of Diablo, Santa Ana, and other high winds and their impact on fire spread through embers
- Effectiveness of early detection and fire suppression efforts
- Determining the return period or likelihood of the 2017 and 2018 events and weather conditions
- Uncertainty around human-related ignition
- Lack of comprehensive exposure information such as community mitigation and enforcement, individual mitigation measures, or building information (such as presence of appurtenant structures)
- Incorporating the impacts of risk-mitigation efforts, where supporting data is limited
- Post-event factors such as changes in coverage for additional living expenses, demand surge, building code changes, potential for subrogation, and administrative/legislative rulings (e.g., mudslides deemed covered)
- Potential impacts of climate risk[23]

A large range of output does not mean that any model is inaccurate or unreliable. Though the wide range of model outputs can cause concerns with consumers, regulators, and executives, this should be expected as there continues to exist a significant amount of uncertainty in the peril itself. However, wildfire catastrophe models are the most comprehensive way to evaluate, assess, and price for wildfire risk, and continued and regular use has the potential to allay concerns.

23 For example, see an in-depth report from the California Department of Insurance that focuses on related impacts, "Trial By Fire: Managing Climate Risks Facing Insurers in the Golden State"; September 2018.

Potential actions

The devastating impact of Hurricane Andrew on Florida and the Gulf Coast in 1992 served as a catalyst for the insurance industry to look for new ways to assess hurricane risk, ultimately resulting in widespread adoption of hurricane models. The recent wildfire seasons in California and other Western states could similarly serve as a catalyst for the insurance industry to take a different approach toward wildfire risk and develop a better understanding and appreciation for wildfire modeling. Modeling and data vendors are critical partners in educating the insurance industry and regulators on wildfire models, similar to their roles in advancing the acceptance and reliance on hurricane modeling.

One challenge that has slowed the evolution of wildfire models has been the lack of detailed claims data to help modelers better understand the propensity for loss in a wildfire event. The 2017 and 2018 wildfire seasons generated a large number of claims, therefore providing valuable insight into ancillary loss coverage, such as temporary housing, business interruption, and subsequent mudslides. Modeling vendors could use detailed claims data from these recent seasons to refine their assumptions and improve their models.

Rigorous modeling review similar to that done by the FCHLPM not only promoted better modeling techniques and greater transparency to the modeling assumptions and processes, but it also brought the insurance industry, regulators, vendors, and consumers together. However, FCHLPM review is at the state level, with a focus on how well the individual models assess Florida's hurricane or flood exposure specifically. It is an expensive process, both to the state government and to the vendors. Individual states should exercise caution if establishing a wildfire modeling review process. An impartial regional- or even national -level review of catastrophe models may be the most efficient way to increase confidence in wildfire models.

With California being a focal point of wildfire activity, the development of wildfire models that are acceptable to California regulators will be critical. California regulations currently only allow for the use of complex catastrophe models for the perils of earthquake and fire following earthquake. For other perils including wildfire, insurers are expected to use a multiyear, long-term average of historical events to develop a catastrophe provision. It is almost certain that a long-term average of past losses will not accurately reflect the current state of wildfire risk, and relying on limited, volatile historical data can promote significant rate instability when events occur, such as in 2017, 2018, and 2020.

Due to expected recurrence of extreme events and a lack of resilient and sustainable building, regulators should become more familiar with and seriously consider the benefits of wildfire models, as well as the risk to the market and insurance availability.

