MILLIMAN REPORT

State of Insurance for Wildfires

Issue Brief on behalf of Alliance for Wildfire Resilience

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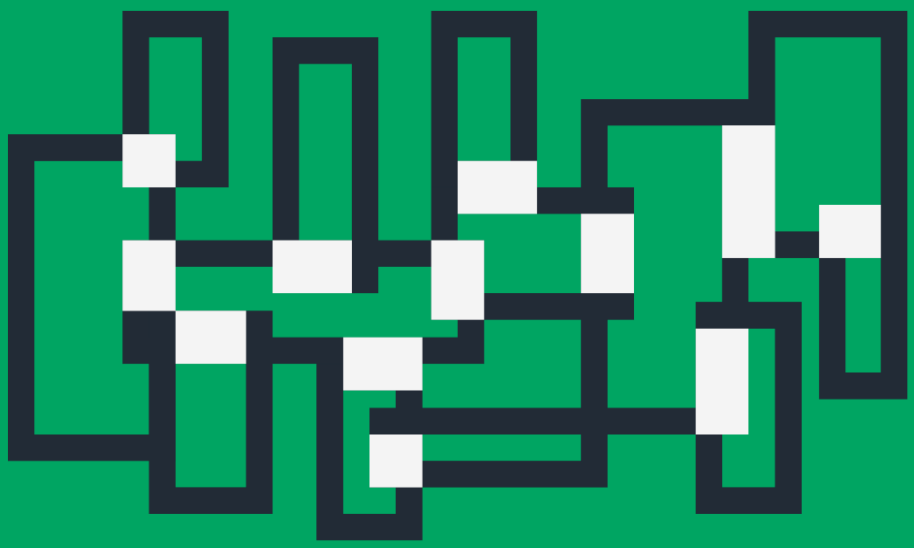

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Purpose of Report

In many areas of the U.S., communities are facing unprecedented challenges associated with wildfires, principally urban conflagrations, which have become more frequent and destructive over the past decade. Escalating wildfire risk has destabilized insurance markets, leading to cascading economic effects such as delayed real estate transactions, stalled new construction, and property value decreases.

Many legislators and regulators are hearing from constituents who have experienced unplanned premium increases or the inability to secure coverage. Policymakers are striving to understand how wildfire affects homeowners' access to insurance and what interventions may work to address the problems.

Alliance for Wildfire Resilience ("AWR") was formed with the goal of reducing the long-term consequences of wildfires in the United States by fostering partnerships to achieve meaningful and lasting changes in wildfire policy. AWR engaged Milliman, Inc. ("Milliman"), an independent actuarial consulting firm, to prepare this issue brief as an educational resource designed to be used by federal policymakers.

The purpose of this brief is to summarize at a high level the issues faced by U.S. homeowners in wildfire-exposed areas and the current challenges in managing wildfire risk today. It explains how wildfire risk is affecting the sustainability of the property insurance market that serves as a critical financial safety net for individuals, businesses, and communities. This brief also offers insights on ways federal policymakers can help effect meaningful change in order to reduce risk and restore sustainable insurance in wildfire-exposed areas, with benefits to economic resilience and stability.

Throughout the brief we have included references to more detailed documents that might be useful in gaining a deeper understanding of the concepts discussed. Milliman and AWR are available to answer any questions about this brief.

1 How is Wildfire Risk Impacting Homeowners and Communities?

1.1 URBAN CONFLAGRATION RISK IS INCREASING

While "wildfire" is commonly used to describe all types of fires occurring in wholly or partially natural areas, it is crucial to distinguish fires occurring in vegetative landscapes from urban conflagrations. These fires may start as wildfires burning in vegetation but, as the fires enter urban or suburban communities and spread uncontrollably from structure to structure, they are more accurately known as urban conflagrations. Although traditional wildfires remain a significant threat to ecosystems and infrastructure, the modern wildfire crisis is increasingly driven by urban conflagrations resulting in widespread structural loss.

Urban conflagrations have become larger, more frequent, and more severe, primarily due to a combination of factors:

- *Changing atmospheric conditions*. Warming temperature trends, persistent droughts and changes in precipitation patterns have created environments where fuels dry more quickly and remain combustible for longer periods throughout the year.[1] As a result, fire seasons have lengthened by an average of 84 days since the 1970s across the Western United States.[2]
- *Historic fire suppression.* Past land use and decades of wildfire suppression have led to changes in vegetation that have increased the potential for extensive areas of high-intensity wildfires.[3] This "fire deficit" has disrupted natural ecological processes that historically limited fuel loads through regular, low-intensity burns and has promoted the growth of invasive fire-intolerant plant species.[4] The combination of these factors has created conditions where fires burn hotter, spread faster, and threaten more communities with unprecedented intensity.
- *Increased construction of vulnerable structures in fire-prone areas.* Countrywide, the number of housing units in areas designated as Wildland Urban Interface ("WUI") increased 25% (35.8 million to 44.7 million) from 2000 to 2020.[5] The top five states in terms of percentage increase in number of homes over that time period were Nevada (98%), Utah (59%), Arizona (54%), Florida (52%), and Texas (52%); California had an increase of 22%. Much of this development occurs with vulnerable construction within and adjacent to fire-prone wildlands and with little preparation for fire.[6] The expansion of the built environment into fire-prone areas has not only increased exposure to wildfire but also increased the probability of human-driven ignitions within areas already prone to fire.[7]

More than half of the communities with the greatest potential for catastrophic urban wildfire events are not in the West: Florida, Texas, Oklahoma, and Alabama are among the top 10 states when ranked by communities with high urban wildfire risk factors.

