Managing Unpriced Climate Risks in US Housing Markets

Jesse D. Gourevitch*, Karina French†, Carolyn Kousky‡, Yanjun (Penny) Liao§, Adam Pollack‖, and Joakim A. Weill#

Introduction

The physical impacts of climate change impose large costs on households, private companies, and all levels of government (Hsiang et al. 2023). In recent years, there has been growing evidence that housing markets are not accurately pricing current and future expected costs from climate change into property values, thus creating housing bubbles (Keys and Mulder 2020; Bakkensen and Barrage 2022). In the US housing market, estimates of the magnitude of unpriced flood risk under climate change range from $40 billion (Hino and Burke 2021) to more than $200 billion (Gourevitch et al. 2023). The magnitude and distribution of mispricing for other climate-related hazards remain uncertain, though emerging evidence shows market behaviors consistent with incomplete capitalization of wildfire risk (McCoy and Walsh 2018).

Mispriced climate risk can lead to inefficient allocation of capital and uninformed household decisions, resulting in investments that further increase damages from climate-related hazards (Condon 2022). This dynamic is particularly evident in real estate markets, where unpriced climate risk is creating perverse incentives for continued development in high-risk areas and underinvestment in hazard mitigation (Colby and Zipp 2021; Bakkensen and Barrage 2022; Peralta and Scott 2024). The resulting increase in exposure and vulnerability of properties is

*Environmental Defense Fund (corresponding author; email: jgourevitch@edf.org); †Environmental Defense Fund and Emmett Interdisciplinary Program in Environment and Resources, Stanford University; ‡Environmental Defense Fund; §Resources for the Future; ‖Thayer School of Engineering, Dartmouth College, and School of Earth, Environment, and Sustainability, University of Iowa; #Federal Reserve Board of Governors

We thank Kate Boicourt, Lala Ma, and Frances Moore for providing thoughtful comments and feedback on earlier versions of the article. J.G. was supported by the High Meadows Foundation. J.G., C.K., K.F., and A.P. were supported by the National Science Foundation (NSF) as part of the Megalopolitan Coastal Transformation Hub (MACH) under NSF award ICER-2103754. This is MACH contribution number 73. The views expressed in this article are solely the responsibility of the authors and should not be interpreted as reflecting the opinions of the NSF, MACH, the Federal Reserve Board of Governors, or of any other person associated with the Federal Reserve System.

Electronically published July 1, 2026

Review of Environmental Economics and Policy, volume 20, number 2, summer 2026.
 Published by The University of Chicago Press for AERE. https://doi.org/10.1086/741732

further driving up the costs of extreme events for property owners, insurers, lenders, and state and federal governments (Office of Management and Budget 2022; Hsiang et al. 2023).

Mispriced climate risk also threatens the stability of the housing market. As with any asset price bubble, housing markets have the potential to suddenly and unpredictably readjust, leading to a rapid drop in prices. The more prices diverge from what is economically efficient (i.e., prices that reflect the expected future costs of climate impacts), the greater the likelihood that any localized price readjustments have spillover effects into other regions and other parts of the economy. In 2015, Mark Carney, then the governor of the Bank of England and now the current prime minister of Canada, described this dynamic—a rapid decrease in asset prices driven by a sudden change in beliefs about climate-related risks—as a "climate Minsky moment" (Carney 2015), referencing a term named for economist Hyman Minsky, who theorized about sudden collapses in asset prices. Though Carney was referring to transition risks associated with energy-related asset prices, a similar effect could apply in the context of pricing physical climate risks (Keys and Mulder 2020; Bakkensen and Barrage 2022).

Mispriced climate risk in the housing market is largely a function of two drivers: (1) imperfect and asymmetric access to information about physical climate risk (Fannie Mae 2023), and (2) dissociation between who bears the cost and benefits of development in high-risk areas (Council of Economic Advisors 2023). Information failures are a product of the club good (nonrivalrous, but excludable) nature of proprietary climate risk models, the technical and scientific challenges in estimating climate risks at an individual property level, and the difficulty of communicating risk broadly and accurately due to cognitive, social, and political barriers. The dissociation between benefits and costs is the result of the broad subsidization of climate-related costs, leading to moral hazard and perverse incentives related to development in hazardous areas.

Mispricing can also occur if households are overly optimistic about future physical risk from climate change (Baldauf, Garlappi, and Yannelis 2020; Bakkensen and Barrage 2022) or about society's likelihood of fully mitigating damages through investments in risk reduction. At present, however, wholesale optimism appears to be misguided, particularly in regard to the pace and magnitude of future warming (Carvalho et al. 2022). On the risk mitigation side, there are many measures that are effective in reducing damages, but none fully eliminate the risk of loss, as some may believe (Ludy and Kondolf 2012; Royal and Walls 2019). Nor are these interventions on track to be adopted at a scale sufficient to reverse the trend of growing economic losses. Because many risk reduction measures are public goods or require collective action, private markets on their own are unlikely to reduce the expected future costs of climate impacts to a level that is economically optimal. Meanwhile, public sector investments in risk reduction face significant governance challenges due to capacity and resource constraints, particularly at the local level (Liao, Sølvsten, and Whitlock 2025; Liscow 2025).

A range of policies has been proposed to correct the drivers of mispriced climate risk. These strategies broadly include: (i) improving access to and the quality of climate risk information, (ii) pricing insurance premiums based on actual current risk and incorporating climate-related credit risks into the cost of mortgage financing in high-risk areas, and (iii) reducing other public subsidies associated with developing in risky places. Although these policies have the potential to shift housing markets toward more accurately pricing climate risk, they could pose unintended economic and financial risks if the housing market abruptly readjusts to rapid changes in information and price signals. Similar to how the policy, economic, and technological shifts associated with the transition toward a low-carbon economy create financial risks associated with the repricing of certain assets (Campiglio et al. 2018), climate adaptation strategies that lead to a rapid and disorderly capitalization of climate risks in property values could trigger a Minsky moment and lead to widespread market instability. Such a disorderly transition would create financial strain for households and firms and could potentially lead to a spike in strategic defaults among underwater mortgages.

These policies could also worsen socioeconomic inequality. As low-income populations are disproportionately exposed to climate impacts (Hsiang, Oliva, and Walker 2019; Wing et al. 2022) and hold a higher proportion of their wealth in home equity (Congressional Budget Office 2022), price depreciation among high-risk properties could effectively widen existing wealth gaps as home equity for property owners declines (Gourevitch et al. 2023). For municipalities that have a large share of at-risk properties and are heavily reliant on property taxes, capitalizing climate risk in property values could have negative consequences for tax revenues and bond ratings, threatening local governments' ability to provide essential public goods and services on which many low-income residents rely (Shi and Varuzzo 2020; Gilmore, Kousky, and St. Clair 2022). Further, accurate climate risk pricing in home values could have a gentrification effect, such that low-income homeowners and renters are pushed out of low-risk areas and into high-risk areas, effectively increasing their exposure to climate impacts (Keenan, Hill, and Gumber 2018).

Addressing these concerns will require policy makers to navigate trade-offs between price efficiency, distributional impacts, and short-term market stability. From a policy design perspective, achieving a single objective in managing unpriced climate risks is relatively straightforward, whereas managing trade-offs between multiple objectives may require more complex strategies. In the housing market context, state and federal governments have an array of policy tools that could be used to better align the price of physical assets with the expected future costs of climate impacts. In addition to improving economic efficiency, these policies can also be designed and implemented to support market stability and mitigate regressive distributional impacts to varying degrees. To avoid a rapid and disorderly devaluation of assets, policies that deflate the climate risk housing bubble following a gradual, predictable, and transparent pathway can help ensure market stability. Although this type of optimal pathway has been discussed in the context of how to phase in carbon prices to minimize financial risks associated with transitioning away from fossil fuels (Barrage 2020; Carattini, Heutel, and Melkadze 2023; Network for Greening the Financial System 2023), it has received relatively little attention in the context of repricing physical climate risk. To avoid regressive impacts, policy strategies can be designed and implemented in ways that protect lower-income households from the financial repercussions that may result from repricing.

