



Climate Change, Disaster Risk, and Homeowner's Insurance



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At a Glance

Climate change heightens the risks of wildfires and other natural disasters. As insurance payouts for losses sustained in those disasters increase and as uncertainty about future losses grows, people in many high-risk areas have faced difficulty obtaining or affording insurance coverage for their property. As risk and costs increase, premiums will increase as well, which may make insurance less affordable for homeowners. If state regulators do not allow higher premiums, insurers may exit high-risk areas, reducing the availability of insurance.

In this report, the Congressional Budget Office analyzes recent changes in property insurance markets and considers alternative insurance products as well as policy approaches to increase the availability and affordability of insurance for homeowners and renters. The highlights of that analysis include the following:

- Higher land and ocean temperatures, drought, sea level rise, and excessive precipitation are all features of climate change that contribute to increasing the risks of natural disasters, including wildfires, hurricanes, and floods. With increased uncertainty attributable to climate change, insurers may limit coverage for risks that are difficult to quantify or where regulators constrain their ability to set prices reflecting risk.
- Households may underinsure for natural disasters for a variety of reasons, including a lack of information about the risks and the extent of any postdisaster government assistance.
- Means-tested subsidies would make coverage more affordable for low- and moderate-income households. That approach has the advantage of targeting assistance and preserving incentives for other policyholders to mitigate losses, but controlling costs and implementing the program could be difficult.
- Other approaches would expand the availability of insurance. States could lessen regulatory constraints on insurers' risk-based prices. The federal government could act as a catastrophic risk reinsurer or insurer, as it does for flood insurance, and bear more of the cost of disasters.

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Notes About This Report

All years referred to in this report are calendar years unless otherwise specified.

Numbers in the text, tables, and figures may not add up to totals because of rounding.

Summary

Natural disasters put people and homes at risk nationwide. Households with insurance that covers losses from a natural disaster are better able to recover financially and return to their homes. As climate change and other factors increase the frequency, severity, and geographic reach of many kinds of natural disasters, more households in many high-risk areas are finding insurance difficult to obtain or afford.

In this report, the Congressional Budget Office describes changes in insurance markets and analyzes insurance products and policy approaches that could make insurance more widely available and affordable for homeowners and renters. Historically, hurricanes have posed the greatest risk, but in the past decade, wildfires have emerged as a catastrophic risk for insurers. Recent experiences with wildfires in the United States have been costly, both in terms of economic damage and lives lost.

How Is Climate Change Affecting the Risk of Natural Disasters?

Climate change affects disaster risks in several ways. High temperatures and persistent droughts increase the risk of wildfires by creating conditions that make it easier for fires to ignite and to spread. Oceans have also reached historically high temperatures, which makes hurricanes more severe by increasing the amount of moisture they carry and unleash on communities in their path. That, in turn, increases the risk of coastal flooding, particularly in places where sea levels have risen. Understanding those risks and how they are changing is the first step in preparing for them, both to reduce their potential for inflicting damage and to provide resources for those who suffer property losses to recover from them.

How Are Homeowners Responding to the Increased Risk of Natural Disasters?

Mortgage lenders require borrowers to purchase homeowner's insurance policies that cover a range of losses, including those from natural disasters. Losses from many such disasters (including wildfires) are covered by private insurers, but flood and earthquake coverage is excluded from standard policies. Most borrowers do not have to purchase additional flood insurance, but in certain areas,

homeowners with government-backed mortgages are required to do so.

Uncertainty about losses from natural disasters makes it challenging for homeowners and prospective homeowners to understand the risks they face and thus how those risks should be reflected in home prices. Underestimating risks may cause people to be uninsured or underinsured against natural disaster risks. In 2023, insurers covered \$80 billion of the \$114 billion of losses attributable to natural disasters, meaning that 30 percent of those losses were not insured.

In some areas where private insurance is unavailable or too costly, homeowners may purchase a state-sponsored or residual market insurance plan. Those plans differ in the risks they cover and eligibility criteria, but they generally offer coverage to homeowners and renters who find that private coverage is unavailable or costly because their properties are at high risk. As more homeowners purchase policies in residual or state-sponsored insurance plans, risk increases for states' fiscal stability if a catastrophe occurs.

How Do Insurers Cover and Price the Risk of Natural Disasters?

Insurers rely on premiums, reinsurance (that is, insurance for insurers), and capital markets to cover the cost of claims they pay for natural disasters. Policyholders' premiums are intended to cover the cost of expected losses and risk transferred from households to insurers as well as the cost of reinsurance and any insurance-like coverage that insurers purchase in the capital markets. But as uncertainty attributable to climate change increases, pricing that risk becomes more difficult. (Reinsurers begin to make payments when an insurer's losses exceed a specified amount, so they face similar challenges in pricing the coverage they offer to insurers.)

If regulations allow insurers to offer or decline to offer or renew policies on properties on the basis of their risk assessment and to set premiums that appropriately reflect risks, they will make coverage available. Climate change makes it more difficult for insurers to model those risks

and determine appropriate prices. States' insurance regulations sometimes make it more difficult for insurers to set prices high enough to compensate for the increase in risk. Those challenges may be particularly salient for wildfires because losses have increased quickly in recent years, and so has uncertainty about the associated risk. In response to those challenges, insurers have reduced availability in several states, most notably in some western states with high wildfire risk and some states on the Gulf Coast with high hurricane risk.

How Could Different Types of Policies Make Insurance More Affordable for Low- and Moderate-Income Households?

Low- and moderate-income households are more likely to be uninsured or underinsured than high-income households, leaving them more likely to face financial losses after a natural disaster. They also recover more slowly. Traditional homeowner's insurance plans reimburse policyholders for actual losses after a detailed review of individual claims, a process that may be relatively expensive for lower-valued properties.

Several types of insurance products could expand coverage and increase affordability for low-income households to varying degrees. Income-based subsidies could make insurance more affordable for the most vulnerable households. Subsidies could encourage more households to purchase insurance as well. However, determining eligibility and controlling costs for the federal government might be difficult.

Other types of insurance would offer those households more affordable but less complete protection:

- Parametric insurance policies would pay out if some observable, defined thresholds were reached, such as a certain level of rainfall or wind speed. Payouts could be made quickly, transparently, and at low administrative costs. Policyholders could use the payouts for any purpose, but they might not fully cover the actual losses incurred.

- Community-based insurance, purchased by a local government or community group on behalf of residents, could achieve discounts by purchasing policies in bulk and implementing community-level adaptation projects to reduce risk.

Alternatively, rather than changing insurance markets to improve affordability, governments at all levels could work to lower risk. If federal, state, and local governments invested in adaptations to reduce future losses, affordability could improve for all policyholders. However, that approach is outside the scope of this report.

What Policy Approaches Could Expand the Supply of Disaster Insurance?

To increase the availability of disaster insurance, the federal government could expand its role in the disaster insurance market. The government already provides flood insurance through the National Flood Insurance Program (NFIP). CBO looked at two possible approaches. Under the first, a risk-sharing approach, the government would act as a reinsurer for natural disaster losses. It would charge premiums to insurers and pay out claims when an insurer's losses exceeded a specified amount. Under the second, the federal government would assume all the risk and sell insurance coverage directly to households for wildfires or other natural disasters, much in the way the NFIP does for flooding.

Either approach could expand the availability of insurance, reduce protection gaps—the difference between total losses and insured losses—and reduce the need for postdisaster financial assistance. If the government underpriced risk in either approach, the program could be costly to the government and discourage innovation in the private insurance market. Underpricing risk would also encourage development in risky areas, increasing the number of properties at risk, the number of risky policies with coverage, and costs to the federal government (see Table S-1).

Table S-1.

Alternative Policy Approaches to Providing Disaster Insurance

	Current policy	Public-private insurance program with risk sharing	Federal insurance program with little or no risk sharing
Availability	Limited availability in some high-risk areas	Greater availability	Greatest availability
Risk to the federal government	Limited explicit risk but highest implicit risk	Higher explicit risk but lower implicit risk	Highest explicit risk but limited implicit risk
Potential budgetary costs	Net cost of the NFIP as well as the cost of federal assistance after a disaster	Higher costs in most cases, depending on how premiums would be set	Highest costs, depending on how premiums would be set
Incentives to take preventive measures to reduce losses	Strong incentives	Weaker incentives	Weakest incentives
Demand for federal assistance after a disaster	High demand	Lower demand	Lowest demand
Economic effects	Coverage gaps lessen resiliency	Greater resiliency	Greatest resiliency

Data source: Congressional Budget Office.

NFIP = National Flood Insurance Program.

Chapter 1: Climate Change, Natural Disasters, and Home Prices

Climate change is increasing the extent to which natural disasters put lives and property at risk across the United States.¹ The National Oceanic and Atmospheric Administration (NOAA) estimates that in 2023, 28 climate and weather disasters each exacted at least \$1 billion in damages. Together, they caused \$93 billion in damages and 492 deaths.² In real terms (that is, adjusted to remove the effects of inflation), the average annual cost of billion-dollar disasters from 2019 to 2023 was three times their annual cost from 1990 to 1994 (see Figure 1-1). According to many researchers, climate change and higher global temperatures contribute to the reach and severity of such disasters.³ In addition, increased building and population growth in areas at high risk of wildfires and hurricanes mean that more people and property are at risk and so also contribute to larger losses.

1. This report uses the terms disaster and catastrophe interchangeably. The insurance industry often uses “catastrophe” when insured losses from a natural disaster exceed \$25 million, which is the Property Claim Service’s definition of catastrophe. For more details about that term, see Insurance Information Institute, “Spotlight on: Catastrophes—Insurance Issues” (February 19, 2024), <https://tinyurl.com/5f7z52sv>.
2. National Oceanic and Atmospheric Administration, National Centers for Environmental Information, “Billion-Dollar Weather and Climate Disasters: Summary Stats” (accessed February 23, 2024), www.ncei.noaa.gov/access/billions/summary-stats.
3. S. A. Parks and J. T. Abatzoglou, “Warmer and Drier Fire Seasons Contribute to Increases in Area Burned at High Severity in Western U.S. Forests From 1985 to 2017,” *Geophysical Research Letters*, vol. 47, no. 22 (November 2020), <https://doi.org/10.1029/2020GL089858>; John T. Abatzoglou and A. Park Williams, “Impact of Anthropogenic Climate Change on Wildfire Across Western US Forests,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 113, no. 42 (October 2016), pp. 11770–11775, <https://doi.org/10.1073/pnas.1607171113>; and David M. Roms and others, “Projected Increase in Lightning Strikes in the United States Due to Global Warming,” *Science*, vol. 346, no. 6211 (November 2014), pp. 851–854, <https://doi.org/10.1126/science.1259100>.

Wildfires

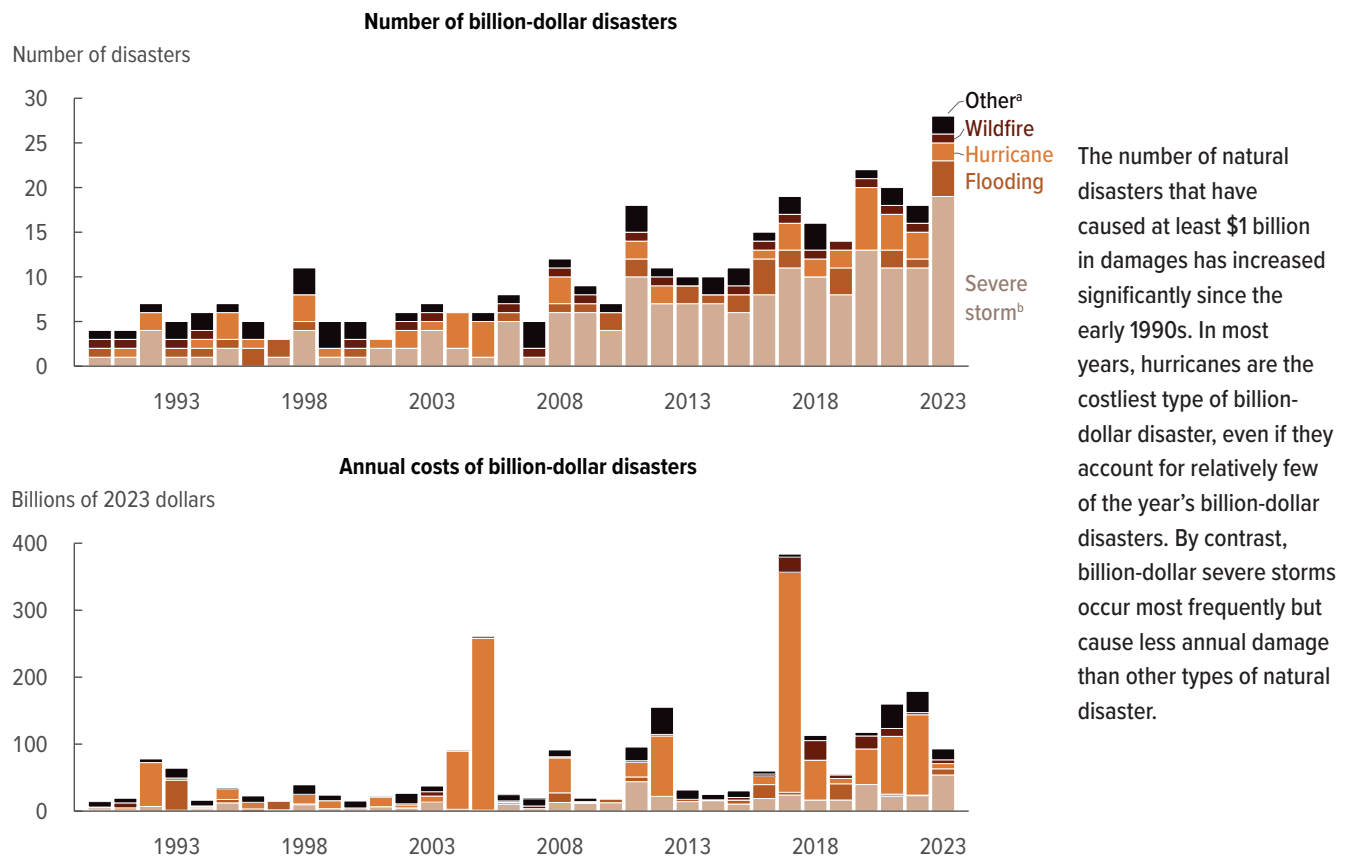
In 22 of the past 34 years, wildfires have been counted among the country’s billion-dollar disasters, including in every year since 2015. Climate change has created hotter and drier conditions that are more conducive to longer and more severe wildfire seasons. In every year since 2010, global average annual land temperatures have exceeded the average over the 1901–2000 period by more than 1 degree Celsius (see Figure 1-2). Those warmer temperatures leave vegetation and other fuels drier, increasing the potential for larger and more severe fires. In addition to creating favorable conditions for wildfires to burn, climate change may lead to more ignitions, as lightning occurs more frequently in higher temperatures.⁴

Additionally, droughts are a frequent occurrence in western parts of the United States that have seen some of the largest wildfires in recent years. In 15 of the past 34 years, the area from the Rocky Mountains westward has been categorized as in drought according to the Palmer Drought Severity Index for all 12 months of the year (see Figure 1-3 on page 8).

Over the past 30 years, the average number of acres burned annually by wildfires in the United States has increased (see Figure 1-4 on page 9). The number

4. S. A. Parks and J. T. Abatzoglou, “Warmer and Drier Fire Seasons Contribute to Increases in Area Burned at High Severity in Western US Forests From 1985 to 2017,” *Geophysical Research Letters*, vol. 47, no. 22 (November 2020), <https://doi.org/10.1029/2020GL089858>; John T. Abatzoglou and A. Park Williams, “Impact of Anthropogenic Climate Change on Wildfire Across Western US Forests,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 113, no. 42 (October 2016), pp. 11770–11775, <https://doi.org/10.1073/pnas.1607171113>; David M. Roms and others, “Projected Increase in Lightning Strikes in the United States Due to Global Warming,” *Science*, vol. 346, no. 6211 (November 2014), pp. 851–854, <https://doi.org/10.1126/science.1259100>; and Congressional Budget Office, *Potential Impacts of Climate Change in the United States* (May 2009), www.cbo.gov/publication/41180.

Figure 1-1.

Billion-Dollar Natural Disasters

Data source: Congressional Budget Office, using data from the National Oceanic and Atmospheric Administration, National Centers for Environmental Information. See www.cbo.gov/publication/59918#data.

The National Oceanic and Atmospheric Administration reports the number of billion-dollar disasters that have occurred since 1980 on an ongoing basis. Disasters meet the billion-dollar threshold if their total costs are at least \$1 billion when adjusted to the current year's dollars using the Consumer Price Index (CPI). As inflation and price adjustments change, the events identified as billion-dollar disasters may change. The events in this figure meet the billion-dollar threshold after being adjusted to 2023 dollars, regardless of the year they occurred.

a. Includes droughts, freezes, and winter storms.

b. Includes hailstorms, derechos, high winds, and tornadoes.

of acres burned fluctuates from year to year for several reasons, including variations in the number of fires, weather conditions, and the effectiveness of suppression efforts, but the total acreage burned annually is trending upward. A five-year moving average of the number of acres burned shows a clear increase over the past three decades: The average number of acres burned nationwide each year from 2019 to 2023 was more than twice the average from 1989 to 1993, even though the number of acres burned in 2023 was the lowest since 1988.

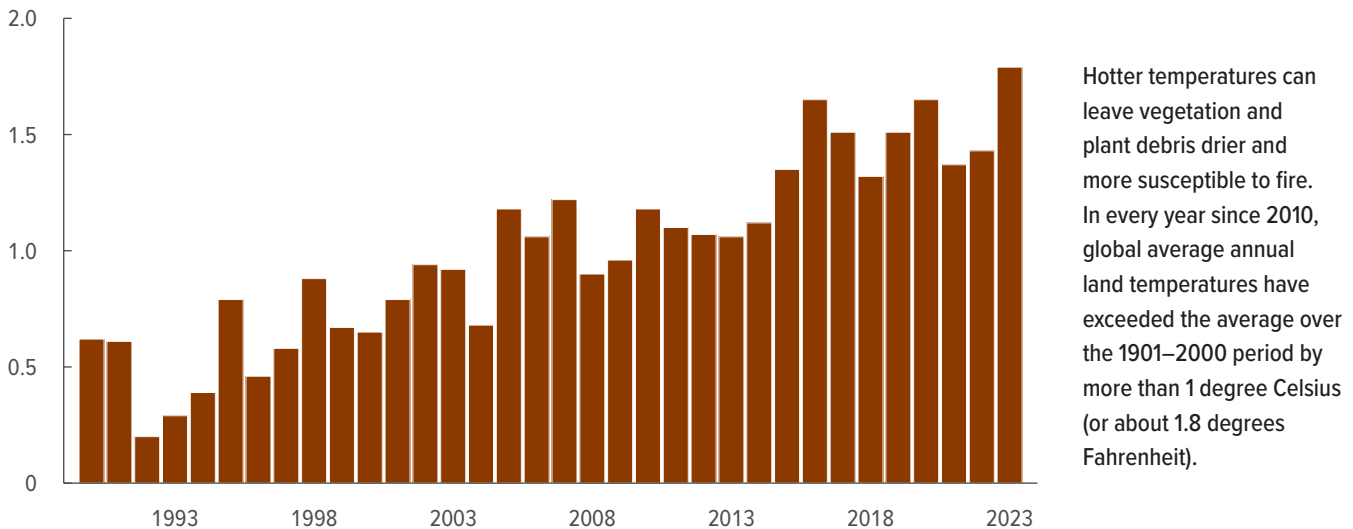
By contrast, the five-year moving average of the number of fires has decreased, from 67,000 fires in 1993 to 59,000 in 2023. That decrease may be related to the increase in acres burned. Areas that have recently experienced fires may not have vegetation to ignite for some time.

Continued climate change is expected to increase the damage inflicted by wildfires. One study estimates that the number of structures destroyed in wildfires will

Figure 1-2.

Amount by Which the Average Global Land Temperature Exceeded the 20th-Century Average

Degrees Celsius



Data source: Congressional Budget Office, using data from the National Oceanic and Atmospheric Administration, National Centers for Environmental Information. See www.cbo.gov/publication/59918#data.

increase from about 17,000 a year currently to about 34,000 annually in 30 years.⁵

Hurricanes and Floods

Climate change has also contributed to higher ocean temperatures, more widespread episodes of heavy precipitation in a short amount of time, and sea level rise.⁶ Those conditions add to the risks of hurricanes and floods in both coastal and inland communities.