Although California has experienced recent notable destruction, wildfire is reaching into more communities and impacting more people. A recent Headwaters Economics analysis shows that more than 1,100 communities in 32 states across the U.S. share similarities with communities recently devastated by urban wildfires. More than half of the communities with the greatest potential for catastrophic urban wildfire events are not in the West: Florida, Texas, Oklahoma, and Alabama are among the top 10 states when ranked by communities with high urban wildfire risk factors.[8]

The occurrence of "fast fires" has also become more prevalent and is predicted to increase in the future. Many of the most deadly and destructive fires share the common characteristic of extremely rapid growth under extreme weather conditions when it is hot, dry and windy. Based on a study of more than 60,000 fires from 2001 to 2020, these "fast fires" represented 2.7% of all events but accounted for 89% of the structures damaged or destroyed. Among the top 20 fastest growing fires, only two originated primarily as forest fires, with 16 in grassland and two in closed shrubland. Five of the top 20 fastest fires were in California, with the other 15 distributed across Oklahoma, Kansas, Oregon, Washington, Texas, Idaho, Nevada and Utah.[9]

1.2 CASCADING IMPACTS ON BROADER ECONOMY

The risks associated with wildfire and other catastrophes are owned by residents and communities, but the financial uncertainty of these risks can be transferred in exchange for an insurance premium with a more certain cost if there is

a well-functioning insurance market. However, rising risk can disrupt the insurance market and have cascading impacts on home ownership, wealth, tax bases and investment.

1.2.1 Housing Market

Housing markets in wildfire-prone regions have begun to show signs of price adjustments associated with the rising risk. A study published in *Landscape and Urban Planning* found that major wildfires caused a 2.2% drop in home values in nearby neighborhoods that were not burned.[10]

Homeowners need to obtain insurance to secure most mortgages, and insurance issues can impact both sales of existing homes and new construction. According to a report from the California Association of Realtors, 13% of realtors in California had a sales transaction canceled in 2024 because insurance was unavailable or unaffordable, almost double the 6.9% reported a year earlier.[11] According to the California Building Industry Association, construction in less developed areas has been slowed because homebuilders cannot figure out how to insure new developments at a price that customers can afford, and multi-family condominium projects have been particularly affected.[12]

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1.2.2 Mortgage Lending

Increasing wildfire risk and disruptions in the insurance market may be affecting the mortgage industry. A study by the Federal Reserve Bank of Philadelphia found increases in mortgage delinquencies among households impacted by fires.[13] Another paper by the Federal Reserve Bank of Dallas found that rising insurance premiums are associated with increased probabilities of default and prepayment within 12 months after premiums change.[14] Drops in home values can increase the risk of mortgage defaults, as experienced in the 2008 mortgage crisis.

1.2.3 Municipal Bonds

As rising risk leads rating agencies and other financial institutions to incorporate climate and catastrophe risk metrics into their underwriting models, the cost of issuing debt to municipalities and public entities in high-risk areas will increase.

As rising risk leads rating agencies and other financial institutions to incorporate climate and catastrophe risk metrics into their underwriting models, the cost of issuing debt to municipalities and public entities in high-risk areas will increase. Research published in the *Journal of Financial Economics* documented that counties with high exposure to climate risks are paying more in underwriting fees and initial yields to issue long-term municipal bonds compared to counties with low exposure, reflecting investors' growing concerns about climate-related fiscal challenges.[15] This increase in the cost of borrowing then flows through the government's finances, ultimately being borne by the taxpayers of that jurisdiction.

Municipal bonds fund 70% of U.S. infrastructure, and higher borrowing costs would make it more difficult for wildfire-exposed communities to improve aging infrastructure and rebuild following disasters. Notably, S&P Global Ratings recently downgraded the credit rating of the Los Angeles water and power utility, citing "the increasing frequency and severity" of wildfires and signaling a potential watershed moment for a market that has ignored climate change and the risk of a disaster wiping out a city's property tax base and forcing a bond default.[16]

1.3 IMPACTS ON INSURANCE SUSTAINABILITY

A sustainable insurance market rests on three pillars: availability, affordability, and reliability:

- Availability signifies that there are enough private insurers willing to offer insurance in a market so that customers can readily obtain the coverage they need.
- Affordability signifies that policyholders are willing and able to pay the premiums charged in order to transfer their risk.
- Reliability signifies that insurers are confident in the market and their ability to remain solvent and pay claims associated with the risks they have insured, given the environment in which they operate.

Escalating wildfire risk is causing cracks in all three of these pillars, disrupting the insurance market and potentially resulting in a lack of available and affordable insurance options that consumers can rely on.

1.3.1 **Availability**

The primary factors that can restrict availability in the private insurance market are 1) inability to measure risk, 2) inability to manage overall risk and 3) inability to match the price to the risk and earn a reasonable return.

1.3.1.1 MEASURING RISK

Sometimes the inherent risk perceived in a market can increase rapidly, leading to short-term market shocks. Catastrophic events are a common catalyst for such changes in risk assessment, potentially triggering a widespread repricing of the risk due to the realization that the hazard was much higher than previously believed. For many years, the most destructive U.S. wildfire on record was the 1991 Oakland Hills fire; it was possible to consider that catastrophe as an anomaly and unlikely to occur again. However, the 2017 and 2018 wildfire seasons caused a fundamental reassessment of wildfire risk by many insurance professionals and fire management experts.