In the following sections, we discuss how three sets of US state and federal policy levers—(1) improving quality of and access to climate risk information, (2) removing public subsidies that suppress private costs of exposure to climate impacts, and (3) increasing public investment in climate-related disaster risk reduction—can be designed and implemented to achieve price efficiency and housing market stability, while mitigating distributionally regressive outcomes. In each section, we synthesize existing empirical research on the causal mechanisms through which these levers can support accurate climate risk pricing, consider how these strategies can be designed to promote market stability and progressive distributional outcomes, and identify areas for future research needed to improve policy design and implementation. We primarily focus our review on risks associated with flooding, wildfires, and hurricanes—in part because of the abundance of research on these perils—though much of our discussion is generalizable to other climate-related hazards. We also focus on the role of homeowners, due to the abundance of research on this segment of the population, but we recognize the need for more research on how these strategies may affect renters.

Improving Quality of and Access to Climate Risk Information

Housing markets operate more efficiently when participants have complete and accurate information about properties' expected future costs. Currently, information about properties' exposure to physical climate impacts is underprovided, leading to uninformed purchasing decisions. Despite the potential role of the government in providing this information to support a competitive housing market, there remains room to improve the availability and accessibility of publicly provided climate risk information. In recent years, the private sector has stepped in to meet a growing demand among some market participants, as evidenced by the launch of many climate risk analytics firms. Yet, the services provided by the private sector are often not available to those without sufficient capital to purchase access, thus worsening informational asymmetries in the market and further disadvantaging households, smaller businesses, and local governments with limited resources (Condon 2023; Boomhower et al. 2024). In addition, the lack of transparency around private sector models and methods obscures the quality of their projections, increasing uncertainty for users and creating the potential for misinformation about climate risks (Fiedler et al. 2021; Roston et al. 2024).

In this section, we summarize current trends in the provision of public and private climate risk information, highlight the potential benefits of more accessible and accurate governmental climate risk data, and discuss possible strategies for improving communication of this information in the market. We also note that the effects of improving information provision are influenced by interactions with cognitive biases (Meyer and Kunreuther 2017) and underlying beliefs about climate change (Baldauf, Garlappi, and Yannelis 2020; Bakkensen and Barrage 2022), both of which lead to the underestimation of risk—though there are signs that the latter is changing (Leiserowitz et al. 2024).

Public climate risk data

State and federal governments could have an important role to play in determining properties' exposure to climate risk and communicating that risk to the market. Climate risk information is a club good (nonrivalrous, but excludable), and if provision of this good is left to private firms, market failures associated with asymmetric information are likely to arise. Yet, there are few publicly available data products that assess risk at the property level and include information about how risks are expected to change over time. Although governmental national maps exist for sea level rise projections and risk of coastal and riverine flooding in the present, these maps have multiple limitations. State-level efforts to map current wildfire risk have gained some traction in recent years, but those efforts have been hindered by lack of funding and political pushback (Ellfeldt 2022, 2024). For other perils, such as drought and severe storms, there are no nationwide, property-specific maps. This has left housing market participants without adequate information about properties' exposure to climate impacts.

Given the federal government's role in administering the National Flood Insurance Program (NFIP), public information about properties' exposure to flood risk is more widespread and easily accessible than with other climate-related hazards. Historically, Flood Insurance Rate Maps (FIRMs) produced by the Federal Emergency Management Agency (FEMA) have been the primary mechanism for communicating this risk to the market. However, these maps are often outdated, lack coverage in parts of the country, and ignore pluvial flooding caused by heavy rainfall (Kousky 2018). They are also based on historical exceedance probabilities and do not provide information on how flood risk is changing. Although these maps are not intended or designed to communicate future risks under climate change, alternative governmental or government-regulated sources of forward-looking flood hazard information do not exist on a national scale. Further, FEMA's FIRMs focus on identifying the modeled 100-year floodplain, referred to as the Special Flood Hazard Area (SFHA; i.e., areas with a ≥1 percent annual probability of flooding). Although the SFHA was developed for regulatory insurance purposes, its now widespread de facto use for flood risk communication creates a false distinction between properties that are exposed to high flood risk and those that are not. Together, these factors limit households' ability to understand and respond to their exposure to current and future losses, leading to inefficient capitalization of flood risk (Pollack et al. 2023).

Improving these maps and accounting for future risk is critical for accurately pricing flood risk in home values (Shr and Zipp 2019; Hino and Burke 2021; Gourevitch et al. 2023; Box-Couillard 2026). To that end, FEMA's Technical Mapping Advisory Council (2015) has for many years suggested that flood maps represent a continuous delineation of risk. This approach has been piloted through the Future of Flood Risk Data initiative, but full deployment is still several years away and would require continued funding. Further, whether or not based on FIRMs, the federal government can play an important role in correcting informational asymmetries by producing flood maps that communicate flood risk not just in the present but also under future climate change. These forward-looking maps could aid individual households purchasing a home or making decisions around investments in hazard mitigation, as well as local governments making decisions related to zoning, housing development, and infrastructure planning.

Updating flood maps may also have several important distributional impacts based on changes in flood insurance demand and flood risk capitalization. Over the past 2 decades, FIRM updates resulted in a net removal of approximately 700,000 properties from the SFHA. The properties removed from the SFHA were primarily located in neighborhoods with more Black and Hispanic residents; this, in turn, led to disproportionate declines in flood insurance uptake among these groups (Weill, forthcoming). Yet, nonfederal flood hazard models and historical flood events indicate that many of the properties removed from the SFHA could still be highly exposed to flood risk (Smiley 2020; Sanders et al. 2023; Flores et al. 2025; Weill, forthcoming). If this is true, then historical FIRM updates have effectively reduced financial resilience to flooding, particularly among Black and Hispanic groups, through diminishing insurance coverage—although these negative effects could be partially offset by lower insurance premiums. Further, limited evidence suggests that there are no positive effects on home sales prices when properties are remapped out of SFHA (Shr and Zipp 2019), creating no home equity benefit for incumbent homeowners. By contrast, for properties remapped into the SFHA, there may be progressive distributional impacts of improving flood insurance uptake among risk-averse incumbent homeowners but regressive impacts associated with negative flood risk capitalization effects.

Assuming that future FIRM updates could communicate flood risk more accurately, this improvement in information provision may have progressive distributional impacts through changes in residential sorting (Hausman and Stolper 2021). At present, access to flood risk information is not uniform across income groups (Bradt, Kousky, and Wing 2021; Kousky and Netusil 2023). This may lead more informed households to locate away from the hazard (Bakkensen and Ma 2020). These differences in informational access may contribute to disproportionate exposure to "hidden" flood risk outside of FEMA-designated flood zones among Black and Hispanic populations (Smiley 2020; Sanders et al. 2023; Flores et al. 2025; Weill, forthcoming). However, when properties with "hidden" flood risk have been remapped into the SFHA, the marginal effects on flood risk capitalization are larger for Black and Hispanic buyers (Box-Couillard 2026), possibly indicating a greater marginal improvement in awareness of flood risk.

In contrast to flooding, responsibility to communicate wildfire risk through the development of wildfire hazard maps has generally fallen on state governments. These maps tend to have limitations similar to FIRMs, such as infrequent updates and coarse categorizations of risk. For example, California delineates Fire Hazard Severity Zones that are "moderate," "high," and "very high." Other western states, including Colorado, Utah, Wyoming, and New Mexico, have comparable provisions. Some states use these maps to impose stricter building codes or disclosure requirements on the high hazard zones (Ma et al. 2024). For instance, since 2008, California has required new construction in certain fire severity zones to follow ignition-resistant building codes (Baylis and Boomhower 2022). However, these requirements can also create political barriers to risk mapping. Oregon withdrew a new wildfire risk map in 2022—intended for implementing new fire-resistant building codes—because of strong pushback from residents who were concerned about higher insurance and building costs (Ellfeldt 2022, 2024).