Section III–

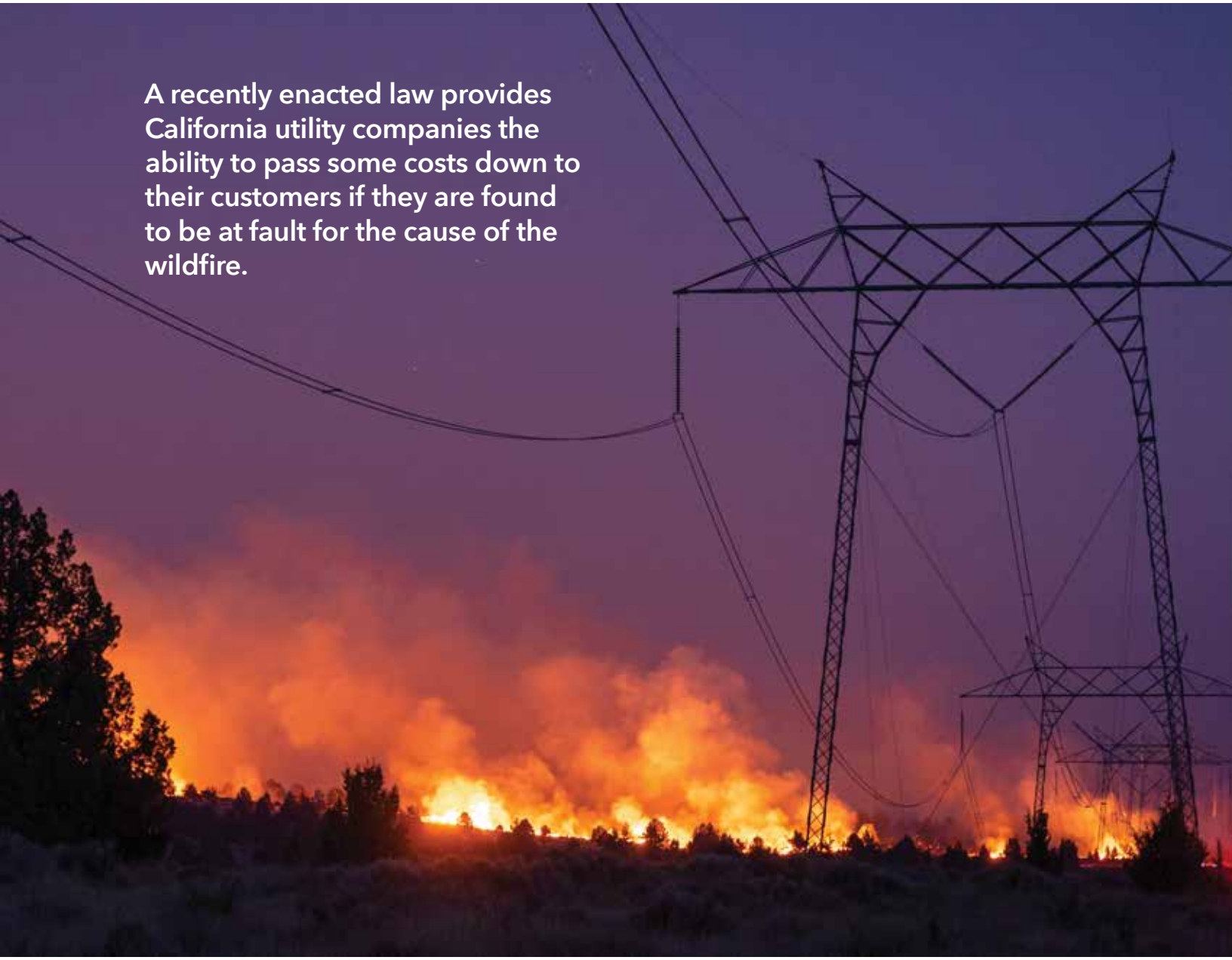
Regulatory and legislative actions as a result of recent wildfires

Many regulatory and legislative actions have been taken in the state of California as a result of the wildfires in 2017 and 2018. Three important goals of any state insurance regulatory department are to ensure availability and appropriate rates of insurance to consumers, to ensure insurance companies treat their insureds fairly in their time of need, and to promote the solvency of insurance carriers.

One of the more prominent laws enacted in California, Senate Bill 917, was in relation to mudslides being considered a covered peril on a standard homeowners policy. In response to mudslides in the Montecito area, the California insurance commissioner issued a formal notice to insurers that mudslide, landslide, and debris flow in areas that were recently impacted by wildfires would be covered if "it is determined that the ravaging of hillsides and vegetation by the Thomas and other fires was the efficient proximate cause of the mudslides." It was further noted "both the Insurance Code and case law have established the legal doctrine of 'efficient proximate cause' which means if the facts show the Thomas Fire, a covered peril, was the efficient proximate cause of the subsequent mudflow, mudslides, debris flow, landslide, or other similar event, then damage caused by those events should be covered under the property owner's insurance policy."[24] Mudslide is a peril normally covered under a flood policy and is typically excluded from a standard homeowners policy. Senate Bill 917 reinforces existing law which requires coverage if the mudflow occurred because of the preceding wildfire.

Three important goals of any state insurance regulatory department are to ensure availability and appropriate rates of insurance to consumers, to ensure insurance companies treat their insureds fairly in their time of need, and to promote the solvency of insurance carriers.

24 "Jones issues formal notice to insurers regarding mudslide coverage for homeowners"; California Department of Insurance; January 29, 2018.