Insurers and reinsurers have become increasingly reliant on sophisticated catastrophe ("CAT") models to help measure catastrophe risk. Without such tools, wildfire coverage would likely be unavailable across broad geographic regions as insurers would lack a sufficient basis for risk management and pricing. In general, although they are currently the best available tools for the purpose, CAT models for wildfire are less mature than models for other perils, such as earthquakes and hurricane.[17] Due to this factor and the relatively small number of events with which to validate models, insurers and reinsurers may be less confident about wildfire model predictions and more conservative with capacity allocation, underwriting, and pricing for wildfire risk.

1.3.1.2 MANAGING RISK

Moreover, wildfires now result in additional exposure beyond direct fire damage, including widespread smoke damage affecting properties far from actual flames, higher additional living expense costs due to prolonged evacuations, labor shortages that cause longer rebuilding timelines, and post-wildfire mudflow and debris flow risks, which can cause significant secondary losses in burn scar areas. These changes have rapidly transformed wildfire from a secondary peril, historically considered manageable through geographic diversification, to a primary catastrophe risk that can threaten insurer solvency.

Insurers need to manage their overall exposure to catastrophic events to stay solvent and ensure the ability to pay claims. Insurance generally relies on the "pooling principle", which is the idea that a portfolio of many policies is less risky than a single policy due to the independence of individual risks. In areas threatened by natural catastrophes, individual risks are far less independent and insurers are at greater risk of simultaneous losses affecting a large percentage of their policies. Thus, insurers typically limit their concentration in certain areas and seek additional protection through reinsurance and/or other risk transfer options such as catastrophe bonds.[18] When risk increases, insurers may need to reduce their exposure (through non-renewals, limits on new business or market withdrawals) and/or purchase additional reinsurance to maintain their financial strength. Financial strength is important to avoid ratings downgrades, which could potentially impact consumers if their homeowners insurance is not deemed sufficiently reliable to meet the requirements of mortgage lenders.

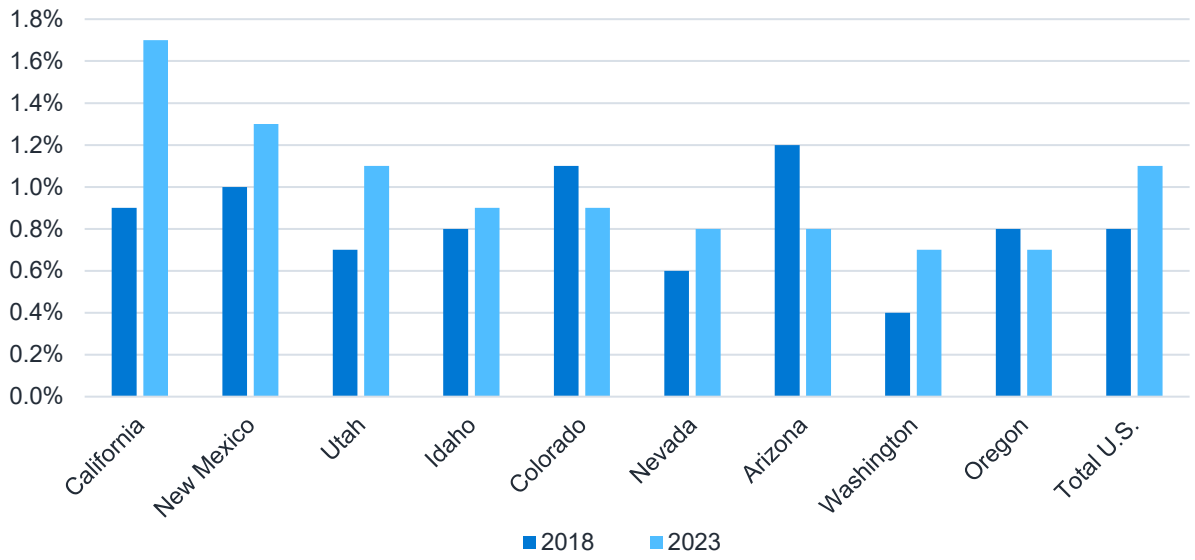
1.3.1.3 PRICING RISK

Availability also depends on insurers' ability to charge a price corresponding to the risk. Homeowners insurance pricing is regulated at the state level, with each state operating independently and resulting in a wide range of regulatory practices across the country. Especially in a rising risk situation, the target of state regulators and consumer advocacy groups is often to delay or suppress premium increases, rather than to address the underlying risks faced by residents that underlie those increases. Insurers in many states with high wildfire risk have faced significant hurdles when attempting to secure actuarially sound rates that reflect current risk levels.

Over a prolonged period, inadequate rates eventually erode insurer surplus, increasing the risk of insolvencies. If insurers are not able to charge a price that earns a reasonable profit for some segments of the market, they may restrict or withdraw availability in those segments.