Private climate risk data

In light of the deficiencies in governmental climate risk information, nongovernmental information on property-level climate risk is becoming more widely available. For example, First Street Technology, a for-profit provider of climate risk analytics, has developed property-level "risk factor" estimates for several climate-related hazards. Several real estate websites, including Zillow, Redfin, and Realtor.com, have purchased these data and made them publicly available as part of their real estate listings. One recent study by Redfin suggests that access to these property-level risk estimates led homebuyers to alter their search, bidding, and purchasing decisions (Fairweather et al. 2024). Research on the impacts of this information on rental markets and renters is relatively sparse; yet, in assessing the effect of "climate attention" language in listings, Giglio et al. (2021) find reduced home prices but little effect on rents, suggesting that this type of risk information is either less salient for renters or is driving would-be homebuyers into rental markets (Sheldon and Zhan 2019) and increasing rental demand in high-risk areas.

However, the emergence of private climate risk data and analytics companies has the potential to worsen informational asymmetries among housing market participants. Apart from

First Street's ordinal "risk factor" scores that can be freely looked up for an individual property, climate risk analytics companies often charge fees that exceed the ability to pay of underresourced communities, small businesses, and households. This privatization of climate risk analytics can create disparities in access to information, resulting in market failures associated with informational asymmetries.

It is also challenging to evaluate the quality and credibility of private vendors' model projections, as concerns over intellectual property prevent them from providing sufficient transparency about models' methods, assumptions, and data inputs (Condon 2023; Chegwidden, Koerth, and Freeman 2024). In response to widespread demand, private sector companies have released a flurry of data products that purportedly provide projections about current and future risks for individual properties. However, given the current state of climate science, climate models, and damage cost methodologies, estimating expected losses at highly specific spatial scales remains a challenging task, producing estimates that are inherently uncertain and difficult to validate. One study that compared model outcomes found substantial differences in estimates of the geographies and populations exposed to flood risk yet provided limited insight into model performance (Schubert, Mach, and Sanders 2024). Without further insight into the accuracy and validity of the model estimates, it is difficult to know whether this property-specific information is supporting or undermining efforts to manage climate risk.

Policy makers can play a critical role in helping to resolve the tension between transparency and proprietary interests in evaluating climate risk models (Keenan 2019; Fiedler et al. 2021; Condon 2023). One option may be for regulators to adopt benchmarking procedures, similar to the Florida Commission on Hurricane Loss Projection Methodology, to safeguard credibility and trust of information while ensuring that commercial methods remain proprietary. Another option may be for the public sector to freely provide climate risk services. In 2023, the White House Council of Economic Advisors suggested in their Economic Report of the President that the federal government could build on its expertise in climate modeling to develop a public catastrophe model, similar to what is used in the insurance industry to estimate risks of extreme events (Council of Economic Advisors 2023). The State of Florida took this approach years ago because of concerns about the black-box nature of the models used in underwriting and pricing property insurance. The Florida Public Hurricane Loss Model is housed at Florida International University and used by insurance regulators, among others. The State of California is now considering developing a public catastrophe model for wildfire. Condon (2023) has also argued for a National Climate Service to provide publicly available, location-specific information about a range of climate risks, in some ways similar to the National Weather Service. Such an undertaking would likely require collaboration across several federal agencies and academic institutions to make significant advancements in climate risk modeling, but it could be widely useful to policy makers, regulators, the private sector, and the public in managing their respective exposure to physical climate risks (Hill 2021; Condon 2023).

Climate risk disclosure

Disclosure requirements for properties exposed to climate-related hazards during real estate transactions are another effective tool for communicating risk to the market and reducing informational asymmetries between buyers and sellers (Fannie Mae 2023). Studies have found that properties exposed to flood and wildfire risk subject to state-level disclosure requirements sell for less than comparably at-risk properties without disclosure (Pope 2008; Hino and Burke 2021; Pollack et al. 2023; Ma et al. 2024; McClain and Mota 2024). Disclosure requirements may also have progressive distributional impacts for reasons similar to FIRM updates, as discussed above.

At present, the design and implementation of these laws vary considerably state-to-state, with many states having no requirements whatsoever or requiring disclosure of quite limited information late in the homebuying process. This inconsistency limits homebuyers' awareness of risk. In Portland, Oregon, for instance, a majority of homeowners do not learn about their property's flood risk until after having made a formal contractual offer (Kousky and Netusil 2023). However, this regulatory landscape may be beginning to change, as New York, New Jersey, North Carolina, South Carolina, Vermont, and Florida have recently passed new laws to improve flood risk disclosure.

Despite their potential, most states' disclosure laws generally require provision of incomplete information about a property's exposure to climate risk. With the exceptions of California, which requires disclosure of exposure to wildfire risk, and Hawaii, which has similar requirements for sea level rise, states' climate risk disclosure laws are typically limited to flood risk and do not consider other types of hazards. Furthermore, many states' flood risk disclosure laws only require disclosing whether a house is located within the SFHA—which, as discussed above, is an insufficient indicator of risk. Disclosure laws also focus almost exclusively on the hazard, and they rarely ensure that prospective homeowners have information about the expected damages to a structure or contents in the event of disaster. New York and New Jersey are the only two states where disclosure laws require the provision of information on how risks are expected to change in the future. Given that many homebuyers intend to live in a property for many years, an accurate and forward-looking understanding of a property' changing risks is essential to developing an informed and reasonable offer.

Policy makers could also consider requiring risk information to be disclosed in ways that are easier for homebuyers to interpret. Examples include how many times the house has previously flooded, how much damage was incurred, and what are the expected average annual costs of flooding. This type of information is more actionable than whether a house is simply located within the SFHA. Although disclosures are generally a state issue, Congress has considered various bills that would tie flood disclosure to the NFIP (see Flood History Information Act of 2021 and 2024). This could be designed to include a variety of detailed information that is already collected as part of NFIP underwriting and claims processing (e.g., previous flood damage, current insurance premiums, experience of repetitive losses). However, research on the effects of disclosing different elements of climate risk information remains limited; more information is needed to design disclosure policies that support uniform informational access and efficient pricing.

Removing Public Subsidies That Suppress Private Costs of Exposure to Climate Impacts

There is a range of public subsidies and other policies that transfer climate-related costs away from residents of high-risk areas, contributing to mispricing of climate risk in housing markets and excess development in hazardous areas. Removing these subsidies and better aligning costs and benefits may encourage households to locate in safer areas (Collier et al. 2023; Ge, Johnson, and Tzur-Ilan 2025). However, these policy changes could also negatively affect low-income households currently living in high-risk areas and could create market instability, particularly if there are abrupt and substantial price changes. Providing targeted assistance to specific socioeconomic groups, while gradually phasing out subsidies, may help avoid regressive outcomes and ensure market stability. Although these subsidies take a variety of forms (e.g., Baylis and Boomhower 2019; Druckenmiller et al. 2024; Bradt and Aldy 2025), we focus our discussion specifically on insurance pricing and mortgage lending and securitization practices, given their fundamental role in housing finance.

Insurance pricing

Underpricing in public sector insurance programs, such as the NFIP, has encouraged excess development in high-risk areas by suppressing the costs associated with exposure to climate impacts and inhibiting full capitalization of risk (Fabian 2024; Peralta and Scott 2024). Risk-based pricing can thus be a critical tool for communicating current risk, reducing moral hazard in development patterns, and incentivizing investment in risk reduction. However, when insurance prices increase, many homeowners, particularly those with lower incomes, simply drop or reduce coverage and maintain their location choices (Wagner 2022; Collier et al. 2023; Hennighausen et al. 2023; Sastry et al. 2024; Ortega and Petkov 2025).