A recently enacted law provides California utility companies the ability to pass some costs down to their customers if they are found to be at fault for the cause of the wildfire.

Another law of note was *Senate Bill 901*, which was aimed at wildfire mitigation and prevention efforts. SB 901 was managed and funded by the California Department of Forestry and Fire Protection.[25] In response to several of the 2017 wildfires' ignition being attributed to Pacific Gas and Electric Company (PG&E), the law provided PG&E with the ability to borrow funds in order to pay off its liabilities.[26] The law also provided utility companies the ability to pass some costs down to their customers if they are found to be at fault, but not negligent, for the cause of the wildfire. This applied only to wildfires in 2019 and beyond. In July 2019, *Assembly Bills 1054*[27] and *111*[28] were signed into law, establishing the Wildfire Fund to pay eligible claims arising from a covered wildfire in an attempt to reduce the costs to ratepayers in addressing utility-caused wildfires. The Wildfire Fund allows certain electrical corporations to collect charges from ratepayers to support the Wildfire Fund. Section IV of this paper further analyzes key legislative issues related to utility companies.

Below are various other bills and requests that were proposed following the 2017 wildfire catastrophes.

- The California Department of Insurance (CDI) issued a formal notice to insurers directing them to cease all moratoriums on issuing auto insurance in wildfire areas and reminding them that California law prohibits this practice.[29]
- The CDI also issued a cease-and-desist order requiring the California FAIR Plan to terminate immediately the moratorium it initiated on writing new fire insurance coverage in wildfire-impacted areas and ordered the FAIR Plan to make its fire insurance products available to all eligible Californians in keeping with its statutorily mandated purpose.[30]
- SB 824—Approved by Governor September 21, 2018. Filed with secretary of state September 21, 2018.[31]
    - The law prohibits, with certain exceptions, an insurer from canceling or non-renewing a residential property policy for one full year based solely on the fact that the insured structure is located in an area in which a wildfire has occurred and a state of emergency was declared.

25 *Senate Bill No. 901*; California Legislative Information; September 21, 2018.
26 "CAL FIRE Investigators Determine Causes of 12 Wildfires in Mendocino, Humboldt, Butte, Sonoma, Lake, and Napa Counties"; California Department of Forestry and Fire Protection; June 8, 2018.
27 *Assembly Bill 1054*; California Legislative Information; July 12, 2019.
28 *Assembly Bill 111*; California Legislative Information; July 12, 2019.
29 "Illegal auto policy moratoriums in southland wildfire areas leads regulator to take action"; California Department of Insurance press release; December 11, 2017.
30 "FAIR plan ordered to cease and desist fire insurance moratorium"; California Department of Insurance press release; December 14, 2017.
31 *Senate Bill No. 824*; California Legislative Information; September 21, 2018.

The law also requires an admitted insurer with written premiums in California above a specified threshold to submit a report with specified fire risk information on its residential property policies to the commissioner every two years. It also requires the commissioner to post a report on wildfire risk compiled from the submitted data to the department's website every two years.

- SB 894—Approved by Governor September 21, 2018. Filed with secretary of state September 21, 2018.[32]
    - Under specified circumstances, the law requires insurers to offer to renew the policy for at least the next two annual renewal periods or 24 months, whichever is greater.
    - For policies with dollar limits on the coverage of additional living expenses, the law grants an extension of that coverage for up to 12 additional months, for a total of 36 months, if the insured, in good faith, encounters delays in the reconstruction process that are a result of circumstances beyond their control.
    - For an insured that has suffered a loss from a declared state of emergency, the law requires insurers to allow the insured to use the combined policy limits for primary dwelling and other structures.
- SB 917—Approved by governor September 21, 2018. Filed with secretary of state September 21, 2018.[33]
    - The law requires coverage to be provided if losses result from a combination of perils, which includes mudslides, in the event that an insured peril such as fire is found to be an effective proximate cause.
- AB 1772—Approved by governor September 21, 2018. Filed with secretary of state September, 2018.[34]
    - The law extends the amount of time an insured has to rebuild from two years to three years after a wildfire and receive the full replacement costs.
- AB 1797—Approved by governor August 27, 2018. Filed with secretary of state August 27, 2018.[35]
    - The law requires that insurers provide an estimate of the cost necessary to rebuild or replace an insured structure, on an every-other-year basis, when providing replacement cost coverage.

32 *Senate Bill No. 894*; California Legislative Information; September 21, 2018.
33 *Senate Bill 917*; California Legislative Information; September 21, 2018.
34 *Senate Bill 1772*; California Legislative Information; September 21, 2018.
35 *Assembly Bill No. 1797*; California Legislative Information; August 27, 2018.