California historically has promoted some of the most restrictive regulatory constraints, including a prohibition on incorporating wildfire catastrophe models and reinsurance costs in the calculated rate need, and rate hearings that delay rate approval and often result in rates that are much lower than requested.[19] The lengthy and uncertain approval process for rate filings can create a mismatch between risk exposure and premium. Given these constraints, insurers may determine that a more viable strategy is to reduce their risk by retreating or receding from the market rather than pursue full rate indications. The chart below shows how California experienced a much steeper increase in non-renewal rates since 2018 versus several Western states and the U.S. average:

FIGURE 1: HOMEOWNERS INSURANCE NONRENEWAL RATES BY STATE AND TOTAL US: 2018 VS. 2023



Sources: U.S. Senate Budget Committee Staff Report for December 2024. Total U.S. average calculated as exposure-weighted average, using earned house-years by state from National Association of Insurance Commissioners (NAIC) homeowners reports for years 2017 and 2022.

1.3.1.4 NON-ADMITTED INSURANCE

Historically, most property owners obtain insurance coverage through the "admitted" market. For homeowners unable to obtain coverage through the admitted market, the next option is often to seek coverage from "non-admitted" insurers. Non-admitted insurers operate outside state regulatory authority, giving them more flexibility in rates and policy provisions. The non-admitted market grew by double digits for six consecutive years through 2023 due to increasing demand from catastrophe-exposed properties and complex liability risks who could not find coverage in the admitted market.[20] In California, non-admitted insurers wrote 4% of the homeowners insurance premiums in 2023, compared to 0.4% a decade earlier in 2013.[21] Non-admitted insurance is useful to cover unique or high-risk situations and can help to fill the coverage gap created when admitted market availability recedes. However, it offers fewer customer safeguards such as state guaranty fund protection, leaving consumers more vulnerable if the insurer goes insolvent.

1.3.1.5 RESIDUAL MARKETS

When consumers are unable to find coverage in the admitted or non-admitted private markets, many states have established entities to offer insurance directly as a last resort; this is referred to as the "residual market". For property insurance, these often take form as Fair Access to Insurance Requirements ("FAIR") plans, which are state-mandated entities formed and administered by private insurers. A less common type of residual market entity is a "public option", where the state legislature creates a free-standing insurance entity operating under substantial governmental oversight and control, such as the California Earthquake Authority and Florida Citizens Property Insurance Corporation.[22] Residual markets typically offer less flexibility in coverage options and often require subsidization in the form of contingent funding from taxpayers, from policyholders of private insurers, or both.

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One response to insurance availability problems in the West has been the expansion of residual market coverage. As directed by the California insurance commissioner, the state's FAIR Plan has significantly increased commercial property coverage limits in 2025.[23] Following years of market contraction in high-risk areas, Colorado recently formed a new FAIR plan, which was signed into law in May 2023.[24] Additional states, including Nevada, Utah, Idaho, Montana, and South Dakota are also exploring new FAIR plans.[25]

According to A.M. Best, policy counts in property residual markets have nearly doubled from 2018 to 2023. The California FAIR plan policy count grew by 276% from 2018 through 2024, with a 15-fold increase in premiums over the same period.[26]

FAIR plans and other residual market solutions are necessary to provide availability when insurance is not readily or consistently available in the private market. However, using residual markets to address affordability concerns is misdirected; a residual market with rates that are inadequate will likely experience disproportionate growth, increased likelihood and size of deficits and assessments, and ultimately will not be financially self-sustaining.[27]

1.3.2 **Affordability**

Within the context of a sustainable insurance market, affordability refers to whether customers are generally willing and able to buy insurance at the price offered. That said, it is important to note that private insurers are precluded from establishing rates based on their policyholders' ability or willingness to pay, although governmental programs could theoretically contain subsidies based on means testing or some other determination. Actuarial ratemaking standards and state regulations direct actuaries to base rates on the expected value of all future costs associated with an individual risk transfer.

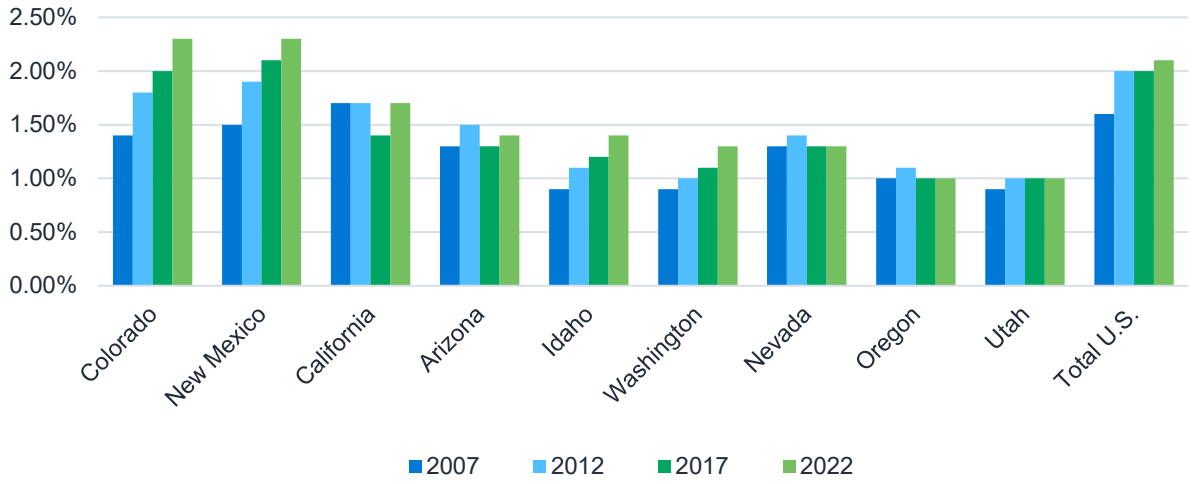
Affordability challenges can arise from unplanned increases in the price of the insurance, as we have seen in areas where wildfire risk is rapidly increasing. Beyond wildfire risk there have been other factors, such as the rising costs of building materials and labor, simultaneously driving up insurance premiums and exacerbating the struggle to maintain affordability.

