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Insurance for Physical Climate Risk Management: Lessons from History

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Introduction

Physical climate threats—such as tornadoes, hurricanes, severe flooding events, and wildfires—are posing increasing risks to American homes and businesses. At the same time, insurers are raising premiums and sending out non-renewals in vulnerable parts of the country to reduce their risk exposure.

The extent to which Americans are now vulnerable to natural catastrophes and extreme weather is unprecedented. But high levels of risk exposure that require innovative solutions and leadership from both the public and private sectors are nothing new in the history of American insurance. Since the late nineteenth century, the insurance industry has protected American cities—and the industry's profits—from foreseeable risks by founding and funding laboratories and institutes that produce and improve knowledge about risks and support the creation of better standards. Organizations such as the National Board of Fire Underwriters (NBFU), the Underwriters Laboratories (UL), and the Insurance Institute for Highway Safety (IIHS) have promulgated guidelines for everything from commercial building safety to motor vehicle design. Over the last century, their advocacy of legal reforms and support for research have helped to build more resilient communities, lower physical risks, and create larger insurable markets. During moments when the industry faced external pressure and criticism of its high premiums, these organizations' research initiatives generated risk assessments that validated premiums and preempted further scrutiny while improving public trust.

Today, there is once again an opportunity for insurance companies to collaborate with state and local authorities to improve community safety, reduce climate risk, and minimize property losses. As a whole, the property and casualty insurance industry is well-equipped with the data, models, and strategic capacity to assist local governments in planning for the future

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and supporting state governments' efforts to incentivize risk mitigation. Most local governments lack the staff and resources to make informed decisions about the physical climate risks facing their communities—much less to develop standards for buildings and land use that will adequately lower these risks.

The insurance industry can again step up to help governments advocate for conditions that will be more conducive to creating insurable markets. By advocating for legal reform through model legislation, founding and funding research institutions to provide empirical grounding for safety standards, and preserving insurable markets in communities that demonstrate progress in risk mitigation, insurers and governments can prepare communities for rapidly increasing climate risks.

A Historical Crisis of Profitability

The catalyst for the insurance industry's past investments in standards setting was a profitability crisis for the insurance industry, accompanied by growing public pressure around insurance premiums. In the nineteenth century, rapid urbanization and industrialization spurred the growth of flammable cities. Fires were frequent. Devastating human and economic losses threatened the viability of the industry as a whole. The 1906 San Francisco earthquake and subsequent fires erased every dollar of underwriting profit insurers had made since 1860.[1] Fire loss in America totaled nearly $520 million in 1906 alone (what would be more than $18.4 billion today).[2] From 1860 to 1907, the industry's underwriting business suffered a net loss of nearly $80 million.

Aware of the risks that electrification could pose to buildings, the insurance industry made two crucial decisions. On July 18, 1866, seventy-five insurance companies gathered in New York to form a fire insurers' trade association—the NBFU—to provide guidelines for reasonable fire insurance coverage and policies to reduce fire risk. The organization converted the threat of fire into a manageable and profitable business by working to understand the mechanics of fire and instituting reforms that would prevent it. As electrical inventions created new hazards, the pioneering engineer William Henry Merrill Jr. founded UL in 1894 to study electrical safety and develop standards for the safe use of electrical systems and appliances. And more than half a century later, as cars were transforming America, insurers again banded together to found and fund the IIHS to conduct vehicle research that would improve vehicle safety and reduce crash losses.

At the same time that insurers sought to reduce their losses and retain their profitability, state insurance regulators—concerned by the appearance of groups of insurers fixing rates—began to step in to ensure that insurers were setting fair insurance premiums.[3] The National Association of Insurance Commissioners was formed in 1871 to encourage the standardization of insurance policy across the fifty states as a substitute for a coordinated federal policy.[4] In 1892, New York introduced the nation's first "comprehensive insurance law," which it substantially revised after a 1906 investigation into fraudulent practices in the industry.[5] From 1909, with Kansas's vesting of rate-setting power in its insurance commissioner, rate-setting became an increasingly significant, albeit often imprecise, responsibility of state insurance regulators.[6] To date, regulation over the insurance industry predominantly occurs at the state level. While the *United States v South-Eastern Underwriters Association* ruling of 1944 determined that federal antitrust regulation applied to the insurance industry, the industry responded by lobbying for passage of the 1945 McCarran-Ferguson Act. This act suspended the Commerce Clause for issues where states regulated the insurance industry, recognizing state primacy in insurance regulation.[7]