In 2021 and 2022, the NFIP began an important reform, shifting toward actuarially fair premiums by instituting a new pricing methodology, Risk Rating 2.0, which modernized rate-setting to more accurately reflect property-specific flood risk. Many locations are seeing only modest price changes because of Risk Rating 2.0. However, in some of the counties that had the largest historical suppression of rates and where there is high flood risk, the average cost of flood insurance is expected to gradually increase by more than 300 percent as price increases are phased in over time. Although it is too soon to evaluate the effect of Risk Rating 2.0 on property prices, in part because of an 18 percent annual cap on premium increases for most existing policies, research has shown that projected increases in the cost of insurance, due to previous NFIP pricing reforms, have been rapidly capitalized in home values (Gibson and Mullins 2020; Georgic and Klaiber 2022; Hennighausen et al. 2023).

Despite drawing on proprietary catastrophe models, a move some politicians have criticized for lack of transparency (Frank 2023), Risk Rating 2.0 is an example of a policy that is gradually transferring costs of flooding away from taxpayers and toward flood zone homeowners. Already there is evidence to suggest that Risk Rating 2.0 has led to a decline in new development in high-risk areas (Fabian 2024). Yet, open questions remain about the time horizon over which these rate changes will be capitalized, who will be most affected, and whether higher rates will incentivize investments in risk reduction (Mulder and Kousky 2023). However, it does seem that demand for flood insurance has already begun to decrease as a result of the higher prices (Ortega and Petkov 2025).

Unlike the NFIP, standard homeowners' insurance has never been explicitly subsidized, but there is some indication of rate suppression in certain high-risk areas. Despite drawing on sophisticated underwriting models, there are instances where private insurers have underestimated the changing risk of certain perils (Kousky 2017). For example, in California, the 2017 and 2018 wildfire seasons erased more than double the combined underwriting profits from the past 26 years (Evans, Webb, and Xu 2019), leading to a reassessment of how climate change is altering wildfire risk in the state. The resulting decline in insurance availability made homebuyers less likely to search for houses with high wildfire risk and had negative effects on home sale prices (You, Kousky, and Atreya 2024). Some state insurance regulations have also inhibited insurers' ability to set premiums that reflect changing assessments of current risk. In California, for instance, there have historically been constraints on insurers' use of catastrophe models to set rates, limitations on passing the cost of reinsurance on to policyholders, and regulatory barriers to increasing premiums by more than 7 percent annually. Many of these restrictive regulations were reformed at the end of 2024, but they may have previously contributed to insurers dropping high-risk customers and even exiting the state.

Reforming insurance regulations that restrict rate-setting is key to repricing climate risk in housing markets. Across states, there is significant variation in insurance regulations, and evidence suggests that insurers have historically cross-subsidized rates in states with highly restrictive pricing regulations by raising rates in states with less restrictive regulations (Oh, Sen, and Tenekedjieva 2026). In states with highly restrictive regulations, this cross-subsidization can decouple risk from insurance prices, potentially reducing incentives for risk mitigation at household, community, and state levels. In states with less restrictive regulations, this cross-subsidization makes insurance less affordable and may be viewed as unfair. As states with highly restrictive regulations are increasingly experiencing diminished insurance availability, policy makers have greater incentive to reform stringent price regulations—as California has done recently—which may reduce cross-subsidization across states.

Risk-based insurance pricing has the potential to create efficiency gains, but it also may lead to negative externalities associated with declines in insurance coverage. When insurance prices increase, many homeowners, particularly those with lower incomes, drop or reduce their coverage (Wagner 2022; Hennighausen et al. 2023; Sastry et al. 2024; Ortega and Petkov 2025). When these households forgo coverage, there is no evidence to suggest that they are adapting to climate risk by other means, such as relocating or investing in risk reduction (Laird et al. 2021; Collier et al. 2023). Lack of insurance coverage negatively affects households' financial recovery after a disaster (Kousky 2019; You and Kousky 2024; Collier and Kousky 2025), which may worsen socioeconomic inequality postdisaster (Rhodes and Besbris 2022). Insufficient coverage also can have negative spillover effects on the surrounding community and local economy in the wake of disaster (You and Kousky 2024) and may place greater strain on federal disaster aid and other social safety net programs (Deryugina 2017). Further, underinsurance can create costs for mortgage lenders, as homeowners without insurance are more likely to prepay their mortgage or become delinquent or default following floods and wildfires (Kousky, Palim, and Pan 2020; Biswas, Hossain, and Zink 2023; Mota and Palim 2024).

To mitigate the adverse effects created by rising premiums and lack of insurance, policy makers could consider a means-tested program to help low-income households maintain their flood insurance coverage. Proposals for this type of affordability program have been mostly discussed in the context of the NFIP, but aspects could apply to private homeowners' insurance and state-run residual market plans. Although proposals vary in terms of eligibility and level of benefit, the general principle is that households with income under a certain threshold would receive some level of assistance in paying premiums (National Research Council 2015; US Government Accountability Office 2016; FEMA 2018). Akin to other social safety net programs, this affordability program could be supported through general tax revenue—not by cross-subsidies within the program, as those would only create further distortions and lower insurance uptake (Kousky and Kunreuther 2014). There is no research to indicate that helping low-income households with the cost of insurance would create moral hazard, but more study is warranted. Other regulatory and enforcement mechanisms could also improve insurance uptake; however, absent protective measures for low-income households, these measures may only worsen broader housing affordability issues (independent of climate risk).

Mortgage lending and securitization

Mortgage lending and securitization practices play an important role in determining who bears the costs of climate-related financial risks and how these risks are priced in housing markets. Following hurricanes, wildfires, and floods, homeowners are more likely to prepay their mortgage or become delinquent or default on mortgage payments (Del Valle, Scharlemann, and Shore 2024; Hopkins, Marr, and Wilson 2024; Issler et al. 2025), leading to potentially substantial losses for lenders and investors in mortgage-backed securities (Dice, Hossain, and Rodziewicz 2023). Declining insurance coverage and financial instability among insurers have the potential to compound these risks by reducing postdisaster household liquidity (Kousky, Palim, and Pan 2020; Biswas, Hossain, and Zink 2023; Mota and Palim 2024). Despite geographic variation in credit risk, rates for federally backed mortgages have historically not varied spatially, thus creating cross-subsidies in the mortgage market (Hurst et al. 2016).

Lenders have traditionally managed credit risk associated with natural hazards by imposing insurance coverage requirements on borrowers, but they are now adopting several new strategies for insulating themselves from the growing risk of climate impacts. Some lenders appear to be raising interest rates for properties exposed to sea level rise, to reflect elevated risk of default or prepayment (Nguyen et al. 2022). Banks are also requiring higher down payments in the SFHA to minimize the probability of strategic default from negative equity and to reduce their losses if default were to occur (Sastry 2026). Other lenders are tightening lending standards (Duanmu et al. 2022) or reducing credit availability in areas with high flood risk (Kim, Olson, and Phan 2024). There is some evidence that lenders manage credit risk associated with climate impacts through increased securitization of mortgages in hazardous areas (Keenan and Bradt 2020; Sastry, Sen, and Tenekedjieva 2023; Bakkensen, Phan, and Wong 2025). However, the most direct evidence of this practice was recently retracted due to methodological issues (Ouazad and Kahn 2022; LaCour-Little, Pavlov, and Wachter 2024, 2025), highlighting a need for more research in this area.

These private adaptation responses may reduce risk for individual lenders but could concentrate risk in other parts of the housing and mortgage markets and could have disproportionately negative effects on particular socioeconomic groups. In general, any lending practice that restricts availability of financing or increases the cost of credit in hazardous areas can send information and price signals to borrowers that lead to capitalization of climate risk in home values. However, these types of actions could further increase housing costs and reduce access to homeownership, particularly for low-income households and people of color (Montgomery and Palmeira 2023; Sastry 2026). Moreover, if lenders are in fact transferring credit risk to the "government-sponsored enterprises" (GSEs), this creates an implicit subsidy for the credit risk associated with financing home purchases in hazardous areas and contributes to the mispricing of climate risk in home values. This cross-subsidization may also be concentrating excess credit risk in mortgage securities (Dice, Hossain, and Rodziewicz 2023; Sastry, Sen, and Tenekedjieva 2023; Kahn, Ouazad, and Yönder 2024).