As consumers face increasing financial strain, it can be tempting for regulators and legislators to focus on delaying or suppressing insurance premium increases. However, while affordability is desirable, efforts to keep prices artificially low can result in unintended consequences. For example, prior to December 2024, California rate regulations specified that a minimum 20-year average of historical catastrophe losses must be used to calculate catastrophe provisions in homeowners rates. However, this methodology resulted in catastrophe rate indications that failed to respond to rising risk until the extreme wildfire events in 2017 and 2018 led to drastic increases within a short timeframe.[28]

Increased competition generally helps affordability, since a greater variety of options for consumers to choose from make it more likely for them to find a lower price point. As previously noted, the inability to match price to risk can potentially lead insurers to limit writings and, in some cases, withdraw entirely from markets. In high-risk areas this can create a cascading effect where each insurer's retreat reduces competition and further hurts affordability.

The chart below shows one useful metric for affordability, the statewide average homeowners premium as a percentage of the median household income for several Western states and the U.S. average:

FIGURE 2: HOMEOWNERS AVERAGE PREMIUM AS A PERCENT OF MEDIAN INCOME: 2007 - 2022



Sources: Data for 2007-2021 from Insurance Information Institute archive of NAIC reports. Data for 2022 from NAIC. Median Household Income by State from US Census Bureau, Historical Income Tables: Households, Table H-8.

In 2022, the average cost for homeowners insurance ranged from 1.0% to 2.3% of median household income for Western states, versus 2.1% for the U.S. in total. However, these statewide averages do not represent the full picture, particularly the experience in high-risk areas.

Affordability issues can financially stress households and cause them to underinsure (by buying policies with high deductibles, insufficient limits, or inadequate coverage provisions), or, in the worst cases, fail to secure coverage at all. While underinsuring or reducing coverage can improve affordability, it leaves homeowners more financially vulnerable to displacement in the event the property is damaged or destroyed. After a disaster, widespread underinsurance can have follow-on impacts to the tax base of entire communities if properties are abandoned, rebuilding is delayed, and homelessness increases.

Regulatory frameworks have struggled to address underinsurance, as most states lack systematic data collection on coverage adequacy, the extent of underinsurance, or the relationship between premium affordability and coverage decisions. The NAIC has taken steps to develop a standardized data call to help fill these knowledge gaps, reduce inconsistencies across states and better address compliance costs and confidentiality concerns.

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1.3.3 Reliability

Reliability refers to a long-term expectation that an insurance market will function properly, both in terms of insurers being able to operate within a stable and predictable system and policyholders being able to count on insurers meeting their commitments.

Aspects of regulation, legislation, and/or the legal environment deemed materially adverse by insurers can cast doubt on the market and cause reliability challenges. For example, if courts deviate from longstanding precedents regarding coverage interpretations or award amounts, or if the system precludes insurers from effectively addressing pervasive fraud, then this can contribute to an environment of uncertainty and unreliability. Another aspect of unreliability includes conditions contributing to widespread insurer insolvency and/or residual market expansion that may transfer additional risk to admitted insurers, their policyholders, and taxpayers in the state.

A company near or in insolvency may close, enter conservatorship, and have remaining funds paid to creditors and claimants. Once the insurer's capital is exhausted, state guaranty funds may serve as backstops for the affected

policyholders; however, guaranty funds can trigger assessments that increase costs for other insurers in the market and their policyholders. Often, the policyholders of insolvent insurers may end up insured in the residual market. For example, when more than 20 companies folded or left Louisiana after a series of hurricanes in 2020-2021, more than 100,000 policies were added to Louisiana Citizens Property Insurance, the state-run insurance market of last resort.[29]

Assessments that are recoupable from taxpayers and non-residual market policyholders in the state may have a negative and unplanned effect on insurance affordability.

Expanding residual markets with high concentrations of risk may create a "death spiral" effect, where increasing assessments drive further market exits, impacting availability and concentrating more risk in the residual market.

Growth in residual markets can also affect the financial health of insurers, which in turn harms the financial stability of homeowners, communities, and local economies. Residual plans generally have some provision that member insurance companies provide funds to cover deficits in the event that losses exceed the plan's surplus and reinsurance recoveries. In some states, portions of the deficits are funded by taxpayers and/or partially recoupable by insurers via premium surcharges to policyholders. However, a recent study found that only 12 of 36 state plans had explicit provisions that prevent insurers from solely bearing the burden of funding deficiencies. As long as the plans are relatively small, this may not present an issue, but uncertainty around assessment and recoupment becomes more significant for residual market plans whose size could represent material risks to member insurers.[30] Further, assessments that are recoupable from taxpayers and non-residual market policyholders in the state may have a negative and unplanned effect on insurance affordability for those households.

Growth in residual market exposure increases the risk of assessments. Expanding residual markets with high concentrations of risk may create a "death spiral" effect, where increasing assessments drive further market exits, impacting availability and concentrating more risk in the residual market.[31]

1.4 INSURANCE MARKET DISRUPTION IS THE SYMPTOM, NOT THE PROBLEM

Currently, insurance capacity is an issue in many wildfire-exposed areas of the U.S., leading some people to believe that federally backed insurance is needed to fill the gap. However, if the federal government steps in and provides a substitute for private insurance without regard to the underlying drivers, that action may make the problem worse.