Reducing Fire Risk Through Insurance Advocacy for Legal Reforms

As technology and the world have changed, the insurance industry has historically stepped in to preserve insurable markets. No peril demonstrates this better than fire. In the nineteenth and early twentieth centuries, fires persistently threatened not just insurance companies' solvency, but also the future of American cities and the prospects of new technologies. Working through the NBFU and UL, the insurance industry fought to drive down fire risk. The success of both efforts provides lessons for our present moment.

In the mid-nineteenth century, steep underwriting losses threatened the viability of even the most sophisticated insurers. The NBFU's key mission was "to devise and give effect to measures for the protection of our common interests and the promotion of our general prosperity."[8]

Following the Chicago (1871) and Boston (1872) fires, underwriters turned to the NBFU to find ways to reduce property losses. The organization led the charge for building code reforms—interventions in the built environment to reduce the creation of risk in communities. At the 1873 annual meeting, president of the NBFU, Henry A. Oakley, spoke of the need to "shape legislation which would benefit [the NBFU's interest] by securing such wise and salutary laws as might prevent the recurrence of other destructive conflagrations."[9] The

organization's ability to achieve that goal was premised on its broad membership. By 1875, it represented over 90 percent of America's insurance premiums and 95 percent of the nation's total insurance capital.[10]

Over the course of the 1890s, the NBFU laid the foundation for many modern building codes and fire safety rules. The 1891 Model Building Law incorporated the latest research on fire prevention.[11] It initiated a push to set building codes and standardize construction to enable insurers to assess risk more efficiently. The following year, the NBFU convened insurance electric light inspectors to lay the groundwork for an electrical code that would include electric wiring and lighting.[12] NBFU No. 70, published in 1897 and updated every three years since, is today the world's most widely adopted building code.[13]

The NBFU recognized that protecting cities from the threat of fire required a national approach toward fire safety. In 1901, the organization added a new clause to its mission statement—in support of safe building construction and the adoption of fire protective measures.[14] The NBFU then joined the National Association of Fire Engineers in recommending regulations for building construction.[15] In 1904, the organization developed standards for public fire protection measures such as for municipal water supply, fire department organization, and firefighting equipment; and in 1905, the NBFU drew upon its experience to transform guidelines into a single piece of legislation—a model building code—to help shape safe building construction.[16] This code was widely disseminated to jurisdictions around the country. Many municipalities adopted the NBFU's suggested code, either in whole or with alterations.[17]

This coordinated program of fire prevention became a significant force in reshaping the American safety landscape. The Great Baltimore Fire of 1904 resulted in over $50 million in losses—$30 million of which were the responsibility of insurance companies.[18] Less than three months after this event, Toronto faced a $12-million fire.[19] The NBFU knew it needed to act to reduce city risks and thus appointed a Committee of Twenty to study the dangers of fires in congested cities. The committee delivered a detailed report in May 1906 that examined conditions in fifty-five large cities, at a cost to its member companies of $183,635 (or $6.4 million today).[20] The report set out recommendations for inspected cities to adopt the NBFU's proposed building code and provided detailed recommendations for municipal reform for public safety. Within eighteen months of its first report, forty-three cities inspected by the committee spent a total of $5 million on improving their fire defenses. St Louis had its initial inspection in March 1905 and addressed 55 percent of the committee's suggestions within a year.[21]

The insurance industry's historical efforts to reduce fire risk were not limited to building codes and model regulations.