- AB 1799—Approved by governor July 9, 2018. Filed with secretary of state July 9, 2018.[36]
  - The law requires insurers to provide one free, full set of certified policy documents, including endorsements and the policy declarations page, within 30 days of a covered loss when requested by the policyholder.
  - Prior to this law, insurers were only providing the declarations page of the policy documents or a sample policy.
- AB 1800—Approved by governor September 21, 2018. Filed with secretary of state September 21.[37]
  - In the event of a total loss, the law clarifies the current law that an insurer must pay the full extended replacement cost coverage, when purchased by insureds, regardless of whether the policyholder chooses to rebuild at the same location, rebuild at a new location, or purchase an already-built home.
- AB 1875—Approved by governor September 21, 2018. Filed with secretary of state September 21.[38]
  - The law requires the Department of Insurance to establish the *California HomeInsurance Finder* on its website. Lawmakers are seeking to help homeowners connect with an agent/broker for residential property insurance and not be left without coverage. There are several situations—e.g., an insured is denied coverage or whose policy is canceled by an insurer—where the law requires that the insurer provides the insured information about the finder site.

In total, two dozen laws were enacted by September 2018.[39] In addition to issues related directly to insurance, these laws addressed topics related to utilities, controlled burns, and clear-cutting.

One of the most impactful laws to the insurance industry, SB 824, saw its first impacts in December 2019. Insurance Commissioner Ricardo Lara issued a one-year moratorium preventing insurance companies from non-renewing policyholders near recent wildfire areas. The moratorium covered an area representing about 800,000 California homes. Following the historic 2020 wildfire season, a second non-renewal moratorium was issued. This moratorium prohibited non-renewal for 2.1 million homes. Approximately 364,000 homes were impacted by both moratoriums, effectively disallowing non-renewals for over two years.[40]

36 *Assembly Bill No. 1799*; California Legislative Information; July 9, 2018.
37 *Assembly Bill No. 1800*; California Legislative Information; September 21, 2018.
38 *Assembly Bill No. 1875*; California Legislative Information; September 21, 2018.
39 "Governor Brown Signs Legislation to Strengthen Wildfire Prevention and Recovery"; California Office of the Governor; September 21, 2018.
40 "Insurance Commissioner Lara Protects More Than 2 Million Policyholders Affected by Wildfires from Policy Non-Renewal for One Year"; California Department of Insurance; November 5, 2020.

A year after the September 2018 laws, in October 2019, another series of 22 laws were enacted by October 2019. reforms.[41] These laws were based on Gov. Gavin Newsom's Strike Force Report and directed at the following areas of focus, with the majority addressing wildfire prevention and response:

- Catastrophic wildfire prevention and response
- Mitigating climate change through clean energy policies
- Fair allocation of catastrophic wildfire damages
- A more effective California Public Utilities Commission (CPUC) with the tools to manage a changing utility market
- Holding PG&E accountable and building a utility that prioritizes safety

During the 2020 wildfire season, AB 2167 was brought to the Senate. The bill would have required the commissioner to investigate, study, and prepare a report which addressed:

The extent to which the commissioner may use its authority to create one or more market assistance plans to ensure that residential property insurance is fair, available, and affordable in high fire risk communities in the state, including assessing the need for market assistance plans and how the commissioner may implement those market assistance plans.

The costs and benefits of authorizing insurers to include the cost of reinsurance as part of the rate for residential property insurance, and the extent to which the cost of reinsurance could be estimated specifically for wildfires and homes in high fire risk areas.

41 "Governor Newsom Signs Bills to Enhance Wildfire Mitigation, Preparedness and Response Efforts"; California Office of the Governor; October 2, 2019.

The extent to which the establishment of a public wildfire catastrophe model would be appropriate for use in residential property insurance ratemaking.

Though the bill failed to pass, it was a notable attempt from the legislature to direct the California Insurance Commissioner to study and report on allowing property and casualty insurers to factor in catastrophe models and reinsurance costs in rate setting.

California lawmakers have been active in enacting changes as a result of the record-breaking wildfire events. Mandatory changes to coverage such as requiring coverage for wildfire-related mudslides and extending living expense coverage timeframes may impact future availability and affordability of insurance. With the constantly changing regulation and legislation in California, actuaries must revisit their estimated and actual loss costs to determine whether any of these outcomes might warrant incorporation of their resulting impacts. This can lead to the question of whether the insured is the one who is ultimately bearing the cost of the rulings meant to help provide them coverage in times of hardship.