Federal insurance programs are subject to significant political interference and uncertainty from administration to administration. Additionally, they establish a status quo that is often unresponsive to evolving situations, and can discourage private insurers from expanding in high-risk areas if government sets rates to be artificially low instead of being truly reflective of risk. That does not necessarily make for the best outcomes to serve at-risk communities. Although there can be a role for government to provide premium subsidies, this never actually reduces costs; it just creates a mechanism where the costs are shifted from some people/places/times to others.

Although there can be a role for government to provide premium subsidies, this never actually reduces costs; it just creates a mechanism where the costs are shifted from some people/places/times to others.

Public discourse and regulatory responses around the wildfire crisis have often mischaracterized insurance as the problem rather than recognizing it as a symptom of a larger problem – too much risk for the market to bear. Risk-based insurance premiums communicate the relative safety of an area and drive behavior. If homeowners cannot get affordable insurance, they may act to mitigate their risk, or they may decide that it is too risky to live there.

When insurance becomes widely unavailable, unaffordable, or both, a necessary part of any effective solution is to reduce the risk.

Policy actions that are intended to change insurer behavior without reducing risk can actually force the underlying pillars out of balance and accelerate the collapse of the insurance market. They may also have the unintended outcomes of delaying recognition of the risk, disincentivizing early intervention, putting more families in harm's way and ultimately increasing costs. Therefore, when insurance becomes widely unavailable, unaffordable or both, a necessary part of any effective solution is to reduce the risk.

2 Challenges and Suggestions for Wildfire Risk Reduction

This section explores some of the challenges involved in reducing wildfire risk and suggests ways federal policymakers can play an effective role.

2.1 EFFECTIVE MITIGATION MUST BE MULTILAYERED

According to the Insurance Institute for Business & Home Safety ("IBHS"), there are four elements that all conflagrations share:[32]

- Typically preceded by or occur during drought conditions.
- Include densely packed structures with combustible exterior and framing materials.
- Weather conditions with winds of at least 20–30 mph.
- Fuels (such as ornamental vegetation, wooden privacy fences and sheds) that connect the dense structures together, providing a pathway of fire.

To slow fire spread, neighborhoods must function as fuel breaks rather than fuel sources.

IBHS notes that the combination of an active wildfire and a built environment conflagration can be too dangerous for direct fire suppression tactics, especially in situations where weather conditions are so extreme that aerial fire suppression resources cannot be used in coordination with ground resources. To slow fire spread, neighborhoods must function as fuel breaks rather than fuel sources. Neighborhoods must resist ember attacks as wildfire approaches as well as break the chain of fire spread through flame contact and radiant heat.

Consistent with this research and the previously mentioned "fast fires" study, a recent report on preventing urban conflagration recommends focusing on time as the common denominator of the problem of urban disaster fires in order to craft effective risk mitigation strategies. Community ignition time can be altered through home hardening and defensible space, especially at likely fire entry points. Additionally, fire arrival into the community can be delayed through strategic vegetation management.[33]

Utility-caused ignitions have driven many of the recent destructive wildfire events and tend to occur in proximity to populated areas, creating immediate threats to communities and minimal warning time. Accordingly, utility hardening and safety is another important component of reducing exposure to conflagration, but regulatory oversight of utility mitigation varies dramatically by state.[34] California and Oregon have mandated a framework for utilities companies to develop Wildfire Mitigation Plans (WMPs) and implement comprehensive utility wildfire safety programs, including Public Safety Power Shutoffs (PSPS) during extreme fire weather. Additionally, some utilities operating in other states have created analogous WMPs and PSPS plans and made them publicly available even where they are not required by law or regulation to do so. However, many utilities in the Southeast, Gulf Coast, and Upper Midwest lack even a public plan describing their implementation of wildfire mitigation or safety shutoffs. States with minimal or no specific regulatory requirements addressing utility wildfire mitigation may be underprepared for their wildfire exposure.[35]

POSSIBLE SOLUTIONS:

Improve land use planning: The federal government could create incentives to encourage local governments to improve land use planning to reduce wildfire risk.[36] Federal support for improved land use planning and defensible space requirements would help local governments develop and implement more effective wildfire risk reduction ordinances.

Provide assistance for strategic vegetation management: Additional funding focused on strategic fuel management around WUI communities would complement existing forest management efforts. By focusing specifically on this interface, such a program would create more effective buffers around vulnerable

communities, such as wetlands, urban greening, or other forest strategies to limit fire spread or change fire behavior.[37]

Increase adoption of utility wildfire mitigation plans: The federal government could also develop standards for electricity utility wildland fire mitigation plans and encourage the adoption of those plans by all electric utilities.[38]

2.2 NEED FOR STAKEHOLDER COLLABORATION AND COORDINATION

Effective wildfire risk management involves collaboration among numerous public entities at various levels (federal, state, and local) and with diverse expertise (forestry, land use planning, fire service, building codes, etc.) as well as private entities like utility companies. These agencies/entities have traditionally operated independently, creating coordination challenges that impede effective risk management. Meaningful risk reduction will require new partnerships taking collective, coordinated actions.