Under supervision from the Federal Housing Finance Agency, the GSEs have not historically differentiated loan securitization practices based on properties' exposure or vulnerability to climate-related hazards (Hurst et al. 2016; Gete, Tsouderou, and Wachter 2024). However, there have been many proposals for how federal policy makers and regulators could manage climate-related credit risks (Federal Housing Finance Agency 2021). For example, the GSEs could price in credit risk via higher guarantee fees for government-backed loans in hazardous areas (Gete, Tsouderou, and Wachter 2024). The GSEs could also mitigate credit risk by increasing insurance coverage requirements for loans to be acceptable, coupled with annual verification of insurance coverage, and ensuring that insurance companies are sufficiently rated by high-quality rating agencies (Sastry, Sen, and Tenekedjieva 2023). In general, these types of activities may protect lenders and the GSEs but would also increase the costs associated with borrowing or restrict the types of borrowers eligible for loans in high-risk areas.

In developing regulations designed to reduce mortgage credit risk in the face of climate change, policy makers may need to manage trade-offs between maintaining access to homeownership, preserving home values, and reducing mortgage credit risk. Lending and securitization practices that increase the cost of accessing credit and decrease credit availability could discourage homeowners from building in and relocating to high-risk areas, reducing their exposure to climate-related hazards. This could, in effect, drive price deflation of properties in high-risk areas, which could lead to a loss of wealth for current homeowners. To avoid regressive outcomes, these approaches can be complemented by policies that ensure that pricing climate risk does not become a new form of redlining (Montgomery and Palmeira 2023). Alternatively, maintaining access to cheap credit for hazardous properties could trap low-income people in high-risk areas without any of the financial means to recover when a disaster hits.

Increase Public Investment in Climate-Related Disaster Risk Reduction

Investments in disaster risk reduction generally do not affect the efficiency with which climate risk is capitalized in housing markets, but they can promote housing market stability by fundamentally lowering the costs of climate-related hazards. That said, the policies previously discussed all aim to correct market failures and improve pricing of climate risk in property values. By contrast, investments in hazard mitigation shrink the gap between current prices and economically efficient prices by decreasing expected future losses, thus reducing the likelihood of market instability while repricing occurs. In the absence of adequate compensatory transfers, targeting these public investments to protect low-income populations can also mitigate otherwise regressive impacts of repricing.

The availability of federal funding for hazard mitigation has varied widely over the past decade. Between 2020 and 2024, federal funding for hazard mitigation reached historically high levels, creating important opportunities for states, local governments, and households to invest in risk reduction activities. In 2025, a large share of hazard mitigation funding was halted by the new administration. At present, the future availability of these resources, as well as the structure of the agencies administering them, has not yet been clarified. Despite these new developments, accessing these funds in the past was more difficult for underresourced communities (Seong, Losey, and Gu 2022; Tyler et al. 2023). If these resources become available again in the future, the agencies tasked with deploying these funds, particularly FEMA, the US Army Corps of Engineers (USACE), and the Department of Housing and Urban Development (HUD), could help to ensure that resources are allocated to communities most in need by reducing or waiving local cost-sharing requirements and providing greater support in submitting proposals and administering grants.

Federal investments in hazard mitigation have also been subject to benefit-cost analysis requirements to ensure that spending is cost-effective. These requirements have historically led to prioritization of projects in communities with higher property values (Miller et al. 2023). These investments include USACE infrastructure projects, FEMA's Building Resilience in Communities grants (ended in March 2025), and Hazard Mitigation Grant Program, and HUD Community Development Block Grant Mitigation funds. For many of these programs, benefits are estimated based on avoided damages to properties. Thus, when conducting benefit-cost analyses in comparably hazardous areas, projects in areas with higher property values theoretically indicate higher benefit-cost ratios. In the absence of compensatory transfers, this evaluation of public investments may potentially lead to regressive outcomes (Liscow 2018; Liscow and Sunstein 2024).

Previous efforts were made to address systemic preferences that directed federal investments in hazard mitigation toward areas with higher property values. For example, the Justice40 Initiative directed billions of dollars across hundreds of government programs based on "disadvantaged community" prioritization criteria, with similar approaches employed in various state governments (Walls, Hines, and Ruggles 2024). As another example, the updates to the US Office of Management and Budget's (OMB) Circulars A-4 and A-94 in 2023 provided guidance on applying income weights in federal benefit-cost analyses to account for the diminishing marginal utility of income. Applying these weights has the potential to direct more funding toward high-risk communities that might otherwise be considered to have relatively low willingness to pay for hazard mitigation (Liscow and Sunstein 2024; Lockwood et al. 2024). The shift in OMB guidance from using 3 and 7 percent discount rates to a 2 percent discount rate would have also placed a greater value on future risk reduction, helping low-income communities overcome benefit-cost ratio thresholds for certain grants. However, the Justice40 Initiative was revoked in 2025, and the state of the 2023 updates to Circulars A-4 and A-94 are currently in flux; whether the 2003 versions are reinstated or whether a new guidance process will be undertaken is uncertain.

Public investments in disaster risk reduction could also lead to gentrification (Keenan, Hill, and Gumber 2018), undermining their potential to mitigate climate impacts for low-income households. Although there is limited research on the specific effects of climate-related hazard mitigation on residential sorting, there is abundant evidence that demonstrates how improvements to environmental amenities, such as clean air, contribute to sorting across race and income (e.g., Banzhaf and Walsh 2008; Depro, Timmins, and O'Neil 2015). For levee construction to protect against flooding, there is no evidence of sorting by income; however, homebuyers in newly protected areas are more likely to be White or Asian and less likely to be Black or Hispanic (Bradt and Aldy 2025). Furthermore, any gentrification impacts of investments in climate resilience would likely affect homeowners and renters in the same neighborhood differently, as incumbent homeowners may benefit from increased home values, whereas existing renters might face higher rents. To offset displacement associated with investments in risk reduction, a wide range of local housing policies may need to be considered, including increasing the supply of new housing in less hazardous areas (Chapple et al. 2023).

Clearly and consistently linking public and private investments in hazard mitigation with reductions in NFIP and homeowners' premiums is critical for ensuring the market pricing of actual risk (Boomhower, Fowlie, and Plantinga 2023). Otherwise, the incentive for making these investments will be diminished. This requires including the protective value of such investments in the models used by insurers, including the NFIP, for underwriting and pricing. FEMA's Community Rating System provides one example of a federal program that incentivizes local investment in hazard mitigation by clearly linking engagement in specific community-level risk reduction activities with corresponding NFIP premium discounts (Sadiq et al. 2020). Similarly, many states require private homeowner's insurance companies to provide premium discounts to households for certain building practices that protect homes against wind and wildfire damage. Still, more could be done to ensure that insurance pricing and underwriting models are fully capturing the benefits of community-level investments in risk reduction.

Conclusion

Adapting to physical climate impacts poses overlooked transition risks that may threaten the stability of housing markets and related economic sectors. Despite the inherent difficulties in determining who bears the costs of climate change and the numerous research gaps that hinder policy design and implementation, several solutions for repricing climate risk exist that support housing market stability and reduce the likelihood of regressive outcomes. Such policy reforms will require improving the quality of and access to climate risk information, removing public subsidies that suppress private costs of exposure to climate impacts, and increasing public investment in disaster risk reduction. Together, these solutions have the potential to reduce the total economic cost of climate impacts and protect those who are most vulnerable, simultaneously balancing the immediacy of the need for adaptation while avoiding a chaotic disruption to market values and economic sectors.

References

Bakkensen, L., and L. Barrage. 2022. Going underwater? Flood risk belief heterogeneity and coastal home price dynamics. *Review of Financial Studies* 35 (8): 3666–709.