Other important questions: How will insurers react to the new public policies and decisions set in place? Will they alter their policies to try to either incorporate or anticipate the outcomes of court rulings? If not directly addressed in the policies, how might the changes impact underwriting appetite? In Section IV, we present the evidence showing a decreasing underwriting appetite for admitted insurers in California.

In 2019, The Extreme Events and Property Lines Committee of the American Academy of Actuaries offered these questions as important considerations for regulators, legislators, consumer groups, insurance companies, and distributors to consider and potentially find solutions and answers. Uncertainties in language from regulatory policies or state laws can create misalignment in expectations between all parties; therefore, it is important for insurers to consider working with the states and establish clear intent on any language incorporated in insurance policies.

Another record-setting year of wildfires in 2020 led to further legislative changes to create further mitigation and suppression and the establishment of a Wildfire Fund in California in an attempt to fund certain utility-caused fires. New solutions directly related to the insurance industry have been limited since 2018. However, industry impacts have begun to materialize for insurers and consumers, possibly accelerated by the events of 2020.

Though bills for studying affordability mechanisms, ratemaking practices, and reflection of catastrophe modeling failed in 2020, these issues are critical components of a wildfire solution. Ratemaking allowing recognition of the true cost of each risk—by reflecting either reinsurance costs or wildfire hazard as measured by appropriate modeling—both incentivizes availability of coverage and provides sophisticated risk signals to consumers, builders, municipalities, and other stakeholders. Appropriate modeling also provides a method to assess the impact of mitigation measures, which can provide further incentives for communities and individuals to reduce wildfire risk.

Affordability mechanisms have been employed in many catastrophe-exposed jurisdictions given the recognition that insurance pricing reflecting the true cost of risk may not be feasible for all consumers.

Section IV–

Impacts of unprecedented wildfire activity

Property insurance trends

It is evident that recent wildfire activity in California has impacted the California property insurance industry. For example, the homeowners insurance industry in California recorded a $20 billion total underwriting loss between 2017 and 2018. That is double the total underwriting profit of approximately $10 billion between 1991 and 2016. [42]Several years removed from 2017 and 2018, we are seeing evidence of a changing insurance market in California catalyzed by this historical industry event.

The California FAIR plan provides basic fire insurance coverage for high-risk properties when traditional insurance companies will not. Traditional insurance companies can offer policies in either the admitted market or the surplus lines market. Policies offered through surplus lines are not required to have their rates and coverages approved by state regulators. Additionally, FAIR plan and surplus lines coverages may not be as generous as those in the admitted market. Insurers tend to restrict new policies, or even non-renew existing policies in the admitted market when they find the risk to be in excess of the return they can achieve under their state-approved rates.

It is evident that recent wildfire activity in California has impacted the California property insurance industry.

In recent years, substantial evidence has emerged that insurers are decreasing their wildfire exposure in the admitted market, shifting consumers toward coverage through the FAIR plan or the surplus lines market. The California Department of Insurance reported in 2019 that insurers had sent over 42,000 non-renewal notices to homeowners in the wildfire-exposed counties of the Sierra foothills. This compared to about 24,000 in 2018. Around the same time, the FAIR plan reported a 36% annualized increase in total insured value over a nine-month period. Wildfire models comparing the FAIR plan's exposures from September 2018 to June 2019 showed that the modeled expected losses per property increased by 81%.[43]

42 "Wildfire catastrophe models could spark the changes California needs;" Milliman, Inc.; October 2019.
43 "California SERFF", California FAIR Plan Personal Dwelling Fire and Allied Lines Form/Rate/Rule Filing MISF-132503210; August 25 2020.

Insurers in California are faced with limited options for incorporating advanced wildfire modeling and the costs to reinsure their wildfire risk.

These changes show that the FAIR plan experienced relatively high growth specifically in wildfire-exposed areas. The surplus lines market also appears to have grown rapidly, as the premium volume for homeowners policies has doubled from 2017 to 2020.[44]

Insurers in California today are faced with limited options for incorporating advanced wildfire modeling and the costs to reinsure their wildfire risk, which may be a factor to the decreased risk appetite observed after the recent wildfire events. Each of the admitted market alternatives discussed above can come with consequences to the consumer, such as restricted coverage, and in the case of the surplus lines market, the lack of a state guaranty fund in the case of insurer insolvency. Outside of insurance, consumers could forgo insurance and "self-insure," however that comes with obvious risks and is also not possible for insureds with a mortgage.