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In densely built areas, mitigated parcels may continue to be exposed to significant risk due to conditions present on surrounding parcels, meaning that collective action at a neighborhood or community scale is required to be truly effective.

Wildfire is different than other perils because the home propagates the risk itself; therefore, interruption of that propagation requires home mitigation. In densely built areas, mitigated parcels may continue to be exposed to significant risk due to conditions present on surrounding parcels, meaning that collective action at a neighborhood or community scale is required to be truly effective. However, the benefits and costs of mitigation are not always distributed equally across a community.[39]

The possibilities and challenges are different for new versus existing construction. New developments can be planned using fire-resistant construction techniques and with parcel layouts and defensible space requirements reducing connective fuels between structures. Existing communities will require retroactive mitigation, which is much more expensive and difficult.

Influencing individual risk management decisions represents more than just an information deficit problem. A number of barriers must be addressed in order to increase consumer acceptance and uptake of necessary actions:

- *Limited time and resources:* Implementation of recommended actions is limited by competing financial priorities, with many consumers facing cost constraints and time limitations as barriers. It is often difficult to know which actions are most critical. Effective wildfire risk reduction requires prioritized support and resources to assist the most vulnerable and/or disadvantaged areas. Even well-resourced communities are constrained in their financial and physical ability to mitigate, making it important to develop a prioritized plan based on a risk assessment that focuses on activities with the greatest potential to reduce the likelihood of community-scale losses.[40]
- *Unrealistic expectations about efficacy of other actions:* Many homeowners in high-risk areas contend that improving fire suppression will adequately protect their properties. Some may believe that the burden lies entirely upon utilities to eliminate the risk through grid hardening. However, as was dramatically demonstrated in the recent Los Angeles fires, under extreme high-wind drought conditions these activities can prove insufficient to prevent large-scale conflagrations.
- *Unrealistic expectations about insurance:* Homeowners may refuse to take action unless they are guaranteed insurance availability and/or premium discounts that pay for the cost of the mitigation. Although insurers would typically charge higher premiums to higher risk policies and lower premiums to lower risk policies, the differential may have no relationship to the cost of home hardening, especially over the short term.
- *Resistance to external control:* Homeowners may reject efforts to impose new requirements as an unnecessary and improper infringement of their property rights. They may feel very strongly about their ideal

home and landscape aesthetic, and resist departing from it. In densely populated areas, however, their failure to mitigate can increase the risk to their neighbors, much as secondhand smoke can pose a threat to nonsmokers. Collective action at scale can be more readily achieved if each individual homeowner can be motivated to reduce the vulnerability of their home and those of their neighbors.

Effective wildfire risk reduction also requires clear and consistent mitigation directives that stakeholders at all levels can understand and implement. As discussed in a recent CAL FIRE Risk Modeling Advisory Working Group Report, a municipality might have specific ordinances that homeowners must follow to reduce their wildfire risk, and while these ordinances exceed state minimums, they might not align with the mitigations recognized in rating or underwriting by insurers, none of which might align with the latest available science and understanding of wildfire risk.[41] For example, multiple defensible space standards have historically been promulgated in California, with conflicting guidance on critical areas such as "Zone Zero" (0-5 feet from structures). This inconsistency extends to community-level designations such as Firewise USA® and other state-specific resilience designations.

Effective wildfire risk reduction also requires clear and consistent mitigation directives that stakeholders at all levels can understand and implement.

The insurance industry has responded to the wildfire crisis through support for mitigation standards and legislative action, including forest management and community protection programs, to reduce risk. IBHS launched its Wildfire Prepared Home program in 2022, establishing the first comprehensive, science-based standard for wildfire-resistant construction and landscaping. The program has been expanded to include community-level designations through the Wildfire Prepared Neighborhood initiative, recognizing the importance of collective risk reduction.[42]

These programs and frameworks will take time to scale, and any standards will need to be reinforced through governmental mechanisms such as building codes, defensible space requirements and enforcement in order to maximize their effectiveness.

Additional frameworks such as “Fire Adapted Communities” and “Ready, Set, Go!” have been created to address additional aspects of adaptation to fire, such as evacuation planning and wildfire response. However, these programs and frameworks will take time to scale, and any standards will need to be reinforced through governmental mechanisms such as building codes, defensible space requirements and enforcement in order to maximize their effectiveness.

POSSIBLE SOLUTIONS:

Coordinate mitigation among federal agencies: A coordinated partnership among stakeholder agencies could better facilitate governmental efforts to address wildfire risk reduction actions and increase ignition resistance within the built environment.[43]

Encourage safe new construction: Continued scientific research and innovation is needed in the fields of building design, community design, landscape architecture, and safe and sustainable building practices to create more ignition-resistant structures and communities.[44]

Retrofit existing construction: While addressing new construction through building codes represents an important component of long-term risk reduction, a comprehensive approach must include strategies and requirements for retrofitting existing structures and communities. Mitigations can be planned and prioritized at points where changes in the presence of combustible material (or fuels) will have the greatest potential impact on the community’s risk.[45] Grant programs can provide financial assistance to implement mitigation for low-income, high-risk homeowners.

National Wildfire Resilience Certification Program: A federal "stamp of approval" program, similar to Energy Star but focused on wildfire resilience, could provide easier recognition for mitigation efforts.

2.3 NEED FOR BETTER WILDFIRE DATA, MODELS AND METRICS

In order to make better decisions around mitigation, there is a need for better data, models and metrics with which to assess the impact of mitigation actions on urban wildfire risk.