The insurance industry's historical efforts to reduce fire risk were not limited to building codes and model regulations. At the end of the nineteenth century, confronted with electricity's danger to fire-prone cities, the industry agreed to fund UL, the country's most important shaper of public and household safety. UL can trace its origins to 1893, when William Henry Merrill, Jr., a graduate of the nascent electrical engineering program at the Massachusetts Institute of Technology, was hired to inspect electrical installations at the Chicago World's Fair. The fair structures included miles of electrical wires, a new technology that gave fire insurance companies much cause for concern. The companies hired to underwrite the fair were hesitant to do so and considered denying coverage. To better understand the risks of electricity, they hired Merrill. His trip to the World's Fair inspired him to create an electrical testing laboratory to assess the safety of new products such as the arc lamps and wires that had been demonstrated in Chicago. His new contacts from the fair, the Chicago Underwriting Association and the Western Insurance Union, provided initial funding for Merrill's laboratory in 1894.[22] In 1895, Merrill's three-person team completed seventy-five tests on a budget of $3,000 (or $113,000 today).[23]

UL was incorporated in Illinois in 1901, and the NBFU soon became the key financial supporter. UL tested electrical safety, establishing a body of knowledge about fire safety and showing the fire insurance industry how to prevent and mitigate fire hazards. The benefits of UL in helping to reduce fire risks in the urban environment were so evident that, in 1914, the NBFU formalized its partnership with UL. The partners signed a memorandum of understanding, stating they would "continue to cooperate in preparing regulations for the installation of devices and apparatus having a bearing on the fire hazard."[24] The NBFU believed deeply in the mission of the UL and decided to fund it at a large annual cost to the NBFU. By 1916, the annual budget of the UL had reached $300,000 (or $9.2 million today).[25]

Products certified by UL were widely trusted.[26] Manufacturers were eager for UL to inspect and certify their products in exchange for paying an inspection fee, and this became the foundational business model for UL. In a consumption-oriented society, UL's role in inspecting and certifying goods allowed for a systemic fire prevention approach to be developed. The UL label became known for its credibility, and the resulting economic value supported insurance underwriting, sparking great demand for UL-certified consumer products. Between 1915 and 1923, the annual number of UL labels increased twelvefold, from fifty million per year to fifty million per month.[27] Partnerships created by UL led to the development of key standards such as the electrical installation fire code and the national electrical safety codes, which served to inform municipal and state building codes.

In 2023, just over 350,000 homes in the United States were affected by fires—54 percent lower than the over 750,000 reported in 1980.[28] Firefighters now spend more time responding to medical and rescue calls than to fires.[29] Much of that success can be credited to improvements in building codes, materials, and safety standards that stem from the early work of the NBFU and UL.

Accelerating Safety Through Minimizing Vehicle Risks

The fire insurance industry's support for UL mirrors the auto insurance industry's support of the IIHS. In 1959, three insurance associations that represented 80 percent of the U.S. auto insurance market founded and funded the IIHS.[30] While initially created to support highway safety efforts—under the leadership of William Haddon Jr., the first federal highway safety chief—the IIHS soon transitioned into an independent nonprofit research organization. Today, the institute continues to be supported by auto insurers and insurance associations such as the American Property Casualty Insurance Association.

In 1968, the IIHS became a scientific organization that conducts research and advocacy to promote and improve road safety. Many modern safety standards associated with automobiles can be attributed to IIHS research—from mandatory airbags and federal bumper standards to yellow traffic light intervals and limited right turns at red lights. IIHS bumper tests in 1969 led to the first federal bumper standards, and in 1973, their crash tests led to new federal rules around fuel system design to reduce gas leaks and fires following rear crashes. Later, in 1976, highlights from IIHS crash tests were shown to a U.S. congressional committee to demonstrate the effectiveness of airbags in frontal crashes. The 1990 head-on crash between two 1989 Chrysler LeBarons—believed to be the first of its kind involving two airbag-equipped vehicles—resulted in only minor injuries for both drivers, demonstrating the far-reaching effects of IIHS's work on vehicle safety standards.[31]

Since 1979, even as the number of vehicles and number of miles driven have increased, the number of people killed on roads has fallen.[32] Much of this decline can be attributed to safer vehicles, safer driving practices, and more stringent vehicle safety standards. Fewer crashes and less severe injuries have, in turn, benefited insurers via fewer claims and lower payouts. The rigorous research on crash dynamics and vehicle safety at the IIHS allowed uniform standards for vehicles to be set. And this research continues to inform the risk assessment and underwriting practices of auto insurers, shifting the focus from the vehicle itself to the true instigator of risk: the driver. This profound shift allows insurers to more effectively manage and mitigate risk.