For more than 30 years, average global ocean temperatures have exceeded the annual average over the 1901–2000 period (see Figure 1-5 on page 10). Over the past decade, that gap between ocean temperatures and the annual average temperature has grown even larger; ocean temperatures have been at least 0.6 degrees Celsius warmer each year than the average over the 20th century.

Higher ocean temperatures provide more energy for storms, making them more powerful. Higher temperatures also lead to increased evaporation of water into the atmosphere, which means that snowstorms and rainstorms have heavier precipitation. When a large amount of precipitation falls in a short period of time, the ground may not be able to absorb it, which results in flooding. From 1910 to 2000, about 10 percent of the land area in the United States, on average, received a much greater than normal percentage of annual precipitation in a one-day period.⁷ That average has been exceeded in all but seven years since 1990 (see Figure 1-6 on page 11).

Warmer seas also increase the volume of water in oceans, which contributes to rising sea levels. Over the past century, global sea levels have risen more than 7 inches;

5. First Street Foundation, *The 9th National Risk Assessment: The Insurance Issue* (September 2023), p. 11, <https://tinyurl.com/2467e7y2>.

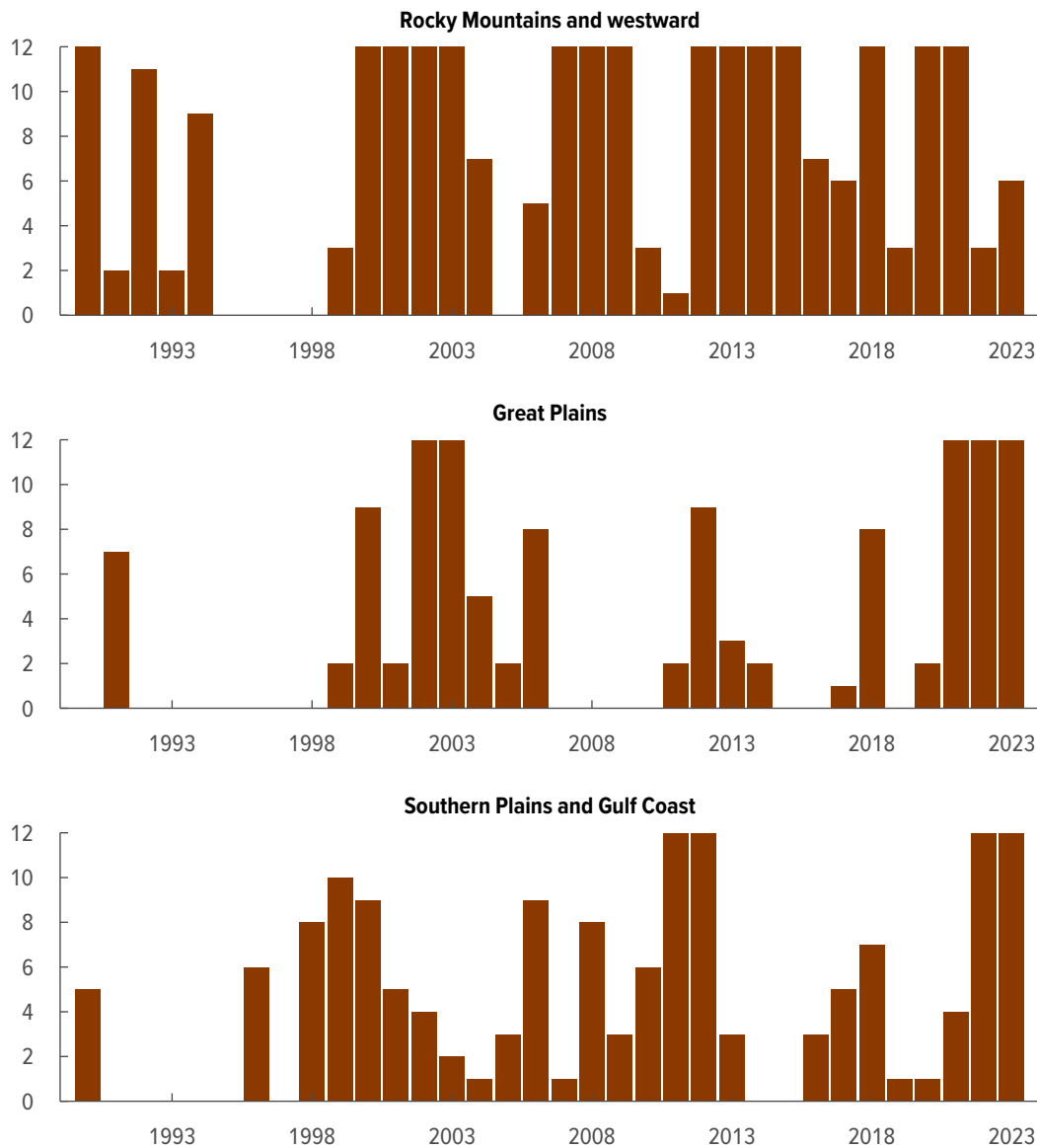
6. Environmental Protection Agency, “Climate Change Indicators: Oceans” (June 27, 2024), www.epa.gov/climate-indicators/oceans, and “Climate Change Indicators: Heavy Precipitation” (June 27, 2024), <https://tinyurl.com/mvufkw3a>.

7. The National Oceanic and Atmospheric Administration determines whether a given location received a much greater than normal share of precipitation in one-day precipitation events by comparing the percentage of that location’s observed annual precipitation that fell in one-day events with all such observations for that location since 1910. If the share for a given year fell in the top 10 percent of one-day precipitation observations, that location was considered to have received a much greater than normal share.

Figure 1-3.

Drought Months, by Region

Months



Drought or abnormally dry weather leaves vegetation and plant debris drier and easier to ignite. In the Rocky Mountains and westward, drought conditions have persisted through much or all of the year for most years since 2000. Other regions have also experienced many months of drought conditions.

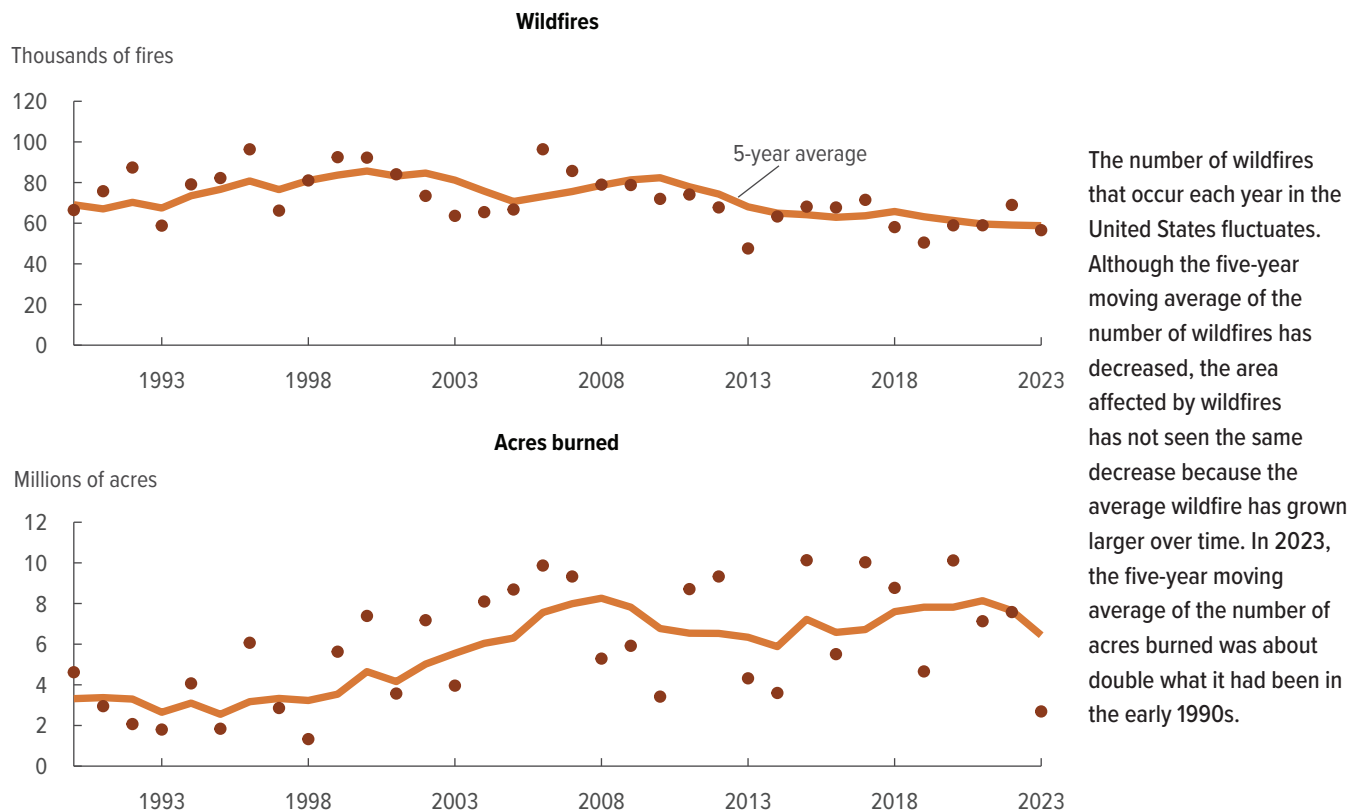
Data source: Congressional Budget Office, using data from the National Oceanic and Atmospheric Administration, National Centers for Environmental Information. See www.cbo.gov/publication/59918#data.

Rocky Mountains and westward encompasses Arizona, California, Idaho, Nevada, Oregon, Utah, Washington, and portions of Colorado, Montana, New Mexico, and Wyoming. The Great Plains region is Kansas, Nebraska, North Dakota, Oklahoma, South Dakota, and portions of Colorado, Montana, New Mexico, and Wyoming. The Southern Plains and Gulf Coast region comprises Florida, Louisiana, Texas, and portions of Alabama, Arkansas, Georgia, Mississippi, New Mexico, and Oklahoma.

Drought severity is measured according to the Palmer Drought Severity Index, which takes into account precipitation levels, temperatures, and moisture levels in the ground (because droughts are cumulative) to compare drought severity between locations over time. For more information, see Michael J. Hayes, "Drought Indices," *Intermountain West Climate Summary* (July 2007), <https://tinyurl.com/38nac53w> (PDF).

Figure 1-4.

Wildfires



Data source: Congressional Budget Office, using data from the National Interagency Fire Center. See www.cbo.gov/publication/59918#data.

about half of that increase has occurred since 1993. In some places, relative sea levels (that is, the height of the ocean relative to land at a particular location) have risen even more (see Figure 1-7 on page 12). In those places, the effects of rising sea levels have been exacerbated by sinking land, also known as land subsidence. A variety of factors can contribute to land subsidence, including tectonic movements, groundwater extraction, oil and gas extraction, and the weight of buildings. In certain areas along the Gulf and East Coasts, rates of land subsidence exceed 10 millimeters (or 0.4 inches) per year.⁸ All told, many areas along the Gulf Coast have

experienced sea level increases of more than 15 inches over the last century.

The Effects of Disaster Risks on Home Prices

How property values reflect disaster risks is important for two reasons. First, home equity accounts for more than half the total wealth of families in the bottom half of the wealth distribution.⁹ Second, the federal budget is exposed to disaster risk through mortgage markets, both through potentially uninsured losses on federally backed mortgages and through Fannie Mae's, Freddie Mac's, and Ginnie Mae's participation in the secondary mortgage market, where about \$9 trillion of federally guaranteed

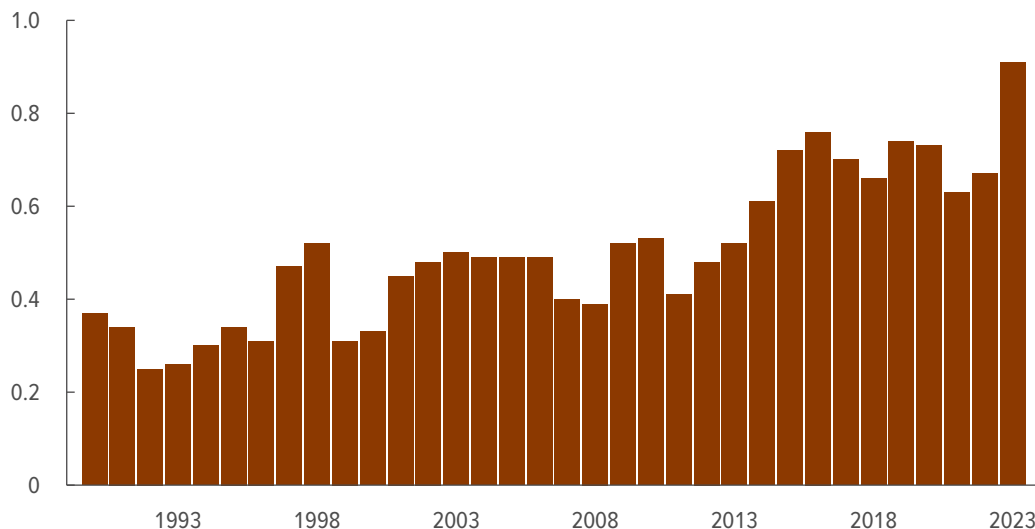
8. Pei-Chin Wu, Meng (Matt) Wei, and Steven D'Hondt, "Subsidence in Coastal Cities Throughout the World Observed by InSAR," *Geophysical Research Letters*, vol. 49, no. 7 (April 2022), <https://doi.org/10.1029/2022GL098477>.

9. Congressional Budget Office, *Trends in the Distribution of Family Wealth, 1989 to 2019* (September 2022), www.cbo.gov/publication/57598.

Figure 1-5.

Amount by Which the Average Global Ocean Temperature Exceeded the 20th-Century Average

Degrees Celsius



Warmer ocean temperatures contribute to higher sea levels and increase the amount of moisture a storm can hold. In 2023, ocean temperatures were nearly 1 degree Celsius (or 1.6 degrees Fahrenheit) above the 20th-century average.

Data source: Congressional Budget Office, using data from the National Oceanic and Atmospheric Administration, National Centers for Environmental Information. See www.cbo.gov/publication/59918#data.

mortgages and securities are traded.¹⁰ The Congressional Budget Office has previously estimated that the total expected flood damage over a 30-year period to homes with federally backed mortgages will rise by more than a third—from \$190 billion (in 2020 dollars in present-value terms) under 2020 climate conditions to \$258 billion under 2050 climate conditions.¹¹ That increase is largely attributable to the changing climate.

Disclosure of risk affects home prices, but such disclosure is not required in all areas. Sales prices of homes in places with disclosure requirements are generally lower than sales prices of comparable homes in areas without such requirements, even though the required disclosures

can provide incomplete information to home buyers.¹² A study that examined wildfire disclosure requirements in California found that homes in places where risk disclosure was required sold for 4 percent less, on average, than comparable homes without mandated risk disclosure.¹³ Another study found that in states with the strictest flood disclosure requirements, the sales prices of properties in flood zones were discounted 4 percent, on average; commercial buyers commanded a discount of almost 7 percent, and nonbusiness buyers received a roughly 2 percent discount.¹⁴

10. Jamie Woodwell, Mike Fratantoni, and Edward Seiler, *Who Owns Climate Risk in the U.S. Real Estate Market?* (Mortgage Bankers Association White Paper, June 2022), <https://tinyurl.com/3dpmp85> (PDF); and Federal Reserve Bank of St. Louis, “Release Tables: Mortgage Debt Outstanding” (accessed August 16, 2024), <https://tinyurl.com/2nytkhhy>.

11. A present value is a single number that expresses a flow of current and future income or payments in terms of an equivalent lump sum received or paid at a specific time. For the agency’s analysis of flood damage to homes with federally backed mortgages, see Congressional Budget Office, *Flood Damage and Federally Backed Mortgages in a Changing Climate* (November 2023), pp. 4–5, www.cbo.gov/publication/59379.

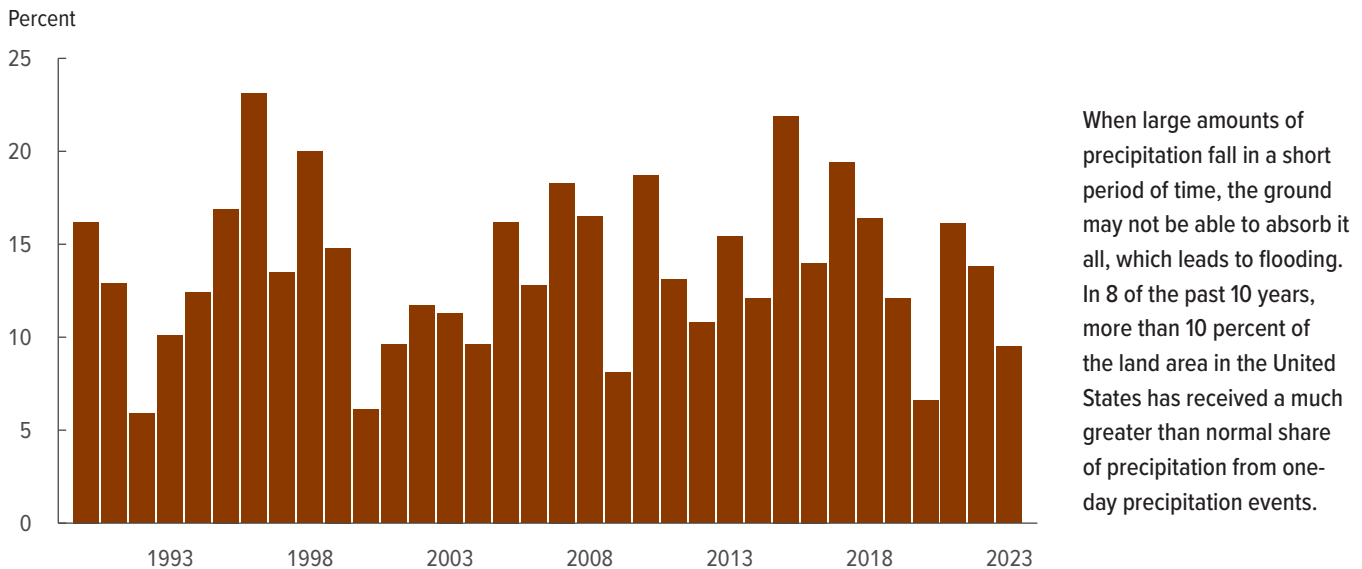
12. Margaret A. Walls, “Does Flood Risk Disclosure Hold (Enough) Water?” *Common Resources* (blog entry, July 12, 2024), www.resources.org/common-resources/does-flood-risk-disclosure-hold-enough-water/.

13. Lala Ma and others, *Risk Disclosure and Home Prices: Evidence From California Wildfire Hazard Zones*, Working Paper 23-26 (Resources for the Future, June 2023), <https://tinyurl.com/5h7c5tec>.

14. William McClain and Nuno Mota, *The Impact of 2019 Changes to Texas’ Flood Disclosure Requirements on House Prices* (Fannie Mae, February 2024), <https://tinyurl.com/2vfa5v78>; and Miyuki Hino and Marshall Burke, “The Effect of Information About Climate Risk on Property Values,” *Proceedings of the National Academy of Sciences of the United States of America*, vol. 118, no. 17 (April 2021), <https://doi.org/10.1073/pnas.2003374118>.

Figure 1-6.

Land Area of the United States That Received a Much Greater Than Normal Share of Precipitation in One-Day Precipitation Events



Data source: Congressional Budget Office, using data from the National Oceanic and Atmospheric Administration. See www.cbo.gov/publication/59918#data.

The National Oceanic and Atmospheric Administration determines whether a given location received a much greater than normal share of precipitation in one-day precipitation events by comparing the percentage of that location's observed annual precipitation that fell in one-day events with all such observations for that location since 1910. If the share for a given year fell in the top 10 percent of one-day precipitation observations, that location was considered to have received a much greater than normal share.