While publicly available hazard maps from agencies like the U.S. Forest Service and state fire agencies provide valuable context for land management, they are updated infrequently, sometimes on five-year cycles or longer. This makes them less useful for capturing recent changes from development, previous fires, or vegetation management efforts. Fire footprints, which are the geographic boundaries of historical wildfires, offer important insights but suffer from inconsistent collection methods across jurisdictions and time periods. These sources also lack the granularity of data needed for property-specific risk assessment.

As discussed in the CAL FIRE Risk Modeling Advisory Working Group Report, wildfire models have been in use for decades and come in many forms, depending on the intended use cases and available input. For example:

- Fire managers use fire simulation models to prioritize and plan for wildfire mitigation actions, such as prescribed fire, mechanical thinning, managing suppression resources, and identifying egress routes.
- Insurance companies rely on multiple sources of data and models to assess wildfire risk. Their focus is on managing and pricing the risks associated with their insured portfolios.
- Electric utilities deploy consequence models that estimate the impact of a wildfire should a utility asset cause an ignition, to inform operational and asset-hardening decisions.

However, none of these models were designed to evaluate the effectiveness of current and prospective mitigations within and outside communities to reduce the risk of urban conflagration. In order to do so, it is critical to consider how fire spreads in the built environment. Structural ignition can occur in multiple ways, including ember intrusion, radiant heat and direct flame contact. Modeling these effects is hindered by a lack of detailed historical and current data on parcel- and community-level data regarding factors such as building materials, defensible space, and other mitigation actions.

In order to make better decisions around mitigation, there is a need for better data, models and metrics with which to assess the impact of mitigation actions on urban wildfire risk.

Current wildfire models often have difficulty distinguishing the risk of structure-to-structure transmission for unmitigated versus well-mitigated homes. Even if the data and models were available, communities may not have the resources to license the models, or the expertise to evaluate results. There is also a lack of guidance and targeted benchmarking metrics (e.g. vulnerability to fast fires) with which to evaluate the costs and benefits of different options.

These gaps lead to several problematic outcomes. Public agencies struggle to prioritize mitigation investments without a clear understanding of where risk is highest and how different mitigation actions might reduce it. Insurers cannot see what mitigation has been done or what needs to be done and reflect it in their risk assessments, and homeowners receive mixed signals about their risk and the most effective mitigation actions to take.

POSSIBLE SOLUTIONS:

Invest in tools for community risk assessment and management: Communities need more sophisticated tools to understand the areas that are most vulnerable to incoming wildfire and structure-to-structure ignition, assess fire response capabilities, and identify the quantity, types, and locations of risk reduction activities that will create the greatest return on investment. Similar risk assessment tools could be applied at a national level to identify communities with the highest wildfire exposure and greatest need.

Provide a framework and resources for continuous evaluation: Funding is needed to regularly assess fire pathways, implement strategic mitigations, monitor results, and continue to improve outcomes. Specific metrics designed around fast fires may help prioritize use of scarce resources and allow more targeted and effective

mitigations. If the community's capacity to mitigate is substantially lower than the investment needed, federal and state grant programs could provide financial resources needed to achieve meaningful risk reduction.

Make mitigation actions visible to insurers: To accurately gauge the state of wildfire risk in communities located in fire-prone areas, there needs to be a common ground truth upon which various consumers of data can rely. A public/private effort is underway to collect and manage previously unavailable data on parcel- and community-level mitigations to help stakeholders engaged in risk measurement and/or risk reduction, which could be supported via federal funding and resources.[46]

3 Conclusion

Today's wildfire crisis represents a daunting challenge, but it is not an unprecedented one. Urban conflagrations like the ones experienced by Chicago, Baltimore, and San Francisco over a century ago seemed unavoidable, yet they were virtually eradicated through transformative changes in building codes developed in collaboration with engineers and the insurance industry

Ignoring the escalating wildfire risk and managing from crisis to crisis reduces the number of options available and drives up the costs of reaction at various levels. State and local policy efforts, with the involvement of the private sector, are crucial to effect meaningful change, but there may be effective actions the federal government can take.

We have the scientific understanding, technological capabilities, and economic motivation, and can direct these toward adapting communities to exist with fire as an enduring element of our landscape. Managing wildfire risk will require aligning many stakeholders, making difficult decisions, finding the necessary resources and implementing solutions at scale, but it is fundamentally a solvable problem.

4 Limitations

This report was commissioned by AWR and is intended to summarize, at a high level, the issues faced by U.S. homeowners in wildfire-exposed areas and the current challenges in managing wildfire risk today. It may not be appropriate, and should not be used, for other purposes. The data and exhibits in this report are provided to support the findings contained herein, limited to the scope of work specified by AWR, and may not be suitable for other purposes. Milliman does not intend to benefit or create a legal duty to any other recipient of this work.

In preparing this report, we relied upon the information obtained from publicly available sources. We did not audit, verify, or review the data and other information for sampling bias, reasonableness, and consistency. Such a review is beyond the scope of our assignment. If the underlying data or information is inaccurate or incomplete, the results of our analysis may likewise be inaccurate or incomplete. In that event, the results of our analysis may not be suitable for the intended purpose.

The materials in this document represent the opinion of the authors and are not representative of the views of Milliman, Inc. Milliman is available to answer any questions regarding this report or any other aspect of our review.

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