Wildfire impacts to utility liability

Investigations into the source(s) of ignition for some recent wildfires have identified electrical transmission lines as the underlying cause, or a contributing cause. Liability of the associated utility companies is often alleged as failure of utility equipment; failure to properly maintain, inspect, or de-energize electric distribution lines; or failure to manage surrounding vegetation. In California, the doctrine of inverse condemnation imposes strict liability in many such cases—that is, negligence or intentional harm are not required to establish liability. Unlike fires ignited by natural sources (e.g., lightning) or individuals, the utility companies deemed to be liable provide a large potential source of subrogation to insurers and other parties impacted by the fires.

In July 2019, the California governor signed into law AB 1054, which established a statewide fund to reimburse participating utility companies for payment of eligible third-party claims arising from a covered wildfire (the "Wildfire Fund"). The Wildfire Fund was established in September 2019 and is designed to reimburse aggregate calendar year claims that exceed the greater of $1.0 billion or the insurance coverage required to be maintained by the liable utility under AB 1054. This fund is expected to ultimately provide claim-paying capacity of approximately $21 billion through a combination of utility rate surcharges and contributions from the investor-owned utility companies.

44 "California Leads Nation in Surplus Lines Premiums on 5th Year of Record Growth"; Insurance Journal; February 4, 2020.

Acting as a risk-pooling mechanism for the participating utility companies, the Wildfire Fund supplements other forms of excess liability insurance coverage for these entities. The Wildfire Fund itself utilized the insurance marketplace for risk transfer in 2019, as the Wildfire Fund administrator is authorized to "purchase insurance … to maximize the claims paying resources of the fund." However, in 2020 it was "determined that the pricing and structure [of the risk transfer program] did not sufficiently meet the goal of enhancing the Fund's durability."

The existence of the Wildfire Fund provides both a potential source of subrogation funding for insurers on losses from future wildfire events, as well as associated challenges for insurance pricing. Insurer estimates of potential recoveries from the Wildfire Fund may need to include, either implicitly or explicitly, assumptions regarding the probability that an individual wildfire is deemed to be caused by a participating utility company and eligible for Wildfire Fund payment, and the amount of subrogation available from the Wildfire Fund (and associated utilities). The subrogation amount may be less than complete in cases where the fund is depleted due either to the severity of a particular wildfire, or the combined impact of multiple wildfire events. The Wildfire Fund assesses its loss potential through a combination of catastrophe and financial models, and this work represents an area of opportunity for further study.

In addition to the utilities themselves, utility contractors are reporting a significant hardening of the liability insurance market. Due to California's inverse condemnation doctrine, operations of these contractors are expected to lead to their inclusion in wildfire-related utility lawsuits going forward. Insurance pricing for this segment is rising, capacity is decreasing, and underwriting requirements are tightening as insurers move to reduce risk in these areas.[45]

In 2018, SB 901 was signed into California law, requiring electric utilities to prepare wildfire mitigation plans. These wildfire mitigation plans include Public Safety Power Shutoff (PSPS) events, where the utilities proactively shut off electric power to protect public safety, as set forth in applicable laws and regulations. Changes in the frequency or duration of PSPS events will further impact the insurance marketplace, including increasing expected loss of business income claims on commercial property policies, food spoilage and power surge losses from personal property policies, and associated liability exposures for the utilities associated with decisions regarding these events.

45 "Utilities contractors challenged in finding wildfire coverage"; *Business Insurance*; May 25, 2021.

Conclusions

The wildfire seasons over the past several years have shown the severe impact that this peril can have on people's lives and property, particularly in the Western U.S.

This paper discusses the wildfire peril, impacts of mitigation measures and climate change, current state of wildfire catastrophe models, legislative and regulatory responses, challenges faced by the insurance and utility industries, and developing impacts to consumers needing to insure their properties. These are all critical components to understanding the current state of the wildfire insurance market and building toward stability, robust coverages, incentives to mitigate, and increased consumer choice.

Additionally, this paper offers perspectives on recommended improvements over the status quo, such as the importance of educating consumers on fire prevention and mitigation and the advancement and acceptance of wildfire catastrophe modeling. Such efforts would help create more fire-resilient communities and allow insurers to better assess the risk and offer appropriate insurance coverage to rebuild.

As the wildfire peril continues to change and evolve, all stakeholders—consumers, insurers, regulators, and legislators—need to examine recent wildfire catastrophes in order to prepare better for future events.

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