Even in places where disclosure is required, it is not clear whether the discounts fully reflect natural disaster risks; a recent study estimated that residential properties exposed to flood risks were overvalued by roughly \$100 billion to \$200 billion when projected flood risk was taken into account. Most of the overvaluation was in coastal counties without flood risk disclosure laws. Homes in those counties sold at a discount of 2.4 percent to 2.5 percent if they were within the Special Flood Hazard Area (SFHA)—areas with a 1 percent annual risk of flooding, as mapped by the Federal Emergency Management Agency (FEMA).¹⁵

In addition, property owners or prospective buyers do not always understand disclosures and take that information into account when deciding whether to buy a

house.¹⁶ For example, the extent to which disclosure requirements affect home prices also depends on concerns about climate risk: Where concerns were above the national median, home prices in SFHAs were nearly 10 percent lower than those of comparable homes without a disclosure requirement. That discount fell to 4.5 percent in places where concerns were below the median.¹⁷

Experiencing a natural disaster also affects home prices. In communities affected by wildfire, either directly or because a fire occurred nearby, home prices initially

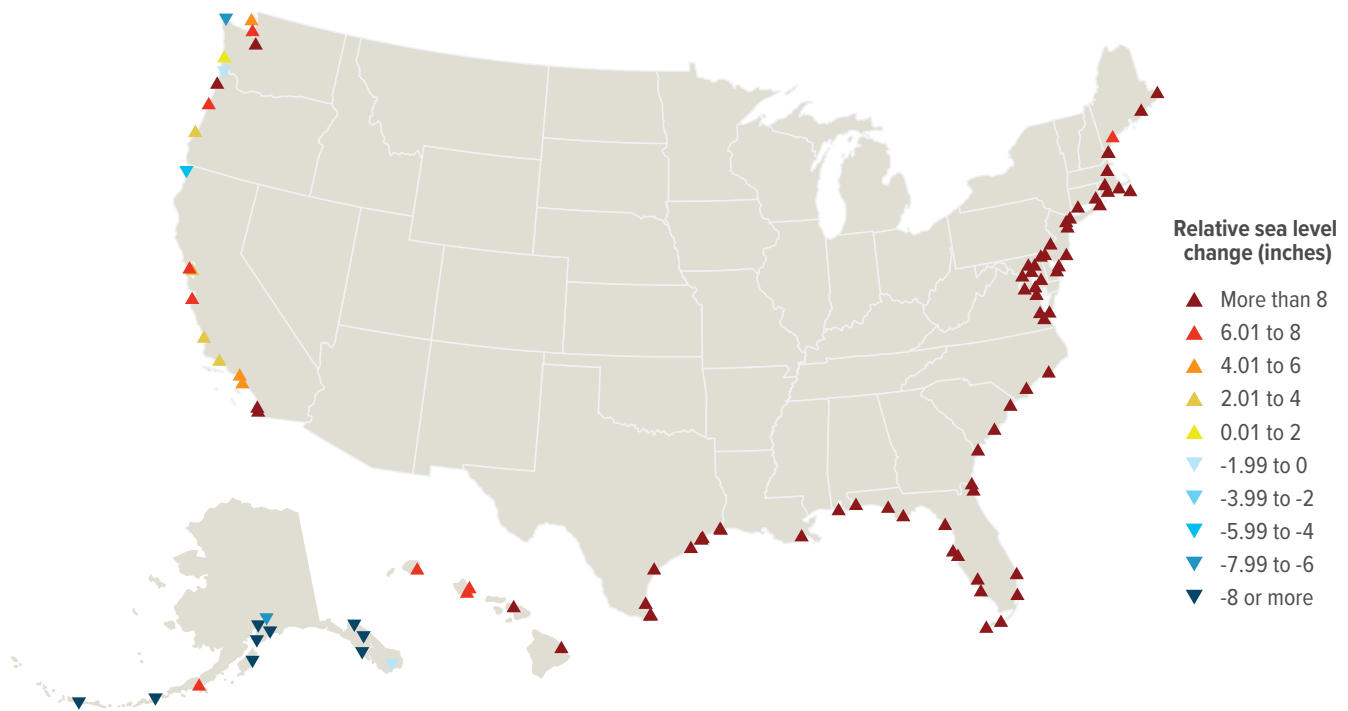
15. Jesse D. Gourevitch and others, "Unpriced Climate Risk and the Potential Consequences of Overvaluation in US Housing Markets," *Nature Climate Change*, vol. 13 (February 2023), pp. 250–257, <https://doi.org/10.1038/s41558-023-01594-8>.

16. Carolyn Kousky and others, "Flood Risk and the U.S. Housing Market," *Journal of Housing Research*, vol. 29, supp. 1 (November 2020), S3–S24, <https://doi.org/10.1080/10527001.2020.1836915>.

17. Jesse D. Gourevitch and others, "Unpriced Climate Risk and the Potential Consequences of Overvaluation in US Housing Markets," *Nature Climate Change*, vol. 13 (February 2023), pp. 250–257, <https://doi.org/10.1038/s41558-023-01594-8>; and Adam B. Pollack and others, "Potential Benefits in Remapping the Special Flood Hazard Area: Evidence From the U.S. Housing Market," *Journal of Housing Economics*, vol. 61 (September 2023), <https://doi.org/10.1016/j.jhe.2023.101956>.

Figure 1-7.

Relative Sea Level Change Along U.S. Coasts, 1960 to 2021



Data source: Congressional Budget Office, using data from the National Oceanic and Atmospheric Administration. See www.cbo.gov/publication/59918#data.

Since 1960, relative sea levels have risen by more than eight inches in many locations along the Gulf and East Coasts. Those increases are caused by rising global sea levels and local land subsidence patterns. Groundwater extraction, oil and gas extraction, and tectonic changes can contribute to land subsidence. By contrast, relative sea levels have fallen in many locations along Alaska's coastline. Research suggests that land is rising as the glaciers that sit atop it shrink.

decrease. A study of home prices in southern California communities that experienced multiple fires showed that prices fell by about 10 percent after one fire and by an additional 23 percent after a second fire.¹⁸ Researchers found that home prices in an undamaged community in Colorado declined by 15 percent after a wildfire two miles away.¹⁹ Likewise, after Hurricane Irma in 2017,

homes in Florida that were exposed to the risk of rising sea levels and that were located in SFHAs faced a 5 percent discount in their value, whereas homes with similar risk that were located outside an SFHA experienced a discount of 4 percent when compared with homes not at risk of sea level rise.²⁰ As with disclosure requirements, the extent to which experiencing a natural disaster affects prices also depends on how worried buyers in a particular area are about climate risks.²¹ However, it is not clear

18. Julie M. Mueller, John D. Loomis, and Armando González-Cabán, "Do Repeated Wildfires Change Homebuyers' Demand for Homes in High-Risk Areas?" in *Proceedings of the Third International Symposium on Fire Economics, Planning, and Policy: Common Problems and Approaches*, General Technical Report PSW-GTR-227 (Department of Agriculture, U.S. Forest Service, Pacific Southwest Research Station, November 2009), pp. 70–81, <https://doi.org/10.2737/PSW-GTR-227>.

19. John Loomis, "Do Nearby Forest Fires Cause a Reduction in Residential Property Values?" *Journal of Forest Economics*, vol. 10, no. 3 (November 2004), pp. 149–157, <https://doi.org/10.1016/j.jfe.2004.08.001>.

20. Freddie Mac, Economic & Housing Research Group, "Sea Level Rise and Impact on Home Prices in Coastal Florida," *Economic & Housing Research Note* (March 2022), <https://tinyurl.com/yw86peth> (PDF).

21. Markus Baldauf, Lorenzo Garlappi, and Constantine Yannelis, "Does Climate Change Affect Real Estate Prices? Only If You Believe in It," *Review of Financial Studies*, vol. 33, no. 3 (March 2020), pp. 1256–1295, <https://doi.org/10.1093/rfs/hhz073>.

whether the effects of a disaster on home prices persist.²² Researchers found that prices in Colorado rebounded two to three years after a fire.²³

The downward pressure on home prices from natural disaster risks may be offset by homebuyers' preferences, including for features such as proximity to coastal or forested areas. One analysis found that in 2021 and 2022, net migration to counties facing high wildfire risk

totaled 446,000 people; net migration to counties facing high flood risk was 384,000 people in those years. More than half of single-family homes built since 2010 are in areas facing wildfire risks.²⁴ In addition, property owners in high-risk areas can offset downward pressure on their home prices by improving their homes' ability to withstand a natural disaster. Certain improvements and adaptations can reduce the risk of damages, leading to lower insurance premiums and higher home prices.

22. Brigitte Roth Tran and Daniel J. Wilson, *The Local Economic Impact of Natural Disasters*, Working Paper 2020-34 (Federal Reserve Bank of San Francisco, February 2023), <https://tinyurl.com/4a7a6uwu>.

23. Shawn J. McCoy and Randall P. Walsh, "Wildfire Risk, Salience, and Housing Demand," *Journal of Environmental Economics and Management*, vol. 91 (September 2018), pp. 203–228, <https://doi.org/10.1016/j.jeem.2018.07.005>.

24. Lily Katz and Sheharyar Bokhari, "Migration Into America's Most Flood-Prone Areas Has More Than Doubled Since the Start of the Pandemic," *Redfin News* (July 24, 2023, updated August 31, 2023), <https://tinyurl.com/3zf5nukt>; and Lily Katz and Taylor Marr, "America Is Increasingly Building Homes in Disaster-Prone Areas," *Redfin News* (September 9, 2022), <https://tinyurl.com/2m8t9rxh>.

Chapter 2: Homeowners' and Insurers' Responses to Natural Disasters

In several states, the rising cost of insured losses from natural disasters is pushing up the cost and limiting the availability of homeowner's insurance. As risk increases and uncertainty makes it harder to price that risk, private insurers are discontinuing or reducing coverage in high-risk areas of several states. When homeowners cannot find coverage in the private marketplace, they are often forced into states' involuntary or residual plans. Regulators in some states have made changes to regulations with the aim of making insurance more available and affordable in the private market. Those changes have often had unanticipated consequences for the market.

Homeowner's Insurance and Natural Disasters

Climate change and the growing uncertainty regarding losses from natural disasters make it more difficult for insurers to set premium prices that reflect risk. Risk-based pricing is important because it enables insurers to offer policies in risky areas and can provide signals to homeowners and communities about where risk is higher and how risk can be reduced. Risk-based pricing can also provide incentives for improving disaster resiliency (the capacity to withstand shocks and recover from disasters).¹

For homeowners, the uncertainty associated with climate change can increase costs: Insurance premiums may be higher to reflect the uncertainty about losses, coverage may be insufficient or unavailable if insurers cannot set prices that reflect risk, and mitigation efforts to reduce risk may be costly. Homeowners in wildfire-prone areas, particularly in California, have found coverage costly or difficult to obtain in recent years. Climate change, development in areas at risk, and regulatory requirements all contribute to the challenges for the insurance market in areas at high risk of wildfire.² Similar issues face

homeowners seeking insurance coverage for losses due to hurricanes and earthquakes.

Standard Homeowner's Insurance Coverage

Mortgage lenders generally require borrowers to obtain homeowner's insurance coverage as a condition of the loan. Premiums for that insurance are typically bundled into a homeowner's monthly mortgage payments; the mortgage lender holds those monthly payments in escrow and then pays the insurer when premiums are due. The insurance covers losses or damages from a variety of perils, including natural disasters (except losses from floods and earthquakes, which require separate coverage).

Private insurers aim to set premiums that reflect the risks to a given property. They factor in the size and location of any structures on a property, the hazards faced in the area, and the probability of any of those hazards occurring. Insurers also may take into account measures that homeowners have taken to reduce the risk of damage, such as using fire-resistant building materials, trimming vegetation, or elevating structures. If insurers can estimate risk and charge premiums that reflect that risk, they will offer coverage, though not always at prices that property owners are willing to pay.

When homeowners with standard homeowner's insurance experience damage from a disaster, they submit claims for reimbursement for specific losses, a portion of which may be covered. That process can be long and expensive, but it ensures that policyholders' insurance payouts—called indemnity payments—are based on the losses they experience.

Homeowner's insurance, like other types of property insurance, is regulated at the state level.³ Insurance providers that are licensed by the state—also called admitted insurers—must comply with regulations. In many

1. Markus K. Brunnermeier, *The Resilient Society* (Endeavor Literary Press, 2021), <https://markus.scholar.princeton.edu/news/resilient-society>.

2. Reinsurance Association of America, *Dynamics and Challenges in California's Homeowners Insurance Market* (September 2023).

3. Department of the Treasury, Federal Insurance Office, *Insurance Supervision and Regulation of Climate-Related Risks* (June 2023), <https://tinyurl.com/3cc6ee23> (PDF).

states, those regulations include getting approval for any proposed premium increases. If an admitted insurer fails, the state guarantees that outstanding claims will be paid, often by passing the cost of those claims on to other admitted insurers. Policies may also be offered by insurance providers that are not licensed by the state—called nonadmitted or surplus lines insurers—though that coverage may be more expensive. It also lacks state guarantees in the case of failures. Surplus lines insurers typically hold riskier policies.

Flood Insurance

Standard insurance policies cover most types of natural disasters, but they do not provide coverage for damage from flooding.⁴ The federal government provides most flood insurance coverage for residents in the United States, offering policies through the National Flood Insurance Program.⁵ In fiscal year 2023, the NFIP had 4.7 million policies in place and collected premiums and fees of \$4.5 billion.

For most homeowners, flood insurance is not required, and researchers have estimated that about 4 percent of single-family homes have flood coverage.⁶ It is mandatory for those with government-backed mortgages in Special Flood Hazard Areas—areas with a 1 percent annual risk of flooding. In the Congressional Budget Office's assessment, however, roughly 40 percent to 50 percent of flood damage occurs outside SFHAs.⁷ For instance, in Harris County, Texas, 68 percent of the 154,000 houses that flooded during Hurricane Harvey in 2017 were outside an SFHA and were uninsured.⁸

The lack of NFIP coverage is not uniformly distributed: CBO found a lower rate of coverage for properties at risk of flooding in communities with lower median household incomes.⁹

Even properties with NFIP coverage may be underinsured because building coverage is capped at \$250,000. CBO analyzed flood claims from the 2003–2022 period and found that the cap affected about 13,000 claims, or 1.4 percent of all claims paid; those claims represented 8.1 percent of all dollars paid for building damage.

The exclusion of flood damage from standard homeowner's insurance policies affects the portion of losses covered by insurance. In a 2019 report, CBO estimated that 77 percent of expected annual wind losses from hurricanes would be covered by insurance, but only 16 percent of the flood losses would be covered by flood insurance.¹⁰

Residual Insurance Plans

Currently, 32 states offer homeowner's insurance coverage through residual (or involuntary) insurance programs to cover hazards other than floods to high-risk policyholders who might not be able to purchase coverage in the private market. Throughout the entire United States, residual property insurance plans collected \$5 billion in premiums to cover 2.3 million properties worth \$837 billion in insured value in 2022. Nearly all—98 percent—of those properties were residential.¹¹ Although the plans differ in many aspects, they all generally seek to act as “insurer of last resort” and provide coverage on a temporary basis. Many such plans originally provided coverage in inner-city communities where private insurers did not offer coverage.¹² In many states now, the highest-risk residential policies end up in residual state insurance plans because property owners cannot obtain private coverage.

4. Standard homeowner's insurance generally excludes losses from earthquakes (though not losses from fires that earthquakes may trigger).

5. Analysts estimated that private flood insurance accounted for less than 5 percent of residential policies in 2018 (175,000 to 220,000 policies), but the market has grown since then. See Carolyn Kousky and others, *The Emerging Private Residential Flood Insurance Market in the United States*, Report 23-03 (Resources for the Future, July 2018), <https://tinyurl.com/y3dfydpm> (PDF).

6. David D. Evans, Leighton A. Hunley, and Brandon Katz, *Unpriced Costs of Flooding: An Emerging Risk for Homeowners and Lenders* (Milliman, January 2022), <https://tinyurl.com/ut7nrhp9>.

7. Congressional Budget Office, *Flood Damage and Federally Backed Mortgages in a Changing Climate* (November 2023), p. 9, www.cbo.gov/publication/59379.

8. Jeff Lindner and Steve Fitzgerald, memorandum to Harris County Flood Control District Flood Watch/Partners (June 4, 2018), p. 13, <https://tinyurl.com/283shyw5> (PDF).

9. Congressional Budget Office, *Flood Insurance in Communities at Risk of Flooding* (July 2024), www.cbo.gov/publication/60042.

10. Congressional Budget Office, *Expected Costs of Damage From Hurricane Winds and Storm-Related Flooding* (April 2019), p. 3, www.cbo.gov/publication/55019.

11. Insurance Information Institute, “A 50-State Commitment: Residual Markets,” in *A Firm Foundation: How Insurance Supports the Economy* (accessed August 21, 2023), <https://tinyurl.com/4z9vbecm>.

12. Ramzee Nwokolo, “How FAIR Plans Confronted Redlining in America,” *Chicago Fed Letter*, no. 484 (Federal Reserve Bank of Chicago, September 2023), <https://tinyurl.com/55bszypj>.

The structures of the plans vary, but most include state-mandated participation by private insurance companies. For instance, California has a Fair Access to Insurance Requirements (FAIR) plan, which provides coverage for losses caused by fire. All admitted insurers in the state participate in the plan and share in profits and losses according to their share of the California insurance market. Recognizing the effect of climate change on insurance markets, Colorado recently authorized its own FAIR plan to address the increasing difficulty of obtaining private coverage in the state.¹³ By contrast, other states, including Louisiana and Florida, offer residual insurance plans through state-owned insurers. Some of the state-owned funds are exempt from federal taxes; those savings are reflected in the premiums they charge.¹⁴

Eligibility and premium rules vary for each program. In Louisiana, premiums must be at least 10 percent higher than prevailing private rates so that they do not compete with the private market. In keeping with that requirement, Louisiana increased rates for residual plans in 2023 by more than 60 percent; the average premium is over \$4,000.¹⁵ Florida homeowners are eligible for a state plan (from the Citizens Property Insurance Corporation) only if private insurance is unavailable or is charging premiums 20 percent higher than those charged by Citizens.¹⁶ (The plan's actuaries estimate that its rates are more than 40 percent below those charged by private insurers for properties with similar risks.)¹⁷ To be eligible for the FAIR plan in California, homeowners must verify that traditional coverage is not available to them, and their premiums are then based on risk. Despite those

requirements, the rates that state plans charge may not be high enough to cover the risks that the policies pose.

State plans also differ in how losses are shared and paid for. In California, if a property insurance company offers coverage in the state, it is required to participate in the FAIR plan. If FAIR plan policyholders have more losses than are covered by their premiums and the plan's reserves, insurers bear those losses proportionally to their market shares. Whether or how insurers might recoup those losses is uncertain, which lessens insurers' willingness to make private coverage available or remain in California.

Losses in Florida's Citizens plan can trigger special assessments or premium surcharges, first on its policyholders and, if that is insufficient, on all homeowners' insurance policyholders in the state.¹⁸ Because of losses suffered from Hurricanes Irma in 2017, Michael in 2018, and Ian in 2022, both Citizens and the Florida Hurricane Catastrophe Fund (which provides reinsurance to Citizens and private insurance companies) might need to rely on postevent bonding and emergency assessments if a single 1-in-100-year storm or series of smaller severe storms were to hit the state in 2024.¹⁹ Losses have also driven up premiums; since 2020, the average premium in Florida has risen by about 40 percent in real dollars (which are adjusted to remove the effects of inflation), reaching \$3,300 in 2023.²⁰

In recent years, participation in residual plans has grown. The number of policies in California's FAIR plan nearly doubled from April 2018 to December 2021 and has since continued to rise.²¹ The plan's total exposure

13. Colorado Department of Regulatory Agencies, Division of Insurance, "Fair Access to Insurance Requirements (FAIR) Plan" (accessed August 21, 2023), <https://tinyurl.com/2xyj7zjk>; and Colorado Department of Regulatory Agencies, Division of Insurance, *Homeowner Availability Study* (prepared by Oliver Wyman Actuarial Consulting, March 2023), <https://tinyurl.com/kcr3xs5r> (PDF).

14. State Board of Administration of Florida, *Florida Hurricane Catastrophe Fund: 2022 Annual Report* (2023), <https://tinyurl.com/bhz2ds8f> (PDF).

15. First Street Foundation, *The 9th National Risk Assessment: The Insurance Issue* (September 2023), pp. 26–27, <https://tinyurl.com/2467e7y2>.

16. Meeting minutes, Citizens Property Insurance Corporation, Market Accountability Advisory Committee (June 28, 2023), <https://tinyurl.com/3664j3x7> (PDF).

17. Citizens Property Insurance Corporation, "Citizens Board Approves 2023 Rate Recommendations," (press release, March 29, 2023), <https://tinyurl.com/4v87p399>.

18. Citizens Property Insurance Corporation, "Assessments at a Glance," *Policyholder Newsletter* (March 1, 2022), <https://tinyurl.com/4xex8ypz>.