Ensuring Insurability Through Resilience Standards

Today, American homes and businesses are once again threatened, but this time as a result of external environmental conditions. Natural disasters and chronic extreme weather—from earthquakes to wildfires and hurricanes—are more diverse and pose a more complex challenge than just fire or motor vehicle risk. Natural disasters alone resulted in over $112 billion in insured losses in 2024.[33] As insurers look to reduce their risk exposure and ensure their continued viability, some have chosen to limit where they operate. However, there is now an opportunity to enhance the resilience of communities to disasters to reduce the risk they face. This is what the Insurance Institute for Business & Home Safety (IBHS) has done with its FORTIFIED home program, a collection of standards and certification processes to mitigate against homeowner losses from natural disasters.

Formed in 1979 by the property casualty insurance industry, the IBHS is a nonprofit research and communications organization that advises the insurance industry on building science, effective land use control, and hazard mitigation.[34] The institute has combined the distinct capabilities of insurance leadership—from supporting technical research and shaping household knowledge on wildfire risk mitigation to advocating for building code reform—to support the creation of safer cities.

IBHS's technical research has informed the development of mitigation strategies for natural disasters, one of which is the FORTIFIED home program. The program has twenty-four designations for various perils, including hurricanes, hail, and high wind.[35] Adoption of the FORTIFIED standard differs across states, with the most uptake in regions that face higher disaster risk and have financial incentives for adopting those standards. Alabama, for instance, requires insurers to provide discounts for coastal homeowners whose houses comply with FORTIFIED standards.[36] The North Carolina Insurance Underwriting Association provides grants to homeowners along the Outer Banks and Barrier Islands to help reduce the cost of installing a FORTIFIED roof, while some insurers provide discounts for coastal homes with FORTIFIED protection.[37] These standards benefit both insurers and homeowners: A study in Alabama after Hurricane Sally in 2004 found that FORTIFIED construction reduced the loss frequency by at least 55 percent and the loss ratio by at least 51 percent. If all homes were built or retrofitted to these standards, insurers in the sample study would have saved between $99.9 million to $111.8 million in claims, and policyholders would have saved between 61 and 65 percent of deductibles paid—not to mention the nonmonetary benefits of less damage for homeowners.[38]

Paradise is another example of how communities can rebuild with greater resilience with the support of insurance organizations.

To address other forms of natural disasters, the IBHS has also created a Wildfire Prepared Home program that establishes a uniform standard to reduce wildfire risk.[39] This wildfire mitigation standard is based on best practices known to reduce a home's wildfire risk, including setting up a five-foot noncombustible buffer around the home and utilizing noncombustible materials for roofs and gutters.[40] While this is a voluntary program, it allows homeowners to demonstrate their risk-reduction behavior and offers a universal standard that can be applied to entire communities.

Working with the IBHS, the town of Paradise did just that. The devastating Camp Fire in 2018 destroyed over 90 percent of Paradise, California, and displaced over 50,000 residents.[41] Homeowners who chose to rebuild and remain in Paradise soon faced the challenge of securing affordable homeowners insurance, with some resorting to California's FAIR Plan—the state insurer of last resort.[42] Meanwhile, the town of Paradise worked with the IBHS to increase the community's resilience to wildfire. It announced a set of measures for residents to rebuild their homes to IBHS's Wildfire Prepared Home standards, with the Paradise Town Council unanimously deciding to adopt IBHS's recommendations into local ordinance.[43] This effectively embedded wildfire resilience into the recovery plan for Paradise, creating a safer community. The success of adopting IBHS standards was such that, in January 2025, the insurance company Mercury began writing new homeowners' policies in Paradise—the first major insurance company to do so since the 2018 Camp Fire. Mercury's president and chief operating officer, Victor Joseph, said of the decision to insure Paradise houses, "It's vital the insurance industry supports the efforts of communities and homeowners to build greater resilience against wildfires."[44]

Paradise is another example of how communities can rebuild with greater resilience with the support of insurance organizations. The town relied on the research and technical know-how of the IBHS, bringing wildfire resistant buildings into compliance with local building code requirements, which allowed for the return of private insurers. While this is a promising step in the right direction, there is still a long way to go for Paradise. Thus far, Mercury has issued only fifty new home insurance policies, with two hundred more to be added in the future.[45] As of December 2024, just over 2,600 homes have been rebuilt since the fires, raising questions about the long-term recovery of the town and the economic viability of its tax base.[46] Regardless, Paradise is a clear example of how building communities with resilience in mind creates more adaptive and risk-informed communities and demonstrates the role that insurers can play in facilitating and encouraging such behavior.