Bakkensen, L., and L. Ma. 2020. Sorting over flood risk and implications for policy reform. *Journal of Environmental Economics and Management* 104: 102362.

Bakkensen, L., T. Phan, and R. Wong. 2025. Leveraging the disagreement on climate change: Theory and evidence. *Journal of Political Economy* 133 (10): 3132–66.

Baldauf, M., L. Garlappi, and C. Yannelis. 2020. Does climate change affect real estate prices? Only if you believe in it. *Review of Financial Studies* 33 (3): 1256–95.

Banzhaf, H. S., and R. Walsh. 2008. Do people vote with their feet? An empirical test of Tiebout's mechanism. *American Economic Review* 98 (3): 843–63.

Barrage, L. 2020. Optimal dynamic carbon taxes in a climate–economy model with distortionary fiscal policy. *Review of Economic Studies* 87 (1): 1–39.

Baylis, P., and J. Boomhower. 2019. Moral hazard, wildfires, and the economic incidence of natural disasters. NBER Working Paper no. 26550, National Bureau of Economic Research, Cambridge, MA.

———. 2022. Mandated vs. voluntary adaptation to natural disasters: The case of U.S. wildfires. NBER Working Paper no. 29621, National Bureau of Economic Research, Cambridge, MA.

Biswas, S., M. Hossain, and D. Zink. 2023. California wildfires, property damage, and mortgage repayment. Federal Reserve Board of Philadelphia Working Paper no. 23-5, Federal Reserve Bank of Philadelphia.

Boomhower, J., M. Fowlie, J. Gellman, and A. Plantinga. 2024. How are insurance markets adapting to climate change? Risk selection and regulation in the market for homeowners insurance. NBER Working Paper no. 32625, National Bureau of Economic Research, Cambridge, MA.

Boomhower, J., M. Fowlie, and A. Plantinga. 2023. Wildfire insurance, information, and self-protection. *AEA Papers and Proceedings* 113: 310–15.

Box-Couillard, S. 2026. Do Minorities Pay More to Avoid Flood Risk? http://dx.doi.org/10.2139/ssrn.6069390.

Bradt, J., and J. Aldy. 2025. Private benefits from public investment in climate adaptation and resilience. NBER Working Paper no. 33633, National Bureau of Economic Research, Cambridge, MA.

Bradt, J., C. Kousky, and O. Wing. 2021. Voluntary purchases and adverse selection in the market for flood insurance. *Journal of Environmental Economics and Management* 110: 102515.

Campiglio, E., Y. Dafermos, P. Monnin, J. Ryan-Collins, G. Schotten, and M. Tanaka. 2018. Climate change challenges for central banks and financial regulators. *Nature Climate Change* 8 (6): 462–8.

Carattini, S., G. Heutel, and G. Melkadze. 2023. Climate policy, financial frictions, and transition risk. *Review of Economic Dynamics* 51: 778–94.

Carney, M. 2015. Breaking the tragedy of the horizon–climate change and financial stability. *Speech Given at Lloyd's of London* 29: 220–30.

Carvalho, D., S. Rafael, A. Monteiro, V. Rodrigues, M. Lopes, and A. Rocha. 2022. How well have CMIP3, CMIP5 and CMIP6 future climate projections portrayed the recently observed warming. *Scientific Reports* 12 (1): 11983.

Chapple, K., A. Loukaitou-Sideris, A. Miller, and C. Zeger. 2023. The role of local housing policies in preventing displacement: A literature review. *Journal of Planning Literature* 38 (2): 200–214.

Chegwidden, O., M. Koerth, and J. Freeman. 2024. Climate risk companies don't always agree. CarbonPlan. https://carbonplan.org/research/climate-risk-comparison.

Colby, S., and K. Zipp. 2021. Excess vulnerability from subsidized flood insurance: Housing market adaptation when premiums equal expected flood damage. *Climate Change Economics* 12 (1): 2050012.

Collier, B., T. Huber, J. G. Jaspersen, and A. Richter. 2023. Homeowners' willingness to hedge flood risks as prices increase. http://dx.doi.org/10.2139/ssrn.4635177.

Collier, B., and C. Kousky. 2025. Household financial resilience after severe climate events: The role of insurance. In *Handbook of insurance*, vol. I, 99–122. Cham: Springer.

Condon, Madison. 2022. Market myopia's climate bubble. *Utah Law Review* 63. https://doi.org/10.26054/0d-xhps-7c5e.

———. 2023. Climate Services: The Business of Physical Risk. *Arizona State Law Journal* 55: 147–209.

Congressional Budget Office. 2022. Trends in the Distribution of Family Wealth, 1989 to 2019. https://www.cbo.gov/publication/60343.

Council of Economic Advisors. 2023. Economic Report of the President. https://bidenwhitehouse.archives.gov/wp-content/uploads/2023/03/ERP-2023.pdf.

Del Valle, A., T. Scharlemann, and S. Shore. 2024. Household financial decision-making after natural disasters: Evidence from Hurricane Harvey. *Journal of Financial and Quantitative Analysis* 59 (5): 2459–85.

Depro, B., C. Timmins, and M. O'Neil. 2015. White flight and coming to the nuisance: Can residential mobility explain environmental injustice? *Journal of the Association of Environmental and Resource Economists* 2 (3): 439–68.

Deryugina, T. 2017. The fiscal cost of hurricanes: Disaster aid versus social insurance. *American Economic Journal: Economic Policy* 9 (3): 168–98.

Dice, J., M. Hossain, and D. Rodziewicz. 2023. Flood risk exposures and mortgage-backed security asset performance and risk sharing. Research Working Paper no. 24-05, Federal Reserve Bank of Kansas City, May. https://doi.org/10.18651/RWP2024-05.

Druckenmiller, H., Y. Liao, S. Pesek, M. Walls, and S. Zhang. 2024. Removing development incentives in risky areas promotes climate adaptation. *Nature Climate Change* 14: 936–42.

Duanmu, J., Y. Li, M. Lin, and S. Tahsin. 2022. Natural disaster risk and residential mortgage lending standards. *Journal of Real Estate Research* 44 (1): 106–30.

Ellfeldt, A. 2022. Wildfire map sparks homeowner outrage in Oregon. *E&E News*, August 8.

———. 2024. How current is that wildfire risk map? Depends on the state. *E&E News*, January 1.

Evans, D., C. Webb, and E. Xu. 2019. Wildfire catastrophe models could spark the changes California needs. Milliman. https://www.milliman.com/en/insight/wildfire-catastrophe-models-could-spark-the-changes-california-needs.

Fabian, J. 2024. The price of risk: Flood insurance premium reform and local development. Working paper. https://jfabian14085.github.io/jacobfabian.com/fabian_job_market_paper.pdf.

Fairweather, D., M. E. Kahn, R. D. Metcalfe, and S. Sandoval-Olascoaga. 2024. Expecting climate change: A nationwide field experiment in the housing market. NBER Working Paper no. 33119, National Bureau of Economic Research, Cambridge, MA.

Fannie Mae. 2023. Consumer flood risk awareness and insurance study. https://www.fanniemae.com/media/49491/display.

Federal Housing Finance Agency. 2021. Climate and natural disaster risk management at the regulated entities. https://www.fhfa.gov/public-input/climate-and-natural-disaster-risk.

FEMA. 2018. An affordability framework for the national flood insurance program. https://www.fema.gov/sites/default/files/2020-05/Affordability_april_2018.pdf.

Fiedler, T., A. Pitman, K. Mackenzie, N. Wood, C. Jakob, and S. Perkins-Kirkpatrick. 2021. Business risk and the emergence of climate analytics. *Nature Climate Change* 11 (2): 87–94.

Flores, A., T. Collins, S. Grineski, M. Amodeo, J. Porter, C. Sampson, and O. Wing. 2025. Federally-overlooked flood risk inequities in the conterminous United States. *Scientific Reports* 15 (1): 10678.