19. Citizens Property Insurance Corporation, *Annual Report of Aggregate Net Probable Maximum Losses, Financing Options, and Potential Assessments* (prepared by Raymond James, February 2024), <https://tinyurl.com/5yyjvpuy> (PDF); and Florida Hurricane Catastrophe Fund, *Annual Report of Aggregate Net Probable Maximum Losses, Financing Options, and Potential Assessments* (prepared by Raymond James and Associates, February 2024), <https://tinyurl.com/yfj86fb9> (PDF).

20. First Street Foundation, *The 9th National Risk Assessment: The Insurance Issue* (September 2023), pp. 26–27, <https://tinyurl.com/2467e7y2>.

21. California Department of Insurance, "Court Delivers Win for Homeowners in Expanding FAIR Plan Coverage," (press release, November 29, 2023), <https://tinyurl.com/3ue9bcrs>.

exceeded \$300 billion at the end of 2023. The number of policies in Louisiana's plan increased from nearly 50,000 in 2021 to more than 150,000 in 2022.²² In Florida, the number of Citizens policies rose from fewer than 450,000 in 2019 (or a 6 percent market share) to over 1.2 million in 2023 (or a 16 percent market share).²³ That company is now the largest homeowner's insurer in the state.

Why Households Might Be Underinsured Against Disaster Risks

Households might be underinsured against the losses they could experience in high-consequence but low-probability events like natural disasters for several reasons.²⁴ Most homeowners who purchase coverage do so because they are required to, either by their mortgage lender or, in the case of flood insurance, the federal government. They often do not understand what their insurance covers, nor do they necessarily know the dollar limits of that coverage. If insurers exit a market for regulatory, financial, or other reasons, homeowners might have difficulty obtaining comparable coverage, leaving them underinsured or even uninsured.

Homeowners without a federally backed mortgage and those who own their homes outright face no such mandates. Some of those with a mortgage may be prepared to default, knowing that those holding or guaranteeing the mortgage will bear some of the costs.²⁵ Other homeowners may prefer to recover losses by selling their property to a buyer who will tear down the home and build a new one. Even if homeowners are informed about the risk of disasters, they may also act as if a low-probability event has a zero probability, which is a form of behavioral

bias.²⁶ In addition, homeowners might overestimate federal assistance. Federal Emergency Management Agency grants to households are limited to \$42,500 in fiscal year 2024 (with annual adjustments for inflation), and the Small Business Administration provides disaster loans, but neither replicates insurance coverage (see Box 2-1). Besides insurance, households rely on savings, charity, and federal assistance to help cover losses, but none of those sources of funds is a good substitute for insurance.

Underinsurance contributes to protection gaps—the difference between total losses and insured losses. The larger the gap, the less resilient a community is; that is, its recovery from a natural disaster will be slower and less complete.

Insurers' Coverage and Pricing of the Risk of Natural Disasters

How insurers set rates, diversify their risks, and finance claims payouts affects the affordability and availability of insurance options for homeowners. As climate change increases uncertainty about the timing and size of catastrophic losses, insurers have begun to adjust their practices. Continued development in areas of western states with high wildfire risk and in areas on the Gulf and East Coasts with high hurricane and flood risk puts more people and property in harm's way; such risky development also prompts insurers to adjust their practices.²⁷

Insured Losses From Natural Disasters

Climate change is affecting losses both globally and in the United States.²⁸ Protection gaps are significant in the United States and larger elsewhere. Insurance coverage increases with income, making it more widespread in developed countries than it is in many developing countries. In addition, coverage tends to be greater in

22. Department of the Treasury, Federal Insurance Office, *Insurance Supervision and Regulation of Climate-Related Risks* (June 2023), pp. 38–40, <https://tinyurl.com/3cc6ee23> (PDF).

23. Citizens Property Insurance Corporation, *Florida Residential Property Market Share* (December 2023), <https://tinyurl.com/2pzsx539> (PDF).

24. Carolyn Kousky, "The Role of Natural Disaster Insurance in Recovery and Risk Reduction," *Annual Review of Resource Economics*, vol. 11 (October 2019), pp. 399–418, <https://tinyurl.com/pb5wfy3b>; and Kai-Uwe Schanz, *Understanding and Addressing Global Insurance Protection Gaps* (The Geneva Association, April 2018), <https://tinyurl.com/yhkvxbs4> (PDF).

25. Yanjun Liao and Philip Mulder, *What's at Stake? Understanding the Role of Home Equity in Flood Insurance Demand*, Working Paper 21-25 (Resources for the Future, August 2021), <https://tinyurl.com/4n6jzj65>.

26. Robert Meyer and Howard Kunreuther, *The Ostrich Paradox: Why We Underprepare for Disasters* (Wharton School Press, 2017), <https://tinyurl.com/yc4wdcw7>.

27. Volker C. Radeloff and others, "Rapid Growth of the US Wildland-Urban Interface Raises Wildfire Risk," *Proceedings of the National Academy of Sciences of the United States of America*, vol. 115, no. 13 (March 2018), pp. 3314–3319; <https://doi.org/10.1073/pnas.1718850115>; and Marshall Burke and others, "The Changing Risk and Burden of Wildfire in the United States," *Proceedings of the National Academy of Sciences of the United States of America*, vol. 118, no. 2 (January 2021), <https://doi.org/10.1073/pnas.2011048118>.

28. Jerry Theodorou, *The Truth About Catastrophes*, R Street Shorts, no. 133 (R Street Institute, December 2023), <https://tinyurl.com/2pwfn24s> (PDF).

Box 2-1.

Federal Assistance After Disasters

The federal government helps communities and households recover after disasters, providing funding to meet the immediate needs of people in an affected community and to repair and improve infrastructure so that future disasters are less costly.¹ The Congressional Budget Office has estimated that the federal government paid for about 60 percent, on average, of the total costs of damages from major hurricanes that occurred between August 2005 and December 2015.² Most of the money went to state and local governments for infrastructure repair; only about a quarter of the funding, on average, went to individual households.

The largest source of federal financial assistance after disasters is the Federal Emergency Management Agency's

Disaster Relief Fund (DRF).³ Over the 1990–2023 period, the amount appropriated for the DRF totaled nearly \$570 billion (in 2023 dollars); just under 70 percent of that amount was provided through supplemental appropriations (see the figure). The rest was provided through annual discretionary appropriations. A few disasters account for a disproportionate share of total spending. Hurricanes constitute the largest category of DRF spending, and spending related to COVID-19 exceeded \$100 billion over the 2020–2023 period.

Federal assistance is not a substitute for property insurance. It is available only when the President declares a disaster. Many households suffer losses from natural disasters in which the damage does not rise to the level of a Presidential declaration. Even when such a declaration is made, not all households that suffer losses are located within the designated area, and federal disaster assistance covers only a small portion of residential property losses from natural disasters.

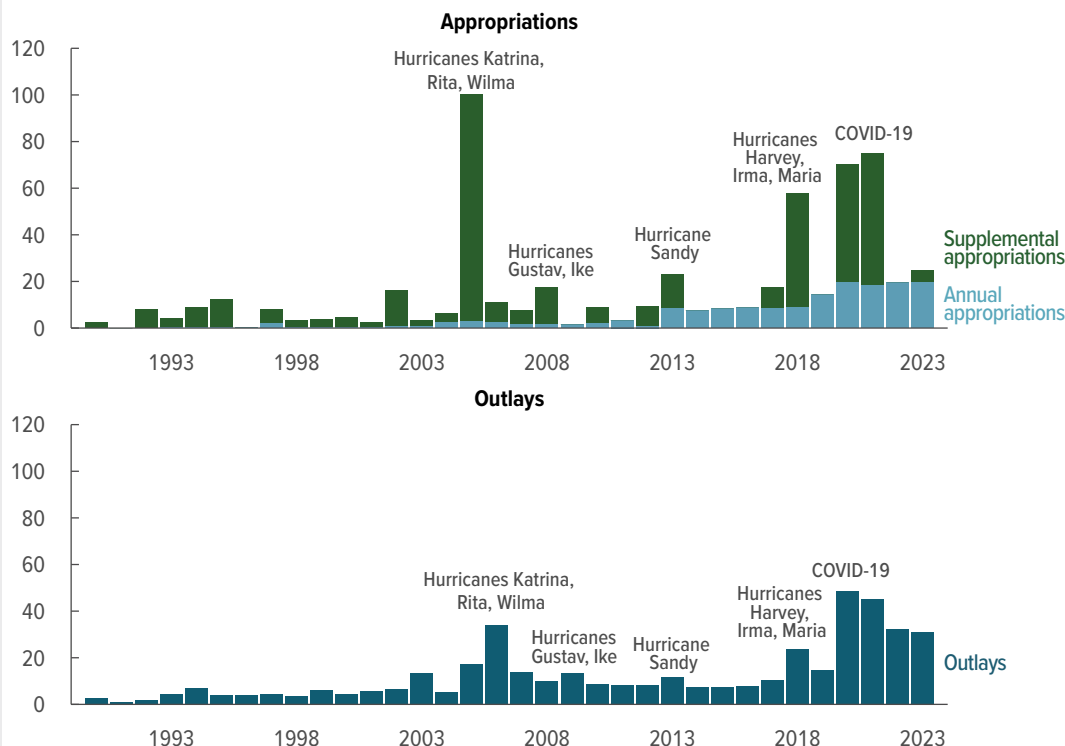
1. Government Accountability Office, *Disaster Recovery: Actions Needed to Improve the Federal Approach*, GAO-23-104956 (November 2022), www.GAO.gov/products/GAO-23-104956.

2. Congressional Budget Office, *Potential Increases in Hurricane Damage in the United States: Implications for the Federal Budget* (June 2016), www.cbo.gov/publication/51518.

3. Congressional Budget Office, *FEMA's Disaster Relief Fund: Budgetary History and Projections* (November 2022), www.cbo.gov/publication/58420.

FEMA's Supplemental Appropriations for Disasters, 1990 to 2023

Billions of 2023 dollars



Supplemental appropriations for a handful of disasters have been the main driver of the increased amounts of funding for the Disaster Relief Fund over the past 30 years. That funding is spent over multiple years, leading to increased outlays from the fund for several years after a disaster.

Data sources: Congressional Budget Office. See www.cbo.gov/publication/59918#data.

FEMA = Federal Emergency Management Agency.

countries where public insurance programs are in place.²⁹ Global economic losses from natural disasters totaled \$380 billion in 2023, and insurance covered 31 percent of those losses. In the United States, the rate of insurance coverage was more than double that; insurance covered 70 percent of the \$114 billion in losses from natural disasters.³⁰

More widespread insurance coverage would increase demand for reinsurance and could also diversify the risks reinsurers take on across more regions of the globe. Losses from an individual natural disaster can be large, but they are usually concentrated in a specific geographic area. For example, Hurricane Ian, which struck Florida and other southeastern states in September 2022, caused estimated insured losses of over \$56 billion (in 2023 dollars). Hurricane Katrina, which hit Louisiana in August 2005, was the most expensive natural disaster in the world, with insured losses of over \$100 billion (in 2023 dollars). Losses from wildfires, even if they are large, are typically smaller than losses from hurricanes. The Camp Fire in Northern California in November 2018 had the largest insured losses of any wildfire, at \$12 billion (in 2023 dollars).³¹

Insurers' Financing of Catastrophic Losses

Insurers finance the claims they pay in a variety of ways, including the premiums they collect from policyholders, reinsurance, and their own capital. (Capital is the net worth of a company, or the difference between its assets and its liabilities.) Insurers also use capital markets to distribute natural disaster risks and hold costs down.

Premiums. Insurers set premiums to cover all their costs, including expected claims. To earn a competitive return on their capital, insurers must set a price that reflects the uncertainty of the distribution of future losses. Insurers rely on catastrophe modeling to help estimate expected losses, but climate change can affect the underlying probabilities and the size of the losses and make them

more volatile.³² To protect against the volatility of those losses, insurers raise additional capital, and they charge higher premiums for catastrophic risks to cover the costs associated with raising that capital (see below). Premiums are also affected by the cost of reinsurance premiums and the point at which reinsurers begin to take on losses. The National Association of Insurance Commissioners estimated that insurers collected about \$152 billion in premiums for homeowner's property insurance in 2023.³³

Reinsurance. To limit their exposure, insurers purchase reinsurance. Reinsurers begin to make payments under one of two conditions. Some reinsurers take on losses when an insurer's losses from an event exceed an agreed-upon amount; others share in the losses on a percentage basis. Reinsurers typically bear about 30 percent of the insured losses from natural disasters.³⁴

Insurers pay premiums for reinsurance and pass most of those costs through to policyholders. Reinsurance premiums are unregulated and reflect the cost of risk. The price of reinsurance has been rising steadily in recent years; rates doubled between 2017 and 2023. Since then, the pace has slowed: Rates increased just 5 percent for renewals in January 2024.³⁵

As of December 2023, global reinsurers' capital was nearly \$730 billion.³⁶ Because insurers are still responsible for all their policyholders' claims even if a reinsurer fails, the financial strength and credit rating of the reinsurer are important considerations for the primary insurer.

29. Organisation for Economic Co-operation and Development, *Enhancing Financial Protection Against Catastrophe Risks: The Role of Catastrophe Risk Insurance Programmes* (2021), <https://doi.org/10.1787/338ba23d-en>.

30. Aon, *Climate and Catastrophe Insight* (2024), <https://tinyurl.com/yc7ckauf> (PDF).

31. Insurance Information Institute, "Facts + Statistics: Global Catastrophes" (accessed May 28, 2024), <https://tinyurl.com/2s48nm3u>.

32. Catastrophe models provide information about natural hazard events of all magnitudes, including events that produce less than \$25 million in losses.

33. The estimate also includes premiums collected in Canada. See National Association of Insurance Commissioners, "Property and Casualty Insurance Industry: 2023 Top 25 Groups and Companies by Countrywide Premium" (2024), <https://tinyurl.com/mry7jrau>.

34. Testimony of Franklin W. Nutter, President, Reinsurance Association of America, before the Subcommittee on Housing and Insurance of the House Financial Services Committee, *The Factors Influencing the High Cost of Insurance for Consumers* (October 24, 2023), <https://tinyurl.com/aem8e87r> (PDF).

35. Artemis, "Guy Carpenter U.S. Property Catastrophe Rate-On-Line Index," (accessed May 28, 2024), www.artemis.bm/us-property-cat-rate-on-line-index/.

36. Gallagher Re, *Reinsurance Market Report: Results for Full-Year 2023* (April 2024), <https://tinyurl.com/27aky4rv> (PDF).

Reinsurance is purchased from a global marketplace to spread risk across different types of disasters and geographic areas. However, climate change is global, and growing uncertainty about losses affects the reinsurance market as well. If climate risk increases the frequency or severity of disasters or changes where disasters tend to occur, reinsurance will diversify risk less effectively. For example, multiple countries, including the United States, Canada, and Greece, experienced severe wildfires in 2023. How well reinsurance markets can continue to diversify risk will help determine the cost of climate change to property owners.³⁷

Insurers' Capital. Insurers use capital to fund investments that provide a buffer against losses. As of December 2023, insurers in the United States had \$1.1 trillion in capital to support property and casualty policies (that is, coverage for residential and commercial properties, automobiles, workers compensation, and liability).³⁸ Although catastrophic losses have led to the insolvency of some small insurers, insurers' capital has generally been sufficient to cover insured losses from most natural disasters to date.³⁹

Insurance regulators and rating agencies evaluate the adequacy of an insurer's capital relative to the amount of risk it bears; a high rating assures policyholders that their claims will be paid. To maintain a high rating, which affects the premiums an insurer can charge and its ability to raise capital, insurers (and reinsurers) may limit their catastrophic risks.

Capital Markets. Capital markets, which are many times larger than reinsurance markets, offer opportunities for insurers to share natural disaster risks and hold costs down. The amount of disaster risk borne by capital

markets (about \$100 billion) is small compared with insurers' and reinsurers' capital.⁴⁰

Capital markets take on insurance risk when insurers and other entities issue securities called catastrophe bonds.⁴¹ If a predefined disaster occurs within a specified period, bondholders forgive part or all of the bond's interest and principal. Catastrophe bonds can offer protection over multiple years (whereas reinsurance typically covers a single year), can cover a single type of disaster or multiple types, and can pay out on the basis of an issuer's annual losses from disasters or per event losses. Unlike reinsurance policies, catastrophe bonds are backed by safe financial assets and pose little risk of default. For their part, investors use catastrophe bonds to diversify their portfolios and improve their risk-adjusted returns. Changes in the prices and returns on the catastrophe bonds depend on the weather and do not move much with changes in the stock market or general economic conditions.

The legal structure of catastrophe bonds is complicated and adds to costs, so they are more likely to be used by larger entities than smaller ones. Issuers include state residual insurance plans, the National Flood Insurance Program, the New York City subway system, and the Los Angeles Department of Water and Power.⁴² The outstanding catastrophe bond market was valued at \$45 billion in 2023 and has doubled in 10 years.⁴³

The Effects of Climate Change, Catastrophic Losses, and Regulations on the Availability of Disaster Insurance in the Private Market

Private insurers' willingness to offer coverage to property owners depends on their ability to measure and manage risk and to charge premiums that represent the cost of the risk transfer. As the climate continues to change and the risks of natural disasters grow accordingly, insurers face the possibility of experiencing large, ongoing losses as they pay policyholders' claims for more frequent

37. Benjamin J. Keys and Philip Mulder, *Property Insurance and Disaster Risk: New Evidence From Mortgage Escrow Data*, Working Paper 32579 (National Bureau of Economic Research, June 2024), www.nber.org/papers/w32579.

38. National Association of Insurance Commissioners, *U.S. Property and Casualty and Title Insurance Industries—2023 Full Year Results* (2024), <https://tinyurl.com/bdhwj8vn> (PDF).

39. For an analysis of how the capital of the 10 largest insurers would be affected in a catastrophe, see Hyeyoon Jung and others, *Measuring the Climate Risk Exposure of Insurers*, Staff Report no. 1066 (Federal Reserve Banks of New York, July 2023), www.newyorkfed.org/research/staff_reports/sr1066.html.

40. Gallagher Re, *Reinsurance Market Report: Results for Full-Year 2023* (April 2024), <https://tinyurl.com/27aky4rv> (PDF).

41. American Academy of Actuaries, *Insurance-Linked Securities and Catastrophe Bonds* (June 2022), pp. 9, 21–24, www.actuary.org/sites/default/files/2022-06/ILS_20220614.pdf.

42. Alexander Braun and Carolyn Kousky, *Catastrophe Bonds*, Wharton Risk Center Primer (University of Pennsylvania, Wharton Risk Management and Decision Processes Center, July 2021), p. 8, <https://tinyurl.com/88wysh6c> (PDF).

43. Artemis, *Q4 2023 Catastrophe Bond and ILS Market Report* (2024), <https://tinyurl.com/5n6rd3ur> (PDF).

disasters.⁴⁴ If private insurers cannot estimate those losses with confidence, they may, in the short run, decide to not offer policies for the riskiest properties and to raise the price of the insurance policies they offer to cover the higher risk and uncertainty about future losses.⁴⁵

In the long run, those higher prices for insurance can attract additional investment into disrupted insurance markets, increasing the supply. Insurers also typically gain a better understanding of risk over time as they incorporate better data and improve models. Those adjustments take time, during which some property owners might be unable to get the insurance coverage they want at prices they are willing to pay.

Actual costs can vary significantly in any year from the costs that insurers project on the basis of their catastrophe models, and the volatility of losses can be high. Estimates of the effects of climate change may lag because those estimates rely on both historical data and projections. The challenges are particularly relevant for wildfire risks (see Box 2-2).

State regulations can make price adjustments harder to implement. Some regulations limit price increases, which means that risks may rise faster than premiums. Some have also required insurers to continue offering certain policies even after a large loss, delaying the drop in supply that would typically follow such an event. Researchers have also found that insurers operating in multiple states respond to rate suppression in some states by raising rates more in other states with less stringent

regulatory regimes.⁴⁶ Efforts by regulators to make policies affordable and available in the short run can reduce competition and lead to higher prices in the long run by encouraging firms to exit the market. In addition, to the extent that those regulations keep prices for high-risk policyholders below the actual cost of their risk, they provide incentives to build in high-risk areas, which can increase losses over time.

Insurers' Supply and Pricing of Natural Disaster

Coverage. Insurers' ability to price risk, charge premiums in line with that risk, and limit their capital exposure to losses varies for different risks and changes over time. In turn, homeowners in the United States have had varying access to insurance for different natural disasters.