Opportunities for Insurance Leadership Today

The story of fire safety and systemic consumer protection in America is deeply intertwined with the history of the insurance industry. From the NBFU and UL to other organizations such as the IIHS, industry leaders have historically supported the idea that improving public safety and reducing hazardous behaviors are fundamental to the business model of the insurance industry. From the mid-1900s onward, the NBFU's and UL's interventions directly transformed American cities into safer spaces and, as a result, generated larger insurable markets for the companies that funded those laboratories. Modern building codes, standards for safe building construction, and consumer behavioral values have created the notion that safety is a commodity that consumers can obtain by purchasing insurance and adjusting their behaviors.

From this history, the insurance industry can draw clear lessons to create more resilient communities that would support viable economic models. Modern building code adoption is key to increasing a community's resilience, yet only 21 percent of natural hazard–prone jurisdictions have adopted the latest hazard-resistant building codes.[47] Widespread adoption of such codes is necessary for communities to increase their resilience to known risks.

Today, insurance companies have an untapped opportunity to create a national planning enterprise similar to that of the IBHS or UL. To better understand physical climate risk, they could found and fund a national insurance institute for community resilience. For this venture to succeed, however, it has to be guided by a federated organizational structure that includes national-level insurance leadership and strong local partnerships. Such collaborations will equip communities with the knowledge needed to adopt necessary behaviors and lower risk.

Central to this effort would be the use of risk models built on the best available data. (The most expensive version of such platforms would involve creating digital twins—virtual replicas of physical communities with data and simulation capabilities that function much like a "crash-test dummy" for communities.) These risk models could be built at the national level before being distributed to the local level to analyze how hazards would affect the specific infrastructure of a community. Leveraging digital platforms could help communities better understand the perils they are exposed to as well as help insurers better calculate real risk-based pricing for property insurance. This mapping exercise could also aid communities in identifying the necessary standards to handle their specific perils. A more accurate calculation of risk would then enable communities to implement updated land use and

Today, insurance companies have an untapped opportunity to create a national planning enterprise.

building standards, with the understanding that these standards would allow for continued insurance—similar to how the implementation of IBHS standards in Paradise supported the return of insurance companies to the town.

Local players equipped with knowledge about the hazards facing their communities—such as universities that can facilitate research, mutual insurance companies with strong presences in small towns, and local governments—can help implement the updated safety standards. State insurance regulators can also step in, working with both communities and insurers to approve rates that reflect risk reductions. Creating a national enterprise where insurers collaborate with state authorities and local communities will allow for more resilient communities and larger insurable markets, benefiting all. There is a storied history of insurers stepping up during moments of high-risk exposure, and they should do so once again to prepare communities—and property markets—for ever-increasing physical climate risks.

Conclusion

In *The History of the National Board of Fire Underwriters*, Harry Chase Brearley wrote that "civilization moves slowly when it moves blindly."[48] The NBFU's work toward fixing ideal standards for building codes and for municipal fire and water departments formed the basis of improved urban conditions that allowed for "men and nations [to] make swifter progress when their ideals are clearly before them."[49] The work—and funding—of the NBFU, UL, IIHS, and IBHS allowed the insurance industry to obtain exact knowledge and draw conclusions about urban safety. Valuable work by the NBFU and UL supported the fire insurance industry, rescuing it from the financial precarity created by the constant fires of the early 1900s. And fire insurers, in turn, supported broader stabilizing business conditions that heralded economic growth and increased prosperity.

Today, physical climate risks present a new threat to American cities and to the continued viability of the insurance industry. In a time of decreasing public data availability, there is an opportunity to create an initiative aimed at communicating credible information about risks and best practices to local authorities, who should, in turn, use this information and advice to create better future insurable markets for Americans.[50]

About the Authors

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