Frank, T. 2023. 10 states sue FEMA to block higher flood insurance rates. *E&E News*, June 2.

Ge, S., S. Johnson, and N. Tzur-Ilan. 2025. Climate risk, insurance premiums and the effects on mortgage and credit outcomes. Working Paper no. 2505, FRB of Dallas, January. http://dx.doi.org/10.24149/wp2505.

Georgic, W., and H. A. Klaiber. 2022. Stocks, flows, and flood insurance: A nationwide analysis of the capitalized impact of annual premium discounts on housing values. *Journal of Environmental Economics and Management* 111: 102567.

Gete, P., A. Tsouderou, and S. Wachter. 2024. Climate risk in mortgage markets: Evidence from Hurricanes Harvey and Irma. *Real Estate Economics* 52 (3): 660–86.

Gibson, M., and J. Mullins. 2020. Climate risk and beliefs in New York floodplains. *Journal of the Association of Environmental and Resource Economists* 7 (6): 1069–111.

Giglio, S., M. Maggiori, K. Rao, J. Stroebel, and A. Weber. 2021. Climate change and long-run discount rates: Evidence from real estate. *Review of Financial Studies* 34 (8): 3527–71.

Gilmore, E., C. Kousky, and T. St. Clair. 2022. Climate change will increase local government fiscal stress in the United States. *Nature Climate Change* 12 (3): 216–18.

Gourevitch, J., C. Kousky, Y. Liao, C. Nolte, A. Pollack, J. Porter, and J. Weill. 2023. Unpriced climate risk and the potential consequences of overvaluation in US housing markets. *Nature Climate Change* 13 (3): 250–57.

Hausman, C., and S. Stolper. 2021. Inequality, information failures, and air pollution. *Journal of Environmental Economics and Management* 110: 102552.

Hennighausen, H., Y. Liao, C. Nolte, and A. Pollack. 2023. Flood insurance reforms, housing market dynamics, and adaptation to climate risks. *Journal of Housing Economics* 62: 101953.

Hill, A. 2021. *The fight for climate after COVID-19*. Oxford: Oxford University Press.

Hino, M., and M. Burke. 2021. The effect of information about climate risk on property values. *Proceedings of the National Academy of Sciences of the USA* 118 (17): e2003374118.

Hopkins, C., A. Marr, and N. Wilson. 2024. How does mortgage performance vary across borrower demographics following a hurricane? FHFA Staff Working Papers 24-09, Federal Housing Finance Agency.

Hsiang, S., S. Greenhill, J. Martinich, M. Grasso, R. Schuster, L. Barrage, D. Diaz, H. Hong, C. Kousky, and T. Phan. 2023. *Fifth National Climate Assessment: Chapter 19. Economics*. https://nca5.climate.us/downloads/NCA5_Ch19_Economics.pdf.

Hsiang, S., P. Oliva, and R. Walker. 2019. The distribution of environmental damages. *Review of Environmental Economics and Policy* 13 (1): 83–103.

Hurst, E., B. Keys, A. Seru, and J. Vavra. 2016. Regional redistribution through the US mortgage market. *American Economic Review* 106 (10): 2982–3028.

Issler, P., R. Stanton, C. Vergara-Alert, and N. Wallace. 2025. Neighborhood externalities and coordinated rebuilding after wildfires: Evidence from California. December 30. http://dx.doi.org/10.2139/ssrn.3511843.

Kahn, M., Amine O., and E. Yönder. 2024. Adaptation using financial markets: Climate risk diversification through securitization. NBER Working Paper no. 32244, National Bureau of Economic Research, Cambridge, MA.

Keenan, J. 2019. A climate intelligence arms race in financial markets. *Science* 365 (6459): 1240–43.

Keenan, J., and J. Bradt. 2020. Underwaterwriting: From theory to empiricism in regional mortgage markets in the US. *Climatic Change* 162 (4): 2043–67.

Keenan, J., T. Hill, and A. Gumber. 2018. Climate gentrification: From theory to empiricism in Miami-Dade County, Florida. *Environmental Research Letters* 13 (5): 054001.

Keys, B., and P. Mulder. 2020. Neglected no more: Housing markets, mortgage lending, and sea level rise. NBER Working Paper no. 27930, National Bureau of Economic Research, Cambridge, MA.

Kim, D., L. Olson, and T. Phan. 2024. Bank competition and strategic adaptation to climate change. Office of Financial Research Working Paper no. 24-03, Office of Financial Research, Washington, DC.

Kousky, C. 2017. Revised risk assessments and the insurance industry. In *Policy shock: Recalibrating risk and regulation after oil spills, nuclear accidents and financial crises*, eds. Balleisen, E. J., Bennear, L. S., Krawiec, K. D., Wiener, J. B., 43–57. Cambridge: Cambridge University Press.

———. 2018. Financing flood losses: A discussion of the national flood insurance program. *Risk Management and Insurance Review* 21 (1): 11–32.

———. 2019. The role of natural disaster insurance in recovery and risk reduction. *Annual Review of Resource Economics* 11 (1): 399–418.

Kousky, C., and H. Kunreuther. 2014. Addressing affordability in the national flood insurance program. *Journal of Extreme Events* 1 (1): 1450001.

Kousky, C., and N. Netusil. 2023. Flood insurance literacy and flood risk knowledge: Evidence from Portland, Oregon. *Risk Management and Insurance Review* 26 (2): 175–201.

Kousky, C., M. Palim, and Y. Pan. 2020. Flood damage and mortgage credit risk: A case study of Hurricane Harvey. *Journal of Housing Research* 29 (S1): S86–S120.

LaCour-Little, M., A. Pavlov, and S. Wachter. 2024. Adverse selection and climate risk: A response to. *Review of Financial Studies* 37 (6): 1831–47.

———. 2025. Response to Amine Ouazad and Mathew Kahn's Comment on LaCour-Little, Pavlov, and Wachter (RFS 2024). The Wharton School Research Paper, March 6. http://dx.doi.org/10.2139/ssrn.4976769.

Laird, H., C. Landry, S. Shonkwiler, and D. Petrolia. 2021. Riders on the storm: Hurricane risk and coastal insurance and mitigation decisions. *Journal of Ocean and Coastal Economics* 8 (1): 3.

Leiserowitz, A., E. Maibach, S. Rosenthal, J. Kotcher, E. Goddard, J. Carman, M. Ballew, M. Verner, T. Myers, and J. Marlon. 2024. *Climate Change in the American Mind: Beliefs & Attitudes, Spring 2024*. Yale University and George Mason University. New Haven, CT: Yale Program on Climate Change Communication.

Liao, Y., S. Sølvsten, and Z. Whitlock. 2025. Community responses to flooding in risk mitigation actions: Evidence from the community rating system. *Journal of Risk and Insurance* 92 (2): 357–88.

Liscow, Z. 2018. Is efficiency biased? *University of Chicago Law Review* 85: 1649.

———. 2025. Getting infrastructure built: The law and economics of permitting. *Journal of Economic Perspectives* 39 (1): 151–80.

Liscow, Z., and C. Sunstein. 2024. Efficiency vs. welfare in benefit-cost analysis: The case of government funding. *Journal of Benefit-Cost Analysis* 15 (2): 224–51.

Lockwood, J., M. Oppenheimer, N. Lin, and J. Gourevitch. 2024. Socioeconomic distributional impacts of evaluating flood mitigation activities using equity-weighted benefit-cost analysis. *Environmental Research Letters* 19 (7): 074024.

Ludy, J., and G. M. Kondolf. 2012. Flood risk perception in lands "protected" by 100-year levees. *Natural hazards* 61 (2): 829–42.

Ma, L., M. Walls, M. Wibbenmeyer, and C. Lennon. 2024. Risk disclosure and home prices: Evidence from California wildfire hazard zones. *Land Economics* 100 (1): 6–21.