Flooding. Currently, the National Flood Insurance Program is the largest source of flood insurance in the United States, but nearly a century ago, private insurers were the only providers of such insurance. They withdrew coverage after experiencing large losses from the Mississippi River floods of 1927 and 1928. For the next 40 years, virtually no flood insurance coverage was offered, even as the population in flood prone areas grew. As a result, costly federal disaster relief was necessary after Hurricane Betsy in 1965. Three years later, lawmakers created the NFIP to fill the gap.⁴⁷ For decades, the NFIP was the only option for flood insurance.

In recent years, private insurers have reentered the flood insurance market because changes in the NFIP's approach to pricing risk have given private insurance companies more ability to compete. In 2021, the NFIP introduced Risk Rating 2.0. Under that approach, risk is assessed on the basis of structures on a specific property; previously, the NFIP used flood zones as an indicator of risk along with other factors. Roughly three-quarters

44. Lloyd Dixon, Flavia Tsang, and Gary Fitts, *The Impact of Changing Wildfire Risk on California's Residential Insurance Market*, CNRA-CCC4A-2018 (California Natural Resources Agency, Report for California's Fourth Climate Change Assessment, August 2018), www.rand.org/pubs/external_publications/EP67670.html; and Tony Cignarale and others, *The Availability and Affordability of Coverage for Wildfire Loss in Residential Property Insurance in the Wildland-Urban Interface and Other High-Risk Areas of California: CDI Summary and Proposed Solutions* (California Department of Insurance, Availability and Affordability of Residential Property Insurance Task Force, 2018), <https://tinyurl.com/mryfj822> (PDF).

45. Judson Boomhower and others, *How Are Insurance Markets Adapting to Climate Change? Risk Selection and Regulation in the Market for Homeowners Insurance*, Working Paper 32625 (National Bureau of Economic Research, June 2024), www.nber.org/papers/w32625.

46. Sangmin S. Oh, Ishita Sen, and Ana-Maria Tenekedjieva, *Pricing of Climate Risk Insurance: Regulation and Cross-Subsidies*, Finance and Economic Discussion Series Paper 2022-064 (Board of Governors of the Federal Reserve System, June 2022), <https://tinyurl.com/y9daeix9> (PDF).

47. Howard Kunreuther, "The Role of Insurance in Reducing Losses From Extreme Events: The Need for Public-Private Partnerships," *Geneva Papers on Risk and Insurance—Issues and Practice*, vol. 40, no. 4 (October 2015), pp. 741–762, <https://doi.org/10.1057/gpp.2015.14>; and Scott Gabriel Knowles and Howard C. Kunreuther, "Troubled Waters: The National Flood Insurance Program in Historical Perspective," *Journal of Policy History*, vol. 26, no. 3 (July 2014), pp. 327–353, <https://doi.org/10.1017/S0898030614000153>.

Box 2-2.**Uncertain Estimates of Wildfire Risk**

In the case of natural disasters, dealing with uncertainty about losses is challenging and contributes to insurers' limiting their exposure to wildfires and other natural disasters.¹ Insurers rely on catastrophe models to estimate the risks of natural disasters. They use those probabilistic models, which are based on thousands of simulations of events, to estimate potential losses, average annual losses, and the distribution of possible losses. Those simulations supplement past events with projections of future events for two reasons. First, extreme weather events have historically been infrequent, so the historical record does not represent the full range of possible events; and second, climate change may make that record less predictive.

Catastrophe models of wildfires are less widely accepted by insurers and regulators than those for hurricanes and earthquakes. Wildfire risks are changing fast, and gaps in fire data and science create challenges for wildfire modelers.² Those gaps include the following:

- A lack of detailed claims data makes it difficult to understand the potential for losses.
- Both vegetation and structures provide fuel for wildfires, affecting how fast and far a fire can spread. Collecting and keeping up-to-date data on the fuels available for fires is difficult.
- Modeling fires caused by lightning relies on science. But most fires are started by humans, whose behavior is unpredictable.
- Attempts to quantify the effects of fire suppression efforts on risk remain imprecise. The effectiveness of fire suppression efforts, including the use of aerial suppression, tankers, and natural barriers, depends on the fire's location and intensity as well as the speed at which the fire spreads.
- Wildfires differ from other natural hazards in that the risk to a property depends in part on the risk of nearby properties,

which can be a source of fuel for fires or can help to slow or stall a fire's spread. It can be difficult for any individual insurer to know the actions taken by policyholders' neighbors.³

- Modelers may not be well informed about a community's adaptation measures, their enforcement, or their maintenance.

California currently prohibits insurers from using wildfire catastrophe models that simulate future events in the rate-setting process. They instead must rely on historical loss experiences, which can less reliably predict conditions under climate change. Those restrictions may soon be lifted, according to an announcement from California's insurance commissioner.⁴

Other states, such as Washington and Oregon, have encountered controversy and confusion from residents about the use of wildfire risk models and hazard maps in the insurance underwriting and pricing process. The lack of sufficient historical data and constraints on internal resources and expertise make it hard for regulators to validate the models. In addition, different models yield varying results, particularly for lower-probability scenarios in which the largest losses occur.

States can set standards that result in the wider acceptance of catastrophe models. Following the catastrophic losses of Hurricane Andrew in 1992, the Florida Commission on Hurricane Loss Projection Methodology set consistent standards of hurricane model review and certification for use in rate filings. The process increased confidence in the models' results. South Carolina and Hawaii have adopted a similar approach and publish a list of catastrophe models allowed for setting rates. A California working group created in 2021 is reviewing wildfire risk modeling of structures and communities, both to improve the understanding and modeling of wildfire risk and to develop a strategy to account for adaptations.⁵

1. Frances C. Moore, *Learning, Catastrophic Risk and Ambiguity in the Climate Change Era*, Working Paper 32684 (National Bureau of Economic Research, July 2024), www.nber.org/papers/w32684; and Congressional Budget Office, *Wildfires* (June 2022), www.cbo.gov/publication/57970.

2. American Academy of Actuaries, Extreme Events and Property Lines Committee, *Wildfire: Lessons Learned From the 2017 to 2021 Events* (January 2022), pp. 17–25, <https://tinyurl.com/296547tt> (PDF).

3. Nancy Watkins, "A Community-Based Solution: How Actuaries and Fire Chiefs Can Tackle WUI Risk Together," *Carrier Management* (August 29, 2023), <https://tinyurl.com/mude8huw>.

4. California Department of Insurance, "Commissioner Lara Announces Sustainable Insurance Strategy to Improve State's Market Conditions for Consumers" (press release, September 21, 2023), <https://tinyurl.com/28z5kutf>.

5. Risk Modeling Advisory Workgroup, *Risk Modeling Advisory Workgroup Draft Report* (September 9, 2023), <https://tinyurl.com/9jy2uty> (PDF).

of the NFIP's policies were expected to see premiums increase under Risk Rating 2.0.⁴⁸ Those NFIP changes coincided with better mapping and modeling of flood risks, which also strengthened the private market. The number of private flood insurers quadrupled from about 50 in 2016 to nearly 200 in 2022. Estimates of private residential flood insurance premiums exceeded \$400 million for 2022, and total private flood insurance premiums (including commercial premiums) approached \$1.3 billion.⁴⁹ In fiscal year 2023, the NFIP collected \$4.5 billion in premiums and fees, more than three times as much.

Earthquakes and Hurricanes. By contrast, access to private insurance coverage for earthquakes and for wind damage from hurricanes has been trending downward, in part because of rising risks and uncertainty. In addition, new regulations introduced in the wake of catastrophic events have had the unintended consequence of limiting the availability of insurance, which in turn has led states to step in to close coverage gaps. After the Northridge earthquake in January 1994, which caused about \$32 billion of insured losses (in 2023 dollars), more than 90 percent of insurers doing business in California either discontinued homeowner's coverage or restricted it.⁵⁰ One reason for the exits was that California began requiring homeowner's insurance policies to offer coverage for earthquakes. That mandate limited insurers' ability to control their exposure to catastrophic losses.⁵¹ State lawmakers established the California Earthquake

Authority in 1996 to offer earthquake coverage separately from residential insurance. Private insurers can meet the mandate by offering coverage through that program. (A small market for private earthquake coverage exists along with the state's program.)

Similarly, the largest insurance companies discontinued coverage in Florida after hurricanes hit the state in 2005.⁵² The larger national firms were replaced by lower-quality insurers that were less diversified and less capitalized and therefore more prone to failure.⁵³ At the time, Florida was limiting rate increases, and rates for homeowner's insurance were at or below rates in nearby coastal states even though Florida's risk of hurricane-related losses was higher. Florida had to expand its residual insurance program and create the Florida Hurricane Catastrophe Fund to act as a reinsurer to keep rates more affordable as the number of providers shrank.

Recent Developments. More recently, a series of catastrophic losses as well as uncertainty over the risks posed by climate change have pushed some insurers to exit high-risk markets or restrict the issuance of new policies in those areas:

- In the first half of 2023, AIG, Allstate, and State Farm stopped issuing new residential policies in California.
- In 2022, 12 insurers withdrew from Florida or halted new policy offerings.
- In July 2023, Farmers Insurance announced that it would not offer new policies in Florida or renew existing policies.

Insolvencies are also on the rise:

- In 2022, 6 Florida insurers became insolvent.
- Claims from hurricanes in 2020 and 2021 in Louisiana totaled more than \$20 billion, leading

48. Diane P. Horn, *National Flood Insurance Program: The Current Risk Rating Structure and Risk Rating 2.0*, Report R45999, version 13 (Congressional Research Service, April 4, 2022), <https://tinyurl.com/yc4kfxcv>; and Howard Kunreuther, "Flood Insurance Finally Acknowledges Climate Change," *Brink* (Marsh McLennan, June 29, 2021), <https://tinyurl.com/bddmnpns>.

49. AM Best, "Best's Market Segment Report: U.S. Private Flood Market Growing, Especially Commercial Property" (August 28, 2023), <https://tinyurl.com/2vcv6js3>; and Insurance Information Institute, "Facts + Statistics: Flood Insurance" (accessed December 7, 2023), <https://tinyurl.com/2ed6ydky>; and Insurance Information Institute, *Flood: State of the Risk*, Triple-I Issues Brief (August 16, 2023), www.iii.org/article/flood-state-of-the-risk.

50. Insurance Information Institute, "Facts + Statistics: Global Catastrophes" (accessed April 12, 2023), <https://tinyurl.com/2s48nm3u>.

51. California law mandates that homeowner's insurance policies offer coverage for earthquakes, but policyholders can choose whether to purchase it. See California Earthquake Authority, "History of the California Earthquake Authority (CEA)" (accessed April 12, 2023), www.earthquakeauthority.com/About-CEA/CEA-History.

52. Testimony of Rade Musulin before the Senate Committee on the Budget, *Riskier Business: How Climate Is Already Challenging Insurance Markets* (June 5, 2024), <https://tinyurl.com/2htaykjd>; and Carolyn Kousky, *Understanding Disaster Insurance: New Tools for a More Resilient Future* (Island Press, 2022), pp. 114–116, <https://tinyurl.com/3c5zcucy>.

53. Parinitha Sastry, Ishita Sen, and Ana-Maria Tenekedjieva, *When Insurers Exit: Climate Losses, Fragile Insurers, and Mortgage Markets* (SSRN, December 2023), <https://ssrn.com/abstract=4674279>.

11 firms to become insolvent, which affected more than 10 percent of the market.⁵⁴

- In Louisiana, insurers canceled about 1 in 6 homeowner's insurance policies in 2022.⁵⁵

Insolvencies result in costs to states' guaranty plans.⁵⁶ For example, the insolvencies in Florida led the state's guaranty plan to impose a 1 percent emergency assessment (a tax) on insurers in April 2023. Similarly, Louisiana's guaranty plan assessed insurers to recover the plan's losses from 2021 and 2022 and issued a \$600 million bond backed by future assessments. Insurers passed those costs on to policyholders.

Regulations and the Supply of Insurance. Regulators and state lawmakers weigh the tradeoffs between affordability and availability of coverage. As the costs and benefits of the tradeoffs have changed, regulatory policies have changed. California voters passed a referendum in November 1988 that required regulators to approve rates before they can be implemented. In September 2023, the governor issued an executive order that could allow higher rates in high-risk areas in return for greater availability of coverage. In Florida, where insurers have the flexibility to set risk-based rates, recent legislative changes are intended to reduce the cost of insurance litigation. And a recent Louisiana law addresses the ability of insurers to discontinue existing policies.

California. Regulators in California are in the process of designing and implementing changes meant to allow insurers more flexibility in setting insurance premiums after Governor Gavin Newsom issued Executive Order N-13-23 in September 2023. Following that order, the California Department of Insurance announced several regulatory changes intended to stabilize the California insurance market, encourage reentry by insurers, expand insurance offerings in areas at high risk of wildfires, and reduce the number of policyholders in the FAIR

plan.⁵⁷ (Legislation that would streamline the review of insurance rate filings was pending as of August 2024.) Those changes, to be implemented in the coming years, allow insurers to use catastrophe models that account for climate change to measure their risk and set prices. (Currently, insurers rely on 20-year averages of historical losses to set prices.) In addition, insurance companies can account for more reinsurance costs in their rate filings, though they will still need regulatory approval to change their rates. In return, in communities with high wildfire risks, an insurer's market share will have to be at least 85 percent of its statewide market share; that level could be reached in part by offering coverage to policyholders in the FAIR plan. Such policy changes could increase the availability of insurance in the private market and improve risk-based prices, though coverage would be less affordable to policyholders in high-risk areas.

Existing insurance regulations have played a role in the exit of insurers from the private market and the declining availability of private insurance in the highest-risk area in California: the wildland-urban interface.⁵⁸ Wildland-urban interfaces are where residential development meets the undeveloped wildlands (forests and other vegetation), which is where wildfires' risk to property is the greatest. Efforts by insurers to raise rates by more than 7 percent often result in lengthy and costly regulatory delays, which can effectively suppress rates in the riskiest areas and impair insurers' ability to supply insurance. Insurers refuse to renew a larger share of policies in high-risk areas than they do in other parts of the state.⁵⁹ (Rate increases in areas at risk of wildfires are key to insurers' staying in compliance with solvency regulations and maintaining their financial strength ratings from the credit rating agencies.) From 2016 to 2018, more than 2 percent of policies were canceled statewide by insurers; in 2019, more than 3 percent were. In zones designated as at very high risk of wildfires, the share of policies not renewed

54. Louisiana Legislative Auditor, Louisiana Department of Insurance, *Financial Condition of the Residential Property Insurance Market* (October 13, 2022), <https://tinyurl.com/3f4zhct7> (PDF).

55. Department of the Treasury, Federal Insurance Office, *Insurance Supervision and Regulation of Climate-Related Risks* (June 2023), p. 56, <https://tinyurl.com/3cc6ee23> (PDF).

56. *Ibid.*, pp. 36–37.

57. California Department of Insurance, "California's Sustainable Insurance Strategy" (September 2023), <https://tinyurl.com/u2ykhxddd> (PDF).

58. Paulo Issler and others, "Housing and Mortgage Markets With Climate Risk: Evidence From California Wildfires," (Federal Reserve Bank of San Francisco, Virtual Seminar on Climate Economics, November 4, 2021), <https://tinyurl.com/373uzaxs> (PDF).

59. Yanjun Liao and others, *Insurance Availability and Affordability Under Increasing Wildfire Risk in California*, Issue Brief 22-09 (Resources for the Future, November 2022), pp. 3–4, <https://tinyurl.com/5fhmf2bk>.

by insurers was larger: It increased from less than 3 percent between 2016 and 2018 to more than 7 percent in 2019.

In 2018, the state legislature enacted a law that prohibits insurance companies from canceling or refusing to renew a policy for one year in zip codes in or adjacent to areas where a wildfire state of emergency has been declared. Between 2019 and 2023, 26 such moratoriums on nonrenewal of policies were declared, often covering multiple fires and zip code areas.⁶⁰ Those moratoriums are temporarily effective in reducing policy nonrenewals; in affected zip codes, the number of policies that insurers chose not to renew decreased by 20 percent from 2019 to 2020, compared with a 2.5 percent decrease in all other areas in the state.⁶¹ But after a moratorium ends, the number of nonrenewals will probably increase in affected areas.⁶²

Florida. Lawmakers in Florida took steps in December 2022 and March 2023 to encourage private insurers to enter the market and reduce the number of policies in the state's Citizens plan. Those efforts have focused on reducing the size and cost to insurers

of claims by changing the laws governing insurance litigation and reducing fraud.⁶³ The changes increased supply and reduced costs in 2023.⁶⁴ Several private insurers entered the property market, and the number of policies issued by Citizens fell from 1.4 million in September 2023 to 1.2 million in February 2024.⁶⁵ In mid-2024, those developments lowered reinsurance rates for renewals for Florida insurers for the first time in three years.⁶⁶

Louisiana. A 2024 Louisiana law offers insurers more flexibility in managing their risks by repealing a law enacted after Hurricane Katrina in 2005. That law prohibited insurers from dropping a policy or raising its deductible if the policy had been renewed for three years. Under the new law, insurers may choose not to renew up to 5 percent of their policies in a year (more under some circumstances) and may raise deductibles for policies that are renewed. In the short run, more policyholders might be dropped by private insurers and pushed into the state's residual plan, but the flexibility could stabilize the private market and encourage other insurers to enter the market in the long run.

60. California Department of Insurance, "Mandatory One Year Moratorium on Non-Renewals" (accessed June 14, 2024), <https://tinyurl.com/yc5t3np3>.

61. Yanjun Liao and others, *Insurance Availability and Affordability Under Increasing Wildfire Risk in California*, Issue Brief 22-09 (Resources for the Future, November 2022), p. 4, <https://tinyurl.com/5fhmf2bk>.

62. Reid Taylor, Madeline Turland, and Joakim A. Weill, "Climate Change and the Regulation of a Crashing Insurance Market" (draft, November 2023), <https://tinyurl.com/47dehnmt> (PDF).

63. Testimony of Robert Gordon, Senior Vice President, American Property and Casualty Insurance Association, before the Subcommittee on Housing and Insurance of the House Financial Services Committee, *Factors Influencing the High Cost of Insurance for Consumers* (October 24, 2023), <https://tinyurl.com/y4awnzya> (PDF).

64. AM Best, "The State of the Florida Property Market Ahead of the 2024 Hurricane Season," AM Best's briefing (May 30, 2024), <https://tinyurl.com/2rc422pp>.

65. Jerry Theodorou, "Florida Insurance Market on the Mend" (R Street Institute, April 4, 2024), <https://tinyurl.com/mr3e7vpx>.

66. Aon, *Reinsurance Market Dynamics* (July 2024), pp. 13–14, www.aon.com/en/insights/reports/reinsurance-market-dynamics.

Chapter 3: Approaches to Improving Insurance Affordability and Coverage for Low- and Moderate-Income Households

Low- and moderate-income households are more likely to be underinsured or uninsured than high-income households, leaving them more likely to face financial losses after a natural disaster and to recover from those disasters more slowly. As the effects of climate change increase the risk of natural disasters, those households' exposure to financial losses from natural disasters will increase as well.¹ In addition, landlords and property owners will pass through the higher insurance premiums to renters.

Traditional homeowner's insurance policies, or indemnity policies, reimburse policyholders for losses or damages after adjusting (that is, reviewing and processing) individual claims. They have high transaction costs because they require personnel to make on-site inspections and complete paperwork after a claim is made. Therefore, they may be more costly for households with lower-valued properties.

Changes in the design of insurance policies or new public programs that target underserved populations could make insurance more affordable for low- and moderate-income households. Those changes include the following:

- Providing means-tested, or income-based, subsidies to low- and moderate-income households;

- Offering parametric insurance in which an unrestricted payout is made when a triggering event of a specified magnitude occurs; and
- Offering community-based insurance in which a nonprofit or government agency arranges group coverage for community members and makes assistance payments to them.

Low- and Moderate-Income Households' Exposure to Climate Risk

Low- and moderate-income households are more likely to experience financial hardships from disasters than other households. In the 12 months ending in October 2023, about 1 percent of adults in the United States were displaced from their homes because of a natural disaster. That share was more than twice as large among households with incomes below \$25,000 or whose members had less than a high school education. Those households were also less likely to return to their homes and to experience food shortages one month after the disaster. Black and Hispanic residents were also more likely to be displaced by disasters than other residents.²

In the Congressional Budget Office's projections, flood risk is more prevalent in communities with a low median household income. Generally, the largest increases in flood risk over the next 30 years are expected to occur in communities in which most residents are Black or in which most people rent housing.³ Many of those households have minimal financial resources, experience food shortages after being displaced by disasters, and

1. Cristian deRitis, *Assessing the Impact of Homeowners Insurance on House Prices and Affordability* (Moody's Analytics, May 2024), <https://tinyurl.com/bdzdzrsa>; Ruchi Avtar and others, "Understanding the Linkages Between Climate Change and Inequality in the United States," *Economic Policy Review*, vol. 29, no. 1 (Federal Reserve Bank of New York, June 2023), pp. 1–37, <https://tinyurl.com/4juk54v3>; and Carolyn Kousky and Karina French, *Inclusive Insurance for Climate-Related Disasters: Financially Protecting the Unserved and the Underserved Against Climate Disasters* (Ceres, January 2023), pp. 23–25, <https://tinyurl.com/2tb3zz6v>.

2. Census Bureau, "Week 63 Household Pulse Survey: October 18–October 30" (November 8, 2023), Natural Disaster Tables, www.census.gov/data/tables/2023/demo/hhp/hhp63.html.

3. Congressional Budget Office, *Communities at Risk of Flooding* (September 2023), www.cbo.gov/publication/58953.

could benefit from the financial resilience that insurance provides.⁴

Income-Based Subsidies

Income-based subsidies would make insurance policies more affordable for low-income households, but they would impose a budgetary cost. A program that targeted subsidies to people who needed them most, including renters, and phased them out as incomes increased would have some advantages relative to programs that either subsidized all rates or cross-subsidized high-risk policies by charging more for low-risk policies.⁵ Means-tested subsidies would not undermine risk-based premiums, which provide incentives for adaptation efforts that could reduce risk. In addition, the cost of the subsidies could be made transparent in the government's budget, whether funded at the federal, state, or local level. But identifying which households were most in need of subsidies could be difficult, especially if the risks a household faced were not well understood.

Some areas have already instituted income-based subsidies. North Carolina, for example, has a pilot program that provides premium assistance to qualifying households to purchase policies from the National Flood Insurance Program. Other state and local governments have taken different steps to lower the cost of flood insurance for residents with low income, including reducing property taxes for people who purchase flood insurance.⁶

Income-based subsidies differ from how the NFIP has typically subsidized premiums.⁷ The NFIP has historically operated at a deficit because the government has charged premiums that are too low to meet the program's expected costs. Some flood insurance policies have been explicitly subsidized, and others—which the NFIP categorizes as “full risk” policies—have been unintentionally subsidized, a problem that the program is now trying to correct.⁸ Under its Risk Rating 2.0 approach, the NFIP has transitioned to a pricing method that assesses the risk of each individual structure that is insured, rather than using flood zones as an indicator of risk.⁹ Before Risk Rating 2.0, the biggest subsidies were directed to those with the most expensive homes, and premium rates were not based on risk. Both factors reduced adaptation incentives and encouraged excessive development in risky areas.

Parametric Insurance

Parametric insurance relies on predefined, measurable, and objective parameters—such as the amount of rainfall or wind speed in a given location or whether a fire's footprint reaches a property—to trigger payments in pre-specified amounts.¹⁰ Parametric policies are designed not to replace traditional policies but rather to complement them by providing quick and transparent payouts that can be used for unrestricted purposes. Parametric policies provide renters and homeowners protection (generally up to \$25,000) against a range of disasters in the United States. Policies have also been purchased by state and local governments to provide funding for recovery or other disaster-related expenses, such as firefighting.¹¹

4. Andrew Rumbach and Sara McTarnaghan, “More Than 3 Million Americans Were Displaced by a ‘Natural’ Disaster in the Past Year. How Can We Prepare for Our Climate Future?” (Urban Institute Blog, November 15, 2023), <https://tinyurl.com/mry4r5x5>; and Board of Governors of the Federal Reserve System, *Economic Well-Being of U.S. Households in 2021* (May 2022), pp. 35–36, <https://tinyurl.com/2n6kv848> (PDF).

5. Wharton Risk Management and Decision Processes Center, Georgia State University, and the Insurance Information Institute, *Managing Large-Scale Risks in a New Era of Catastrophes: Insuring, Mitigating and Financing Recovery From Natural Disasters in the United States* (March 2008), pp. 2, 13, 259–266, <https://tinyurl.com/mrjk2th3> (PDF).

6. Carolyn Kousky and Helen Wiley, *Improving the Post-Flood Financial Resilience of Lower-Income Households Through Insurance* (University of Pennsylvania, Wharton Risk Management and Decision Processes Center, January 2021), <https://tinyurl.com/4ban9w8d> (PDF).

7. Government Accountability Office, *Flood Insurance: FEMA's New Rate-Setting Methodology Improves Actuarial Soundness but Highlights Need for Broader Program Reform*, GAO-23-105977 (July 2023), www.GAO.gov/products/GAO-23-105977.

8. Congressional Budget Office, *The National Flood Insurance Program: Financial Soundness and Affordability* (September 2017), pp. 24–25, www.cbo.gov/publication/53028.

9. Philip Mulder and Carolyn Kousky, “Risk Rating Without Information Provision,” *AEA Papers and Proceedings*, vol. 113 (May 2023), pp. 299–303, <https://doi.org/10.1257/pandp.20231102>.

10. Guillermo E. Franco and Sydney Hedberg, “Insuring Against Wildfire Risks: The Case for Parametric Insurance” (Marsh McLennan, video, April 2023), <https://tinyurl.com/358mhrcu>.

11. Noreen Clancy and others, *Improving the Financial Resilience of Public Entities and Individuals for Natural Disasters: A Resource Guide for State and Local Government* (RAND Corporation, December 2023), pp. 15–25, www.rand.org/pubs/research_reports/RRA1770-3.html.

Parametric wildfire insurance can also act as reinsurance for traditional insurers.¹²

Nations around the world have used parametric insurance to finance recovery needs following disasters. For example, the Caribbean Catastrophe Risk Insurance Facility, which has shared risks in multiple countries since 2007, makes most of its payments within two weeks of a disaster. (In contrast, indemnity payments under standard homeowner's policies can take several weeks or months after a disaster because insurers face numerous and complicated claims.)¹³

At the individual or household level, parametric policies are useful for their flexibility and quick payouts, especially for cash-constrained households with emergency expenses. A private company offers residential parametric policies for hurricane coverage to residents of Puerto Rico, though the policies are not intended as a replacement for indemnity insurance.¹⁴ The payouts increase with wind speeds and are promised within 10 days. Regulations cap premiums to 2 percent of the policyholder's income and limit the policy document to four pages to enhance transparency.

Payouts from parametric policies offer more flexibility than indemnity payouts. Indemnity policies match claims payouts to specific losses and often only cover property loss. They do not cover costs for other disaster-related expenses, such as evacuations, emergency supplies, debris cleanup, and generators. Those costs can be considerable. Renters may find such nonproperty losses to be particularly costly, especially as they seek temporary housing amid the higher rents that can follow disasters (see Box 3-1).¹⁵ Parametric payments could be used to pay for those expenses.

Because parametric payments generally do not require any claims adjustment, those payments could be made quickly, could involve smaller administrative costs than indemnity policies, and could be appealing to many homeowners.¹⁶ But how well parametric policies would meet the needs of residential policyholders is uncertain, in part because they have not been tested on a large scale.¹⁷ Additionally, policyholders generally place a higher value on insurance when their coverage is based on individual losses rather than an index, which means that demand for parametric insurance could be lower than that for indemnity insurance.¹⁸ Parametric policies might also face regulatory uncertainty and might not be approved for residential use in some states, at least in part because they may result in payments that exceed (or fall short of) the actual losses a policyholder experiences when a payout is triggered.¹⁹

Community-Based Insurance

Community-based catastrophe insurance is a novel approach under which communities and insurers work together to close protection gaps and enhance community resilience. A local government body or community group could arrange for the purchase of insurance for multiple properties in a community.²⁰ A group also could purchase insurance directly for some residents. The details could vary widely: If insurance was arranged by a

the Underserved Against Climate Disasters (Ceres, January 2023), p. 26, <https://tinyurl.com/2tb3zz6v>.

12. Guy Carpenter, *Parametric Wildfire Coverage Innovation* (2022), <https://tinyurl.com/yrb5fb33> (PDF).

13. States have different rules about how quickly payments must be made. Partial payments may be advanced earlier; disputed claims can end up in courts and take much longer to settle. See Insurance Information Institute, "Settling Insurance Claims After a Disaster" (accessed June 5, 2024), <https://tinyurl.com/2ksnh3e2>.

14. Carolyn Kousky, *Understanding Disaster Insurance: New Tools for a More Resilient Future* (Island Press, 2022), pp. 132–151, <https://tinyurl.com/3c5zcucy>.

15. Carolyn Kousky and Karina French, *Inclusive Insurance for Climate-Related Disasters: Financially Protecting the Underserved and*

16. There have been exceptions in the unregulated market for parametric products. See Jason Schupp, "California Climate Insurance Working Group Sizes Up Parametric Solutions" *Medium* (August 5, 2021), <https://tinyurl.com/yc6n5fd7>.

17. Carolyn Kousky, "Management: Catastrophic Risk Transfer in a Post-Pandemic World," in *Challenges and Opportunities in the Post-COVID-19 World*, Insight Report (World Economic Forum, May 2020), pp. 40–43, <https://tinyurl.com/4wy96hw3>.

18. Daniel J. Clarke, "A Theory of Rational Demand for Index Insurance," *American Economic Journal: Microeconomics*, vol. 8, no. 1 (February 2016), pp. 283–306, www.jstor.org/stable/43948909.

19. See Jason Schupp, "The Regulatory Environment for Parametric Insurance," *Medium* (July 20, 2021), <https://tinyurl.com/5kccfymh>; and Tom Dawson, "Perspectives: In Parametric, It's Essential to Define Whether a Contract Is Insurance or a Swap," *Business Insurance* (October 5, 2021), <https://tinyurl.com/yckyjtqw>.

20. Alex Bernhardt and others, *Community-Based Catastrophe Insurance: A Model for Closing the Disaster Protection Gap* (Marsh & McLennan Companies, February 2021), <https://tinyurl.com/mr3xbt5f> (PDF).

Box 3-1.

Renter's Insurance for Disasters

In 2022, 44 million households—more than one-third of all households in the United States—were renters. Nearly half of those households were considered cost-burdened—that is, they spent more than 30 percent of their income on housing. The share of Black and Hispanic renters that are considered cost-burdened is higher.¹ Renters occupy a variety of dwellings; single-unit buildings house about one-third of renter households, and buildings with more than 50 units are home to 38 percent of renter households.²

Renters with low and moderate income, many of whom are cost-burdened, are vulnerable to natural disasters and the mortality risk of extreme heat.³ After a disaster, renters may face the loss of their personal property and be displaced from their home, just like homeowners. If a disaster forces renters to find new housing, they may compete with displaced homeowners for undamaged housing, and that increased demand and constricted supply may push rents higher. As damaged structures are rebuilt, rents may also increase if property owners improve the quality of their rental units. In the year after the 2018 Camp Fire in California that damaged or destroyed 18,800 structures, annual rent in Butte County and some neighboring counties increased by more than 20 percent; statewide, it grew by about 2 percent.⁴

To protect themselves and their property in the event of a natural disaster, renters can purchase insurance that covers

the loss or theft of their personal property and the additional living expenses such as hotels and meals as well as providing liability protection. Although the data on renter's insurance are incomplete, renters are less likely to purchase insurance than homeowners are. For example, before the 2021 Marshall Fire in Colorado—the most destructive wildfire in that state's history, which destroyed more than 1,000 homes—about 97 percent of homeowners were insured, but only 70 percent of renters were.⁵ The National Flood Insurance Program (NFIP) offers policies for renters with coverage up to \$100,000 for the contents of their homes, but such policies are voluntary for renters. Take-up is low: The Congressional Budget Office estimates that, in 2023, 18,000 tenant NFIP policies were in effect in primary residences and residential buildings.

Renters are more likely to be uninformed about flood risks than homeowners. Most jurisdictions do not require landlords to disclose the risks or whether the property has previously flooded. The risk is greater for people living in single-family units, garden apartments, or basement units than for people in high-rise apartments. Basements in some areas are now at high risk of flooding; in New York, an estimated 10 percent of residents with low income who rent are vulnerable.⁶ Disclosures of climate risks would allow renters to make more informed decisions about whether insurance to cover losses in the event of a natural disaster was necessary—or whether to rent a specific unit at all.⁷

1. Joint Center for Housing Studies of Harvard University, *The State of the Nation's Housing 2023* (2023), pp. 32–38, <https://tinyurl.com/53ysmk2p>.

2. Lauren Bauer and others, *Ten Economic Facts About Rental Housing* (The Hamilton Project, Brookings Institution, March 2024), <https://tinyurl.com/3pfx4uv>.

3. Hannah Stephens, Manann Donoghoe, and Andre M. Perry, “How Extreme Heat Threatens Black Renters, and What Policymakers Can Do to Fix It,” *Brookings Metro* (September 6, 2023), <https://tinyurl.com/4bdsekbm>.

4. Selma Hepp, “The Impact of Wildfires on Rent and Home Prices” (CoreLogic, September 3, 2021), <https://tinyurl.com/2cdkmuut>.

5. Andrew Rumbach and others, “Promoting Equitable Wildfire Recovery in Lahaina: Four Lesson for Local Leaders, from Colorado's Marshall Fire,” *Urban Wire* (Urban Institute, November 29, 2023), <https://tinyurl.com/3866tn9c>.

6. Claire Kramer Mills, Ambika Nair, and Julian di Giovanni, “Flood-Prone Basement Housing in New York City and the Impact on Low- and Moderate-Income Renters,” *Liberty Street Economics* (Federal Reserve Bank of New York, November 17, 2023), <https://tinyurl.com/4pd7jj2r>.

7. Mark McArdle, Mikayla Mitchell, and Erik Rubinyi, “Climate Risk Should Be Considered in Housing Decisions,” Consumer Financial Protection Bureau (blog entry, May 11, 2023), <https://tinyurl.com/4s7fnvkd>.

local government, residents could be assessed a premium fee as part of their taxes. A homeowners' association could arrange the purchase and charge members through dues. A community approach could also incorporate means-tested subsidies or other targeted assistance into the program.

Community-based insurance might reduce reliance on state-sponsored residual insurance pools and the need for postdisaster support from the federal government, aid organizations, and other donors. It could allow communities to begin rebuilding sooner, avoiding the delays that sometimes accompany reconstruction funding.

This type of insurance has the potential to provide more affordable disaster insurance through collective buying power and broader participation. With more properties participating, insurance premiums may be more predictable and stable because individual properties' risks are not perfectly aligned. Coverage could be limited to keep costs down, but it could also replicate a standard homeowner's policy. The approach could also be tied to disaster adaptations at the community level, such as instituting stronger building codes or zoning or communicating risk more effectively. Other potential benefits include reduced administrative costs and better data for risk analysis due to pooling numerous policies. Adaptation could be encouraged by premium discounts for both community-based and household efforts, which could reduce a community's postdisaster costs.

Implementing a community-based disaster insurance program would be challenging, however. An education campaign might be necessary to inform residents about disaster risks and garner support for community financing. Insurers might also hesitate to enter an unproven market.

A pilot program is being tested in New York City using a parametric payout to improve the financial resiliency

of low- and moderate-income households in designated neighborhoods with high flood risks.²¹ Many of those households are uninsured or underinsured and have little savings. Federal funding provided \$100,000 for the Center for New York City Neighborhoods (CNYCN) to purchase parametric coverage in March 2023 from Swiss Re, a global reinsurer. Swiss Re uses satellite data, local sensors, and social media images to determine whether a triggering event (rainfall-related flooding) has occurred; if so, the CNYCN would receive a payout of up to \$1.1 million. Qualifying low- and moderate-income households would then apply for grants of up to \$15,000 to meet any of their recovery needs. CNYCN renewed the policy through April 2025, and as of August 2024 the policy has not been triggered.²²

It remains to be seen how successful the pilot program will be. Because rainfall-related flooding events often occur in areas not subject to the mandatory flood insurance requirement, households in the designated neighborhoods might be unaware of flood risks, which could make such community insurance particularly valuable. Regardless of its success, regulatory considerations would affect whether smaller community groups could use a similar approach.²³

21. Testimony of Julian Enoizi, Head of Public Sector, Guy Carpenter on behalf of Marsh McLennan, before the Subcommittee on Housing and Insurance of the House Financial Services Committee, *Encouraging Greater Flood Insurance Coverage in America* (March 10, 2023), <https://tinyurl.com/3a9p7ydb> (PDF); and New York City Mayor's Office of Climate and Environmental Justice, "MOCEJ and CNYCN Launch Innovative Pilot to Address Flooding" (press release, March 6, 2023), <https://tinyurl.com/mr38m3ur>.
22. Theodora Makris, Center for New York City Neighborhoods, personal communication (August 16, 2024).
23. Carolyn Kousky and others, *Harnessing Risk Transfer to Support Immediate Post-Disaster Needs of Low- and Moderate-Income Housing: A Meso-Insurance Pilot in New York City, Implementation Lessons for Community Organizations* (Environmental Defense Fund, October 2023), pp. 15–17, <https://tinyurl.com/35a3r869> (PDF).

Chapter 4: Approaches to Expanding the Supply of Disaster Insurance

As insurers have increased prices or scaled back their insurance offerings to reflect disaster risks and uncertainty from climate change, total losses have increasingly exceeded insured losses. That protection gap (in this case, expressed as the share of uninsured losses to total losses) has increased 5 percent annually since 1999. In dollar terms, uninsured losses from catastrophes increased by about \$50 billion (in 2023 dollars) to over \$60 billion between 2013 and 2022.¹ Even where coverage is generally required by mortgage lenders, gaps can be substantial. For example, more than \$10 billion of the more than \$45 billion in overall property losses from wildfires in California in 2017 and 2018 was uninsured.² Although changes in regulation and improvements in data collection and risk modeling may help make coverage more available, if natural disasters stemming from climate change increase in volatility and uncertainty beyond modeling capabilities, private markets might not close the protection gaps on their own.³

The Congressional Budget Office analyzed two approaches (modeled on existing federal insurance programs) that policymakers might consider to narrow those protection gaps. One approach would create a public-private risk-sharing program in which the federal

government reinsured private insurers. The private insurers would bear the initial losses and then share in all losses beyond a certain amount. A second approach, modeled on the National Flood Insurance Program, would create a federal insurance program with little risk sharing with the private sector beyond purchases of private reinsurance. Both approaches would impose costs on the federal government. CBO analyzed the two approaches in the context of wildfires, but the approaches could also apply to losses from other natural disasters like hurricane winds and earthquakes.⁴

The value of having a federal program is not clear. Private insurance and securities markets have financial incentives to innovate and reduce protection gaps, and capital is not a significant constraint on availability. Other approaches could also encourage private supply without a federal insurance program, but those are outside the scope of this report.

A Public-Private Risk-Sharing Program

A program in which the federal government shared risks with private insurers could be loosely based on the federal government's terrorism risk insurance program, which increased the availability and affordability of

1. Department of the Treasury, Federal Insurance Office, *Insurance Supervision and Regulation of Climate-Related Risks* (June 2023), pp. 60–61, <https://tinyurl.com/3cc6ee23> (PDF).

2. Climate Insurance Working Group, *Protecting Communities, Preserving Nature, and Building Resiliency: How First-of-Its-Kind Climate Insurance Will Help Combat the Costs of Wildfires, Extreme Heat, and Floods* (California Department of Insurance, July 2021), pp. 4, 12, and 38, <https://tinyurl.com/4trz5ekz> (PDF); and Munich Re, “Wildfires and Bushfires: Climate Change Increasing Wildfire Risk” (accessed September 1, 2023), <https://tinyurl.com/3kycjses>.

3. Kendra Marcoux and Katherine R. H. Wagner, “Fifty Years of U.S. Natural Disaster Insurance Policy,” CESifo Working Paper No. 10431 (July 14, 2023), <https://doi.org/10.2139/ssrn.4456363>.

4. Analysts have proposed a federal backstop for public utilities' exposure to liabilities from wildfires that are ignited by utilities. For more information, see Michael Wara, Michael D. Mastrandrea, and Eric Macomber, *Climate Change and Utility Wildfire Risk: A Proposal for a Federal Backstop* (The Hamilton Project, Brookings Institution, May 2024), <https://tinyurl.com/49mdt9tp>. For an analysis of proposals for federal reinsurance of natural disasters that policymakers developed after Hurricane Andrew in 1992 and the Northridge earthquake in 1994, see Congressional Budget Office, *Federal Reinsurance for Disasters* (September 2002), pp. 19–28, www.cbo.gov/publication/14008.

coverage by acting as a reinsurer.⁵ Under this approach, the federal government would take on a portion of the catastrophic risk from private insurers (see Figure 4-1, top panel).