McClain, W., and N. Mota. 2024. The impact of 2019 changes to Texas' flood disclosure requirements on house prices. Fannie Mae. https://www.fanniemae.com/research-and-insights/publications/impact-2019-changes-texas-flood-disclosure-requirements-house-prices.

McCoy, S., and R. Walsh. 2018. Wildfire risk, salience & housing demand. *Journal of Environmental Economics and Management* 91: 203–28.

Meyer, R., and H. Kunreuther. 2017. *The ostrich paradox: Why we underprepare for disasters*. Philadelphia: University of Pennsylvania Press.

Miller, B. M., N. Clancy, D. C. Ligor, G. Kirkwood, D. Metz, S. Koller, and S. Stewart. 2023. The cost of cost-effectiveness: Expanding equity in federal emergency management agency hazard mitigation assistance grants. Homeland Security Operational Analysis Center Operated by the RAND Corporation. https://www.rand.org/pubs/research_reports/RRA2171-1.html.

Montgomery, B., and M. Palmeira. 2023. Bluelining: Climate financial discrimination on the horizon. The Greenlining Institute. https://greenlining.org/wp-content/uploads/2023/08/FINAL-GLI_Bluelining_report_2023.pdf.

Mota, N., and M. Palim. 2024. Mortgage performance and home sales for damaged homes following hurricane harvey. Fannie Mae Working Paper Series. https://www.fanniemae.com/media/52101/display.

Mulder, P., and C. Kousky. 2023. Risk rating without information provision. *AEA Papers and Proceedings* 113: 299–303.

National Research Council. 2015. *Affordability of national flood insurance program premiums*. Washington, DC: National Academies Press.

Network for Greening the Financial System. 2023. NGFS scenarios for central banks and supervisors. https://www.ngfs.net/en/publications-and-statistics/publications/ngfs-climate-scenarios-central-banks-and-supervisors.

Nguyen, D. D., S. Ongena, S. Qi, and V. Sila. 2022. Climate change risk and the cost of mortgage credit. *Review of Finance* 26 (6): 1509–49.

Office of Management and Budget. 2022. Federal budget exposure to climate risk. https://bidenwhitehouse.archives.gov/wp-content/uploads/2022/04/OMB_Climate_Risk_Exposure_2022.pdf.

Oh, S., I. Sen, and A.-M. Tenekedjieva. 2026. Pricing of climate risk insurance: Regulation and cross-subsidies. *Journal of Finance*. https://doi.org/10.1111/jofi.70029.

Ortega, F., and I. Petkov. 2025. To improve is to change? The effects of risk rating 2.0 on flood insurance demand. *Journal of Environmental Economics and Management* 134: 103228.

Ouazad, A., and M. Kahn. 2022. Mortgage finance and climate change: Securitization dynamics in the aftermath of natural disasters. *Review of Financial Studies* 35 (8): 3617–65. https://doi.org/10.1093/rfs/hhab124.

Peralta, A., and J. B. Scott. 2024. Does the National Flood Insurance Program drive migration to higher risk areas? *Journal of the Association of Environmental and Resource Economists* 11 (2): 287–318.

Pollack, A., D. Wrenn, C. Nolte, and I. S. Wing. 2023. Potential benefits in remapping the special flood hazard area: Evidence from the US housing market. *Journal of Housing Economics* 61: 101956.

Pope, J. 2008. Do seller disclosures affect property values? Buyer information and the hedonic model. *Land Economics* 84 (4): 551–72.

Rhodes, A., and M. Besbris. 2022. *Soaking the middle class: Suburban inequality and recovery from disaster*. New York: Russell Sage Foundation.

Roston, E., K. Karra, L. Kaufman, and S. Rangarajan. 2024. The risky business of predicting where climate disaster will hit. *Bloomberg News*. www.bloomberg.com/graphics/2024-flood-fire-climate-risk-analytics/.

Royal, A., and M. Walls. 2019. Flood risk perceptions and insurance choice: Do decisions in the floodplain reflect overoptimism? *Risk Analysis* 39 (5): 1088–104.

Sadiq, A. A., J. Tyler, D. S. Noonan, R. K. Norton, S. E. Cunniff, and J. Czajkowski. 2020. Review of the Federal Emergency Management Agency's Community Rating System program. *Natural Hazards Review* 21 (1): 03119001.

Sanders, B., J. Schubert, D. Kahl, K. Mach, D. Brady, A. AghaKouchak, F. Forman, R. Matthew, N. Ulibarri, and S. Davis. 2023. Large and inequitable flood risks in Los Angeles, California. *Nature Sustainability* 6 (1): 47–57.

Sastry, P. 2026. Who bears flood risk? Evidence from mortgage markets in Florida. *Review of Financial Studies* hhag030. https://doi.org/10.1093/rfs/hhag030.

Sastry, P., T. C. Scharlemann, I. Sen, and A.-M. Tenekedjieva. 2024. The insurance protection gap. May 31. http://dx.doi.org/10.2139/ssrn.4909444.

Sastry, P., I. Sen, and A.-M. Tenekedjieva. 2023. When insurers exit: Climate losses, fragile insurers, and mortgage markets. http://dx.doi.org/10.2139/ssrn.4674279.

Schubert, J., K. Mach, and B. Sanders. 2024. National-scale flood hazard data unfit for urban risk management. *Earth's Future* 12 (7): e2024EF004549.

Seong, K., C. Losey, and D. Gu. 2022. Naturally Resilient to Natural Hazards? Urban–Rural Disparities in Hazard Mitigation Grant Program Assistance. *Housing Policy Debate* 32 (1): 190–210.

Sheldon, T. L., and C. Zhan. 2019. The impact of natural disasters on US home ownership. *Journal of the Association of Environmental and Resource Economists* 6 (6): 1169–203.

Shi, L., and A. Varuzzo. 2020. Surging seas, rising fiscal stress: Exploring municipal fiscal vulnerability to climate change. *Cities* 100: 102658.

Shr, Y.-H. J., and K. Zipp. 2019. The aftermath of flood zone remapping: The asymmetric impact of flood maps on housing prices. *Land Economics* 95 (2): 174–92.

Smiley, K. 2020. Social inequalities in flooding inside and outside of floodplains during Hurricane Harvey. *Environmental Research Letters* 15 (9): 0940b3.

Technical Mapping Advisory Council. 2015. TMAC 2015 annual report. https://www.fema.gov/sites/default/files/documents/fema_tmac_2015_annual_report_summary.pdf.

Tyler, J., R. Entress, P. Sun, D. Noonan, and A.-A. Sadiq. 2023. Is flood mitigation funding distributed equitably? Evidence from coastal states in the southeastern United States. *Journal of Flood Risk Management* 16 (2): e12886.

US Government Accountability Office. 2016. National Flood Insurance Program: Options for providing affordability assistance. FEDS Working Paper. https://www.gao.gov/products/gao-16-190.

Wagner, K. 2022. Adaptation and adverse selection in markets for natural disaster insurance. *American Economic Journal: Economic Policy* 14 (3): 380–421.

Walls, M., S. Hines, and L. Ruggles. 2024. Implementation of Justice40: Challenges, opportunities, and a status update. *Resources for the Future* 24 (1): 1–35.

Weill, J. Forthcoming. Flood Risk Mapping and the Distributional Impacts of Climate Information. *American Economic Journal: Economic Policy*. https://www.aeaweb.org/articles?id=10.1257/pol.20230552&&from=f.

Wing, O., W. Lehman, P. Bates, C. Sampson, N. Quinn, A. M. Smith, J. Neal, J. Porter, and C. Kousky. 2022. Inequitable patterns of US flood risk in the Anthropocene. *Nature Climate Change* 12 (2): 156–62.

You, X., and C. Kousky. 2024. Improving household and community disaster recovery: Evidence on the role of insurance. *Journal of Risk and Insurance* 91 (2): 299–338.

You, X., C. Kousky, and A. Atreya. 2024. Wildfire insurance availability as a risk signal: Evidence from home loan applications. October 27. http://dx.doi.org/10.2139/ssrn.5017469.