This approach would address current weaknesses in the private reinsurance market: That is, prices are rising, and availability is falling. Whether those weaknesses will persist is uncertain; reinsurance prices and availability fluctuate with market conditions.⁶ Moreover, regulatory and legislative initiatives in California and Florida could increase the ability of private insurers to purchase reinsurance, which would increase the availability of residential property insurance.

Under this approach, private insurers would remain the primary insurer for most homeowners. They would set most of the terms of coverage and the premiums for disaster insurance. Private insurers would also bear the initial insured losses through deductibles and continue to share losses above the deductibles. Private reinsurance could cover some of insurers' retained risk. To encourage small insurers to participate, their deductibles could be set as a percentage of premiums in property insurance lines.

The federal government would act as a reinsurer and would cover some of the losses above the insurers' deductible (that is, it would take on the catastrophic risk). The government would set its own premiums and would determine which events would trigger federal coverage. The government also could set a limit (the "cap") on the total exposure or liability of the government under the program, and private insurers would continue to share losses once federal coverage was triggered.

Lawmakers could increase or decrease the risk borne by private insurers as their ability to bear and price risk

increased (as their capital or modeling capacity increased) or decreased (as either the size of the losses or the uncertainty of expected losses increased because of climate change).

Key Coverage and Design Choices

Within the framework described above, several design choices would affect the coverage, cost, and effectiveness of the program:

- Which disasters to cover,
- Whether to make participation by private insurers mandatory, and
- Whether to require coverage for homeowners.

Design choices would affect the extent to which different policy goals were achieved. Those goals could include the following: enabling a faster recovery after a disaster, controlling the risks and costs borne by taxpayers under the program, mitigating and adapting to risk before a disaster, and improving the economy's ability to recover from a disaster. Tradeoffs exist—for example, subsidizing premiums can make insurance more available and affordable but lessen control over risks and costs to taxpayers.

Coverage. A federal disaster insurance program could cover one specific type of disaster or it could cover multiple perils. A program that covered all natural catastrophic risks, including flooding, would probably reduce coverage gaps more broadly.⁷ (Multiperil policies are in place in France, Spain, and New Zealand and are backed by public reinsurance.)⁸ With no need for separate policies to cover losses from fire, wind, flood, or earthquakes, multiperil policies would reduce information and transaction costs for policyholders. Such policies could promote a holistic perspective of risk and mitigation, as people in many states face multiple perils. But that level of coverage would increase risk exposure for governments

5. For more details on the terrorism risk program, see Perry Beider and David Torregrosa, *Federal Reinsurance for Terrorism Risk and Its Effects on the Budget*, Working Paper 2020-04 (Congressional Budget Office, June 2020), www.cbo.gov/publication/56420. For more information about similar public-private risk-sharing proposals to expand the availability of pandemic insurance, see Lloyd Dixon and Jamie Morikawa, *Improving the Availability and Affordability of Pandemic Risk Insurance: Projected Performance of Proposed Programs* (RAND Corporation, June 2021), www.rand.org/pubs/research_reports/RRA1223-1.html.

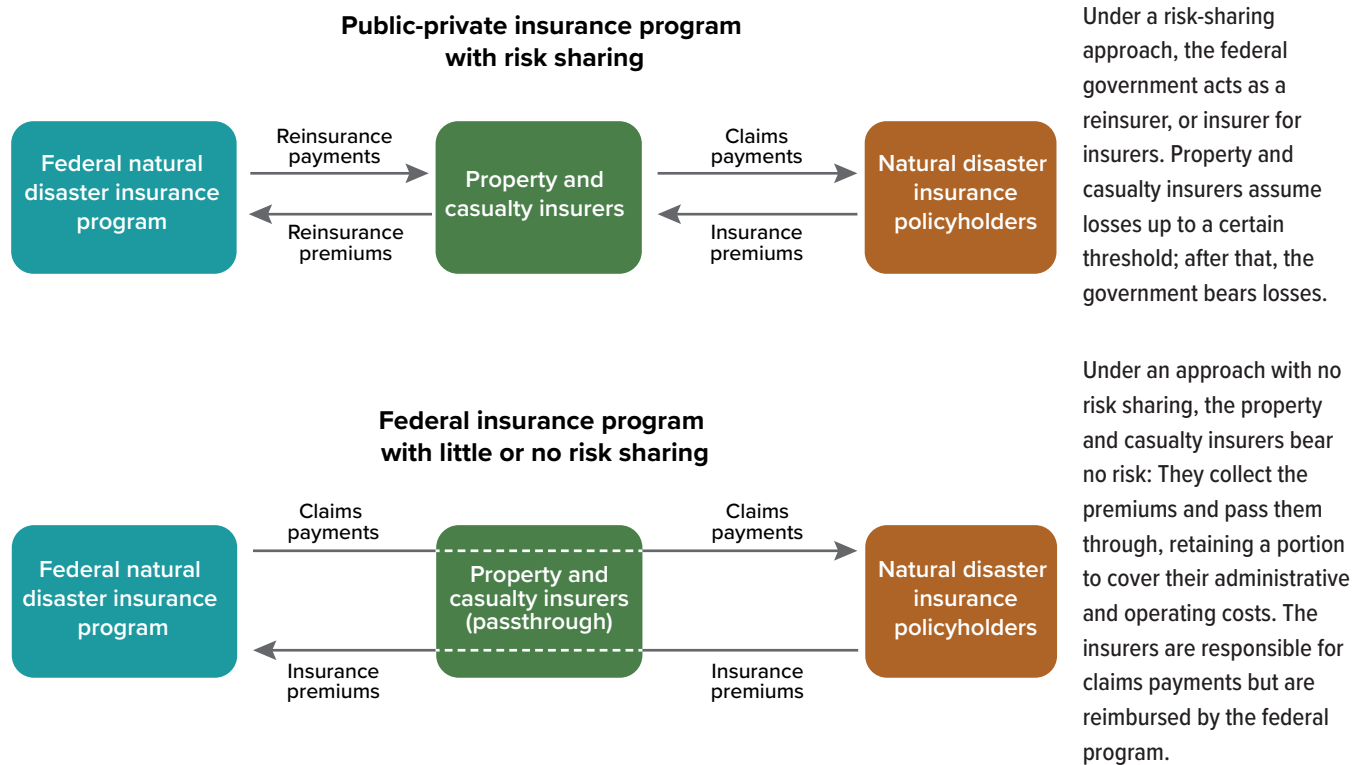
6. Fitch Ratings, "Property Catastrophe Reinsurance Market Dynamics to Slow in 2024," *Fitch Wire* (November 23, 2023), <https://tinyurl.com/bdduudyu>.

7. Howard Kunreuther, "All-Hazards Homeowners Insurance: Challenges and Opportunities," *Risk Management and Insurance Review*, vol. 21, no. 1 (Spring 2018), pp. 141–155, <https://doi.org/10.1111/rmir.12091>.

8. For information about initiatives aimed at developing catastrophe reinsurance in Europe, see International Association of Insurance Supervisors, *A Call to Action: The Role of Insurance Supervisors in Addressing Natural Catastrophe Protection Gaps* (November 2023), pp. 20–23, <https://tinyurl.com/428xcx6j> (PDF); and European Central Bank, European Insurance and Occupational Pensions Authority, *Policy Options to Reduce the Climate Insurance Protection Gap* (April 2023), <https://tinyurl.com/mwa7cb7d> (PDF).

Figure 4-1.

Approaches to Expanding the Supply of Disaster Insurance



Data source: Congressional Budget Office.

and private insurers, and some policyholders would not benefit from such comprehensive coverage if certain perils did not affect them.⁹

Federal coverage could be triggered by losses from a single disaster or by total losses over a period. For example, private insurers' capital might be able to bear the losses from one wildfire, but multiple wildfires in one year would stress insurance markets.

If coverage was limited to state-sponsored residual insurance programs, the cost of the federal program could be lower, but fewer properties would be covered. Only properties facing higher risks would be covered by the federal program, reducing the benefit to pooling risk. States would have an incentive to establish more residual

programs and forgo other changes that could increase private supply.

Private Insurers' Participation. A mandate on insurers would ensure the availability of coverage in the short run but might force them to bear more disaster risk than they would freely choose, which could lower the quality of their coverage or eventually cause them to exit the market. If participation was voluntary, insurers would have an incentive to participate if the reinsurance coverage was less expensive than what they could obtain in the commercial market.

Coverage Requirements for Policyholders. If wildfire risk remained covered under standard fire policies in homeowner's policies, mandates would not have a large effect on wildfire coverage, except in certain high-risk areas. For other types of disaster coverage in which risks are unbundled from standard coverage,

9. Dave Evans and Nancy Watkins, *Natural Catastrophe Perils Insurance*, Milliman White Paper (Milliman, November 2020), www.narfocuse.com/billdatabase/clientfiles/172/22/4218.pdf.

mandating coverage would limit demand for postevent assistance and adverse selection (that is, riskier policyholders disproportionately purchasing insurance); it also would impose costs on policyholders who might prefer to remain uncovered. Alternatively, policymakers could increase coverage by making comprehensive coverage of disasters for homeowners the default choice, in which case homeowners would have to opt out to refuse coverage rather than to opt in for coverage.¹⁰

Methods for Pricing Federal Reinsurance

Risk-based pricing is key to controlling the cost of the program; however, the government has no comparative advantage in pricing risk. The government could use information provided by private catastrophe modelers.

If the government wanted to set risk-based premiums rather than subsidize coverage, it could pursue a market-based method. For example, the government could purchase private reinsurance to cover a portion of its risks and set its premiums in reference to the price it pays for that reinsurance. Alternatively, it could auction reinsurance contracts, using minimum prices based on expected future losses plus an additional amount to cover risk and administrative costs.¹¹ Neither of those approaches for charging premiums would ensure that the amounts collected would be adequate to cover the actual losses experienced, however.

A Federal Insurance Program With Little or No Risk Sharing

If the losses from climate-related natural disasters led private insurers to withdraw permanently and completely from covering disasters, a stand-alone federal disaster insurance program could bear all the risk (see Figure 4-1 on page 35, bottom panel).

The federal flood insurance program does not share risk with primary insurers, but it does purchase reinsurance

on the private market. Under this approach, the government would set rates and the terms of coverage, and private insurers' roles would be limited to marketing policies and adjusting claims. Policymakers would have to make many of the same design choices as they would under a public-private risk-sharing program, including which losses to cover, what type of coverage, and whether coverage would be mandatory. The program could purchase private reinsurance both to reduce its risk and to inform its judgments about setting prices.

Such a program could exist even if private insurance was available. As the history of flood insurance suggests, private insurers may limit the types of coverage they offer after unexpectedly large disasters. And their risk tolerance can change over time, especially as changing risks are better understood and modeled. In addition, as insurance premiums rise and insurers can access more capital, their ability to bear risks increases.

Other Approaches to Increasing the Supply of Private Insurance

The two approaches analyzed do not address all the causes behind property owners' recent difficulties in obtaining insurance coverage at rates they can afford. In some areas, a lack of understanding of risk and the uncertainty about that risk or the effectiveness of adaptation has led private insurers to exit markets. In those places, improvements in data collection and dissemination of the lessons learned from those data to property owners, communities, and insurers could help reverse course. Other changes in government spending and tax policies could also affect insurers' coverage decisions.

Data collection is an area where the federal government could play an expanded role. A National Fire Incident Reporting System exists and serves as a large data system for all types of fires, but not all states or fire departments participate. The system is not designed for wildfires but is suggestive of the data that might be useful to insurers and policymakers at all levels of government.

Where increasing risk makes certain areas vulnerable to catastrophic losses and potentially reduces the availability of private insurance, building codes, land use regulations, and other government actions at all levels could reduce risks to the community.¹² For example, a government

10. Howard Kunreuther and others, *The Impact of a Government Risk Pool and an Opt-Out Framing on Demand for Earthquake Protection*, Working Paper 29144 (National Bureau of Economic Research, August 2021), www.nber.org/papers/w29144.

11. Christopher M. Lewis and Kevin C. Murdock, "Alternative Means of Redistributing Catastrophic Risk in a National Risk-Management System," in Kenneth A. Froot, ed., *The Financing of Catastrophe Risk* (University of Chicago Press, 1999), pp. 51–85; and Christopher M. Lewis and Kevin C. Murdock, "The Role of Government Contracts in Discretionary Reinsurance Markets for Natural Disasters," *Journal of Risk and Insurance*, vol. 63, no. 4 (December 1996), pp. 567–597, <https://doi.org/10.2307/253472>.

12. Hannah Druckenmiller and others, "Removing Development Incentives in Risky Areas Reduces Climate Damages and Yields Co-Benefits," *Nature Climate Change* (August 2024), <https://doi.org/10.1038/s41558-024-02083-2>.

could offer buyouts to current residents, as the NFIP does for property owners with repeated losses. The buyouts themselves would leave fewer properties exposed in high-risk areas and might also make space available to implement adaptation measures that could further reduce risks. Those government efforts would reduce the growth in the number of properties in high-risk areas as well as insurers' expected losses from a catastrophe, thus increasing insurers' ability to expand supply elsewhere.

Government investments in climate risk adaptation could also affect insurance markets.¹³ For example, researchers have found that federal spending for flood adaptation and mitigation reduces expected flood damage by an average of \$2 to \$3 per dollar of spending.¹⁴ In the case of wildfires, spending on forest management could reduce the sources of fuels for the fires.¹⁵

Changing the tax treatment of private insurers' reserves for catastrophic losses to make it less costly for them to raise more capital could also encourage more private insurers. Whether that approach would significantly increase the availability of coverage is uncertain (see Box 4-1).

Advantages and Disadvantages of the Two Main Policy Approaches

CBO evaluated the two main approaches to federal disaster insurance programs—the public-private approach with risk sharing and the federal approach with little or no risk sharing—according to how they would affect the availability of insurance, risk to the government, budgetary costs, mitigation incentives for policyholders,

demands for postdisaster assistance, and the economy. Both approaches share some advantages and disadvantages when compared with current practices as well as relative advantages and disadvantages.

Both approaches would increase the availability of disaster insurance and could improve its affordability from the perspective of policyholders—at a cost to the government (see Table 4-1). How much affordability improved would depend on what coverage was offered and at what price. Both approaches would make the federal government's risk exposure explicit instead of leaving the federal government as an implicit insurer of last resort. Explicit coverage would improve resiliency by reducing uncertainty before an event and financial hardships after an event. Expanded coverage would reduce the demand for governmental assistance after a catastrophic event compared with demand under current policy. Widely available insurance would also alleviate concerns that lenders might not provide mortgages to some borrowers after a disaster or to those at high risk of a disaster. Additionally, it would reduce credit risks to federal mortgage finance programs by reducing uninsured losses. Federal programs cannot lower the cost of risk, which is determined by the expected losses and the volatility of those losses, but they can lower the prices that policyholders pay by passing some costs through to taxpayers at large.

However, the federal government lacks the profit incentive of private insurers and reinsurers to set accurate risk-based prices.¹⁶ If risk was underpriced, a federal program would lead to more damage and larger losses from disasters than under current policy: Underpriced policies would not provide policyholders or community leaders with information about the true risks a property faced, and without that information, policyholders and communities would lack incentives to invest in cost-effective adaptation and discourage development in risky areas.¹⁷ In addition, underpriced insurance would lead to more overvaluation of insured properties. Taxpayers would bear the cost of the subsidies offered by prices that

13. Congressional Budget Office, *Potential Increases in Hurricane Damage in the United States: Implications for the Federal Budget* (June 2016), www.cbo.gov/publication/51518.

14. Congressional Budget Office, *Federal Spending for Flood Adaptations* (forthcoming); Evan Herrstadt and Jared Jageler, *Flood Damage Avoided by Potential Spending on Property-Level Adaptations*, Working Paper 2024-03 (Congressional Budget Office, May 2024), www.cbo.gov/publication/58168; Meri Davlasheridze and Qing Miao, "Does Post-Disaster Aid Promote Community Resilience? Evidence From Federal Disaster Programs," *Natural Hazards*, vol. 109 (2021), pp. 63–88, <https://doi.org/10.1007/s11069-021-04826-2>; and Government Accountability Office, *Disaster Resilience: FEMA Should Take Additional Steps to Streamline Hazard Mitigation Grants and Assess Program Effects*, GAO-21-140 (February 2021), www.gao.gov/products/gao-21-140.

15. Ann Bartuska and Alex Beehler, "Living With Wildfire: Adapting to the New Normal," *Resources* (March 12, 2024), <https://tinyurl.com/2kw34k64>.

16. Congressional Budget Office, *Measuring the Costs of Federal Insurance Programs: Cash or Accrual?* (December 2018), www.cbo.gov/publication/53921; J. David Cummins, "Should the Government Provide Insurance for Catastrophes?" *Review*, vol. 88, no. 4 (Federal Reserve Bank of St. Louis, July/August 2006), pp. 337–379, <https://doi.org/10.20955/r.88.337-380>.

17. Yanjun (Penny) Liao, Margaret Walls, and Matthew Wibbenmeyer, *Facing Wildfire Insurance Challenges: Five Lessons From the National Flood Insurance Program* (Resources for the Future, July 2024), <https://tinyurl.com/p36248vv>.

Box 4-1.

Reducing Taxes on Insurers' Reserves for Catastrophic Losses

Rather than creating a new federal program for catastrophic risks, policymakers could change the way capital reserves held by property and casualty insurers against expected catastrophic losses are taxed. Under this approach, deductions would be accelerated; instead of waiting for catastrophic losses to occur to be able to deduct those reserves as an expense, insurers could deduct from income in the current year a portion of the sums that they set aside as reserves to pay for eventual catastrophic losses.¹

Under the federal tax code and private-sector accounting standards, the reserves that property and casualty insurers set aside for low-probability risks do not count as expenses. Reserves for losses that have been reported by policyholders but that remain unsettled are considered expenses, as are reserves for losses that are believed to have already occurred but for which claims have not yet been reported. Thus, in years in which no catastrophic losses occur, insurers are taxed on their annual premium income, even though some of those receipts might be set aside for future expected losses. Once catastrophic losses occur, insurers can deduct those as expenses. Although deductions are limited to the amount of taxable income in the tax year, losses can be deducted (though the offset is not complete) through carrybacks and carry-forwards.² (The 2017 tax act, Public Law 115-97, eliminated the

ability to carry losses back for most companies outside of the property and casualty insurance sector.)

Expanding the deductibility of amounts set aside as reserves would probably increase the availability of private disaster insurance and lower its costs to policyholders by increasing insurers' ability to bear catastrophic risk because their net income would be higher and the incentive for them to raise capital reserves would be greater. How much this approach would increase the availability and affordability of private disaster insurance is uncertain.

Catastrophe insurance is distinguished from other types of insurance by its necessarily high ratio of reserves to expected losses.³ A precedent for special treatment exists: The federal tax code allows private mortgage insurers to deduct their payments into reserves for catastrophic losses immediately. State laws require those insurers to set aside 50 percent of their annual premiums in reserves for 10 years to help cover catastrophic losses.⁴

Such a change to the tax code would have costs for the federal budget. Federal revenue would be lower in years without catastrophic losses, because the deductions would precede catastrophic claims. If government oversight was inadequate, additional costs could arise if insurers abused the deduction by deliberately overestimating expected losses to shelter additional income from taxation.

1. Rawle O. King, *Tax Deductions for Catastrophic Risk Insurance Reserves: Explanation and Economic Analysis*, Report RL33060 (Congressional Research Service, June 2008); Scott E. Harrington and Greg Niehaus, "Government Insurance, Tax Policy, and the Affordability and Availability of Catastrophe Insurance," *Journal of Insurance Regulation*, vol. 19, no. 4 (2001), pp. 591–612; and David F. Bradford and Kyle D. Logue, "The Influence of Income Tax Rules on Insurance Reserves," in Kenneth A. Froot, ed., *The Financing of Catastrophic Risk* (University of Chicago Press, 1999), pp. 275–306.

2. Kent Smetters and David Torregrosa, *Financing Losses From Catastrophic Risks*, Working Paper 2008-09 (Congressional Budget Office, November 2008), pp. 12–20, www.cbo.gov/publication/20400.

3. Dwight M. Jaffee and Thomas Russell, "Catastrophe Insurance, Capital Markets, and Uninsurable Risks," *Journal of Risk and Insurance*, vol. 64, no. 2 (June 1997), pp. 205–230, <https://doi.org/10.2307/253729>.

4. Laurie Goodman and Karan Kaul, *Sixty Years of Private Mortgage Insurance in the United States* (Urban Institute, August 2017), p. 6, <https://tinyurl.com/yptsw98d> (PDF).

were set too low to cover a property's risks. (Overpriced policies could discourage coverage and lead to lower house prices and overinvestment in measures to reduce risks.)

Federal insurance programs have other disadvantages: They are slow to evolve and innovate as conditions

change and their product offerings may not fit individual policyholders' coverage needs.

Effects on Availability and Pricing

The uncertainty about expected losses and the difficulty of pricing catastrophe risk leaves room for discretion in setting risk-based prices. A program with no risk sharing would give the government full control over pricing,

Table 4-1.

Effects of Alternative Policy Approaches to Providing Disaster Insurance

	Current policy	Public-private insurance program with risk sharing	Federal insurance program with little or no risk sharing
Availability	Limited availability in some high-risk areas as insurers exit those areas. State programs fill some protection gaps for hurricanes and wildfires, but those programs might not be sustainable in the future as climate change increases losses and uncertainty.	Greater availability. Some gaps would remain if private insurers bore a large amount of risk. In areas where lenders did not require coverage, take-up rates would depend on pricing and coverage requirements.	Greatest availability. Take-up rates would be uncertain and would depend on pricing and mandated coverage.
Risk to the federal government	Limited explicit risk through the NFIP and federal mortgage finance programs. Highest implicit risk through its disaster assistance programs for those lacking insurance and the resources to recover after a disaster.	Higher explicit risk but lower implicit risk as protection gaps decline. The share of risk borne by the government could decrease over time as private insurers' modeling improved or as their financial strength increased. The risk to the government could increase if disasters caused more damage and became less predictable.	Highest explicit risk and limited implicit risk through federal mortgage programs; on net, risk would probably be higher.
Potential budgetary costs	Net cost of the NFIP as well as the cost of federal assistance after a disaster.	Higher costs in most cases. The private sector would absorb some costs and supplemental assistance might fall, but the government's risk-based reinsurance premiums might not cover costs.	Highest costs. Costs would depend on how premiums were set. Government programs historically have underpriced risks.
Incentives to take preventive measures to reduce losses	Strong incentives. Competition pushes private insurers to use risk-based pricing and offer premium discounts to homeowners who make adaptations to their property (although regulations about rate changes may reduce those discounts). Lack of information or expectations of federal assistance after a disaster may lessen adaptation incentives, and subsidized federal flood insurance encourages development in areas prone to flooding.	Weaker incentives that would depend on how much risk the government took from the private sector and its willingness to use risk-based pricing and to offer discounts for specific adaptation measures.	Weakest incentives. The government has less incentive than private insurers to use risk-based prices or offer discounts for specific adaptation measures. However, the NFIP mandates some adaptation measures by property owners and local governments, and new federal programs could have similar requirements.
Demand for federal assistance after a disaster	High demand. People who lack insurance or are underinsured will probably seek assistance.	Lower demand. A smaller insurance protection gap might reduce demand.	Lowest demand. The increase in coverage would be greatest.
Economic effects	Private insurance coverage makes the economy more resilient and promotes faster recovery, but coverage gaps are growing.	As coverage gaps declined, homeowners and communities would have more resiliency and stability after disasters. If risks were underpriced, more development and less adaptation could occur in the riskiest areas, which would increase losses.	Coverage gaps would be smallest under this approach, meaning that homeowners and communities would have even more resiliency and recover more quickly after a disaster. If rates were subsidized, losses from disasters might rise because the subsidies could encourage development in riskier areas and discourage adaptation.

Data source: Congressional Budget Office.

NFIP = National Flood Insurance Program.

which would probably lead to broader availability and affordability of coverage than a program with risk sharing, though that outcome would depend on pricing.

A largely federal program might more easily deliver targeted subsidies to low- and moderate-income policyholders, but it might do so by making policyholders in low-risk areas pay more than they might in a private market. With risk sharing, any effect on premiums would be indirect through the federal government's ability to set reinsurance premiums. (Competition among insurers would pressure them to pass through the savings from a federal program to their policyholders.)

Effects on Adaptation Efforts

Private insurers' risk-based pricing probably would provide greater incentives for policyholders to take preventive measures to lessen risks under the public-private risk-sharing approach. Those measures could lead to smaller expected losses that could result in lower premiums and could expand the supply of insurance. Private insurers have expertise in risk management and measurement, and they would have a strong incentive to invest in modeling and data collection. For example, improvements in satellite imagery and drone observations would better enable insurers to include property and community adaptation in wildfire loss modeling.¹⁸ To the extent that their projections grew more certain over time, premiums could fall, especially in a competitive market.

The incentive to lessen risk would probably be weakest in a public program without risk sharing. The NFIP lags private insurers in using property-specific data on risk, but the program provides some incentives for adaptation: New construction in some flood prone areas must be elevated to reduce losses, communities must adopt floodplain management regulations to participate in the NFIP, and communities can earn rate discounts for their constituents if they undertake additional adaptation efforts.¹⁹ In a federal program without risk sharing, then, policymakers could choose to include strong adaptation incentives at both the individual and the community level, including discounts for specific actions.

A program without risk sharing would have greater disadvantages if prices did not reflect the risk of the individual properties. If underpriced, a largely federal program could crowd out private insurers and slow or preclude the development of innovative products and approaches. The approach might forgo the benefits of diversifying risk globally that private reinsurers and capital market investors offer. In addition, a federal program without risk sharing might provide insurance even in places that repeatedly suffer damage. For example, the NFIP continues to offer coverage to properties that have flooded many times, contributing to losses for the program.²⁰ A program with no risk sharing might also be slower to adjust to climate change. For example, the NFIP's flood maps have not kept pace with the rising flood risk from climate change, which has left many homeowners at risk of loss without coverage outside the mandated purchase areas.

Potential Costs of a Public-Private Risk-Sharing Program

To illustrate the possible effects of risk-sharing, CBO analyzed who would pay for insured losses from wildfires and hurricane winds at different levels of risk sharing.²¹ The scenarios show how different levels of disaster risk might be borne by private insurers, either from their own resources or through the purchase of private reinsurance, and by the federal government. The budgetary cost of any program would depend largely on how the government priced the risk it would bear. CBO did not attempt to estimate the premiums or the amounts collected, but the scenarios assume that federal reinsurance would be priced below private reinsurance. If federal coverage was not offered at a discount, then private reinsurers could play a larger role and could reduce the claims and budgetary costs of a federal program.

In a public-private risk-sharing program, private insurers and the federal government would share administrative costs of running the program.

The costs do not include the potential effects of less federal spending on disaster relief, which largely depend on supplemental appropriations, or possible reductions in

18. Judson Boomhower, Meredith Fowle, and Andrew J. Plantinga, "Wildfire Insurance, Information, and Self-Protection," *AEA Papers and Proceedings*, vol. 113 (May 2023), pp. 310–315, <https://doi.org/10.1257/pandp.20231104>.

19. Winston P. Hovekamp and Katherine R. H. Wagner, "Efficient Adaptation to Flood Risk," *AEA Papers and Proceedings*, vol. 113 (May 2023), pp. 304–309, <https://doi.org/10.1257/pandp.20231103>.

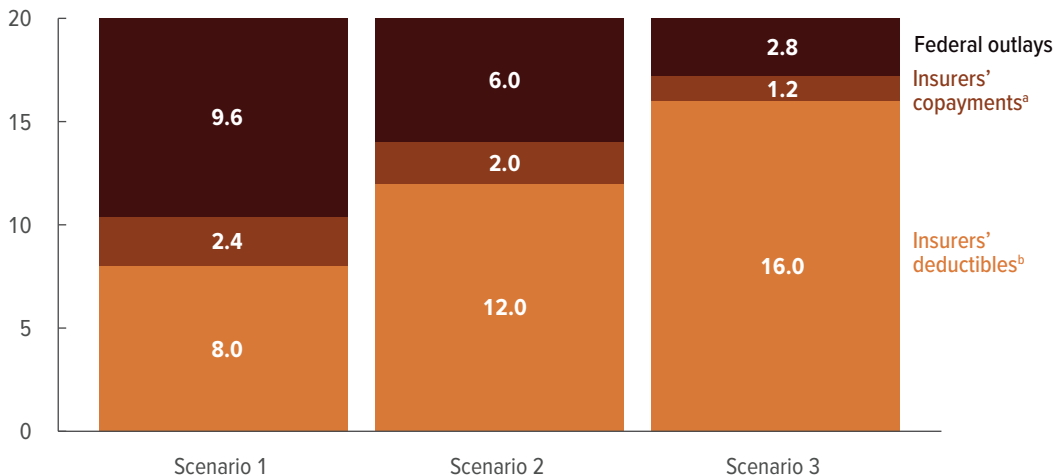
20. Noreen Clancy and others, "One- to Four-Family Properties With Multiple Losses Insured by the National Flood Insurance Program: Property Characteristics, Community Demographics, and Mitigation Strategies," (RAND Corporation, July 2023), www.rand.org/pubs/research_reports/RR2462-1.html.

21. For an analysis of the budgetary effects of risk sharing in other insurance programs, see Congressional Budget Office, *How CBO Analyzes Public-Private Risk Sharing in Insurance Markets* (November 2022), www.cbo.gov/publication/57615.

Figure 4-2.

Allocation of Potential Insured Losses of \$20 Billion for Wildfire Risk Insurance: Three Scenarios

Billions of dollars



These scenarios illustrate how potential insured losses could be shared between insurance companies and the federal government. As insurers' deductibles and copayments increase, federal outlays decrease. To the extent that an insurance company had private reinsurance coverage, some portion of its deductible and copayments would be paid by the reinsurer.

Data source: Congressional Budget Office. See www.cbo.gov/publication/59918#data.

Under scenario 1, insurers' deductibles are set to 20 percent of the prior year's premiums, and copayments are set to 20 percent of insured losses above that amount. Under scenario 2, insurers' deductibles are set to 30 percent of the prior year's premiums, and copayments are set to 25 percent of insured losses above that amount. Under scenario 3, insurers' deductibles are set to 40 percent of the prior year's premiums, and copayments are set to 30 percent of insured losses above that amount.

- a. Insurers' copayments are based on the difference between the insured losses and their deductibles.
- b. Assumes that insurers with \$40 billion of premiums suffered losses and that all reached their maximum deductibles. Actual deductibles would depend on which insurers experienced losses and how the losses were distributed among insurers.

losses in federal mortgage finance programs from smaller uninsured losses from disasters.

Wildfires

CBO analyzed three scenarios for wildfire risk insurance (see Figure 4-2). Under each scenario, private insurers bear different amounts of risk, some of which they may pass on to private reinsurers. The following conditions apply to all three scenarios:

- The insured losses are \$20 billion.
- Insurers' deductibles (the amount they pay before federal reinsurance kicks in) are expressed as a percentage of their prior year's premiums for residential property and casualty policies.²²
- A group of insurers with \$40 billion of premiums suffer losses and all hit their maximum deductible.

Insurers' deductibles are set so that they absorb a sizeable share of the losses.

- Insurers face copayments (or "coinsurance" expressed as a share) on the losses above their deductibles. In these examples, no limits are placed on the copayments.

The specific parameters for the deductibles and the copayments for each scenario were chosen so that insurers would bear at least half the losses; under current policy, they bear all the losses.

In the first scenario, insurers' deductibles are set to 20 percent of the prior year's premiums, or \$8 billion, and copayments are set to 20 percent of insured losses above that amount (\$2.4 billion). In the event of a wildfire causing \$20 billion of insured losses, insurers would bear \$10.4 billion of losses. The government would be responsible for 80 percent of the losses above the insurers' deductible, or \$9.6 billion.

22. Alternatively, policymakers could specify dollar amounts for the deductibles on the basis of the size the loss or on the insurers' assets or as a percentage of their capital.

In the second scenario, insurers' deductibles are set to 30 percent of the prior year's premiums, or \$12 billion, and copayments are set to 25 percent of losses above that amount (\$2 billion). In total, insurers would face \$14 billion of losses. The government would be responsible for 75 percent of the losses above the insurers' deductible, or \$6 billion.

In the third scenario, insurers' deductibles are set to 40 percent of the prior year's premiums, or \$16 billion, and copayments are set to 30 percent of losses above that amount (\$1.2 billion). After a wildfire causing \$20 billion in insured damages, insurers would face \$17.2 billion of losses. The government would be responsible for 70 percent of the losses above the insurers' \$16 billion deductible, or \$2.8 billion.

Losses From Wind Damage From Hurricanes

For other natural disasters in which the potential and experienced losses are larger than those for wildfires, the federal government's reinsurance coverage could start when losses hit a higher trigger point, meaning that private insurers would pay bigger deductibles. Currently, private markets and state-sponsored pools cover most of the risk, but protection gaps are growing.

Under the scenarios for a large natural disaster, such as a windstorm, private insurers and reinsurers would bear larger losses than in the wildfire scenarios. In practice, how losses are borne across insurers would affect the distribution of losses across insurers and the government.

To illustrate the possible effects of risk-sharing, CBO analyzed who would pay for insured losses using three scenarios in which the insured losses exceed historical losses from wildfires (see Figure 4-3). The scenarios show how different amounts of disaster risk might be borne by private insurers. Under all three scenarios, the following hold true:

- The insured losses total \$50 billion.
- Insurers' deductibles are expressed as a percentage of their prior year's premiums for residential property policies.
- A group of insurers with prior year's premiums of \$60 billion suffer losses and all hit their maximum deductible.
- Insurers face copayments on their losses above their deductibles. In the scenarios, no limits are placed on the copayments.

In the first scenario, insurers' deductibles are set to 30 percent of the prior year's premiums, or \$18 billion, and copayments are set to 25 percent of losses above that amount (\$8 billion). The government would be responsible for 75 percent of the losses above the insurers' deductible. In the event of wind damages from a hurricane totaling \$50 billion in insured losses, insurers would pay \$26 billion of the claims, and the government's outlays would be \$24 billion.

In the second scenario, insurers' deductibles are set to 40 percent of the prior year's premiums, or \$24 billion, and copayments are set to 30 percent of losses above that amount (\$7.8 billion). The government would be responsible for 70 percent of the losses above the insurers' deductible. Insurers would pay \$31.8 billion of the claims, and the government's outlays would be \$18.2 billion.

The third scenario sets insurers' deductibles to 50 percent of the prior year's premiums, or \$30 billion, and copayments to 35 percent of losses above that amount (\$7 billion). The government would be responsible for 65 percent of the losses above the insurers' deductible. Insurers would pay \$37 billion of the claims, and the government's outlays would be \$13 billion.

Potential Costs of a Federal Insurance Program With Little or No Risk Sharing

Under this approach, the federal government would be the insurer, paying claims for all the insured losses. Taxpayers' costs would depend on how closely premiums matched losses. The government would incur the full costs to run the program, including those associated with paying private insurers to market and service the policies and for catastrophe modelers to help price the risk.

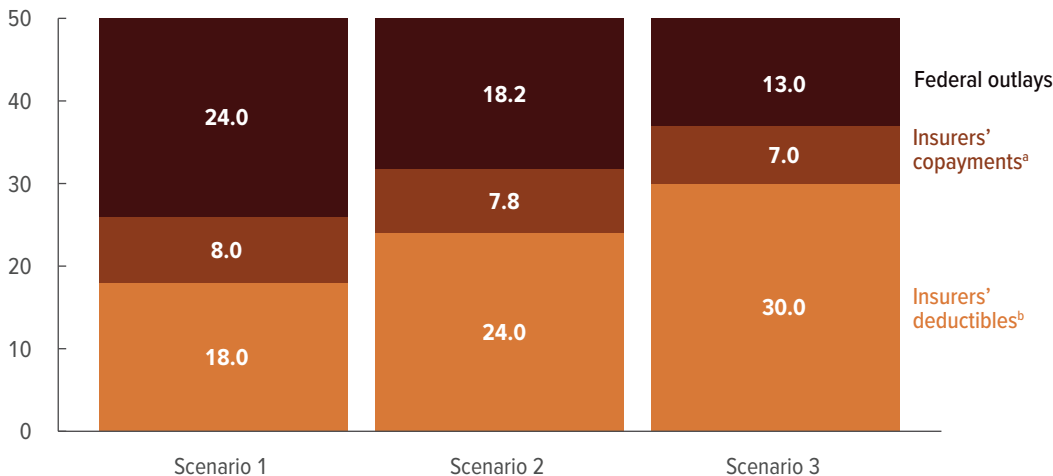
The cost of catastrophic coverage would be high, so pricing would be important. Government insurance programs, including the NFIP, historically have underpriced risks. Estimates of risk vary. One actuarial firm estimated that the cost of insuring wildfire perils nationally for single-family homes would have been about \$3.5 billion in 2020, whereas the cost of insuring hurricane wind damage would have been \$11.1 billion.²³ With the increase in property replacement costs and risk since 2020, the cost today would be higher. Another study projected that more than 10 million structures, or about

23. Dave Evans and Nancy Watkins, *Natural Catastrophe Perils Insurance*, Milliman White Paper (Milliman, November 2020), <https://tinyurl.com/kw7m6dd4> (PDF).

Figure 4-3.

Allocation of Potential Insured Losses of \$50 Billion for Natural Disaster Risk Insurance: Three Scenarios

Billions of dollars



Natural disaster risks such as hurricanes, for which the cost of damages tends to be higher than for wildfires, could also be covered in a public-private risk-sharing program. In these scenarios, the federal government's reinsurance coverage starts when losses hit a higher trigger point to reflect the larger cost of damages, so private insurers would be responsible for a larger share of the damages.

Data source: Congressional Budget Office. See www.cbo.gov/publication/59918#data.

Under scenario 1, insurers' deductibles are set to 30 percent of the prior year's premiums, and copayments are set to 25 percent of insured losses above that amount. Under scenario 2, insurers' deductibles are set to 40 percent of the prior year's premiums, and copayments are set to 30 percent of insured losses above that amount. Under scenario 3, insurers' deductibles are set to 50 percent of the prior year's premiums, and copayments are set to 35 percent of insured losses above that amount.

a. Insurers' copayments are based on the difference between the insured losses and their deductibles.

b. Assumes that insurers with \$60 billion of premiums suffered losses and that all reached their maximum deductibles. Actual deductibles would depend on which insurers experienced losses and how the losses were distributed among insurers.

7 percent of all structures in the United States, have at least a 14 percent probability of experiencing a wildfire in the next 30 years; twice as many structures have a probability between 6 percent and 14 percent of experiencing a wildfire over 30 years.²⁴ A later version of that wildfire model projected that the number of structures destroyed by wildfires annually would double to about 34,000 over the next 30 years, with annual economic damages increasing from \$14 billion to \$24 billion over that period.²⁵

Experiences in other federal insurance programs provide some insights into possible costs. Claims payouts are the largest expense. CBO estimates that in the NFIP, claims will average about 57 percent of total program expenses over the 2025 to 2034 period. The NFIP is authorized to borrow up to \$30.4 billion from the Treasury to pay

claims, and as of September 2023, it owed \$20.5 billion. In 2017, lawmakers canceled \$16 billion of the NFIP's debt after claims from Hurricanes Harvey, Irma, and Maria pushed it to its borrowing limit. Other costs include commissions to market and service the policies—in 2022, the NFIP paid private insurers about \$900 million in commissions to market and service 4.8 million policies. Those commissions represented more than 27 percent of the total amount collected in premiums. The program incurred about \$600 million in additional costs for administrative, flood mapping, and mitigation grant activities.²⁶ The Federal Crop Insurance Program incurred \$2.4 billion in program delivery costs for crop year 2023, which were about 16 percent of the total costs of the program.²⁷

24. First Street Foundation, *The 5th National Risk Assessment: Fueling the Flames* (May 2022), <https://tinyurl.com/6zpc95n>.

25. First Street Foundation, *The 9th National Risk Assessment: The Insurance Issue* (September 2023), <https://tinyurl.com/2467e7y2>.

26. Federal Insurance and Mitigation Association, *The Watermark*, vol. 20 (FEMA, 2022), <https://tinyurl.com/7dhu727m> (PDF).

27. Risk Management Agency, "Crop Year Government Cost of Federal Crop Insurance Program," (accessed August 15, 2024), <https://tinyurl.com/27wdyutn> (PDF). A crop year is designated by the calendar year in which a particular crop is harvested.

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About This Document

This report was prepared at the request of the Ranking Member of the House Financial Services Committee. In keeping with the Congressional Budget Office's mandate to provide objective, impartial analysis, the report makes no recommendations.

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CBO seeks feedback to make its work as useful as possible. Please send comments to communications@cbo.gov.



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