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*The Social, Political, and Economic
Consequences of Climate Hazards*

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The Social, Political, and Economic Consequences of Climate Hazards

ISSUE EDITORS

Max Besbris, Manuel Pastor, Anna Rhodes,
Wolfram Schlenker, and Pamela Winston

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The Social, Political, and Economic Consequences of Climate Hazards



MAX BESBRIS^{ORCID}, MANUEL PASTOR, ANNA RHODES,
WOLFRAM SCHLENKER, AND PAMELA WINSTON

As climate change intensifies, understanding the effects of climate hazards such as wildfires, hurricanes, coastal and riverine flooding, tornadoes, heat waves, and extreme snowstorms is key to understanding patterns of inequality. In this introduction, we review a multidisciplinary literature on the social, political, and economic consequences of climate hazards for individuals and communities in the US. We explore how the risk of exposure to climate hazards is unequal across places and demographic groups and examine how inequalities emerge in the process of recovery after climate disasters. We describe how different political actors shape climate policy as well as the role that government policies and programs play in mitigation and recovery efforts. The articles in this issue push novel research avenues for understanding the intersection of disasters and inequality. We conclude our introduction by discussing the challenges and key directions for future research.

Keywords: climate hazard, inequality, disaster, risk, recovery, climate policy

In January 2025, multiple fires devastated Los Angeles County. The two largest, the Eaton Fire in Altadena and the Palisades Fire in the Pacific Palisades neighborhood, will likely together constitute the costliest wildfire event in US history to date. While catastrophic, the fires were unsurprising. For years, climate scientists have shown that global warming is intensifying the

hydrological cycle, making weather more extreme and climate hazards like wildfires and hurricanes more frequent and more destructive.

The fires in Los Angeles reflected another reality of climate change: as the homes of the wealthy and the poor alike burned, they showed that our climate fates are intertwined. The Pacific Palisades has been a tony neighborhood

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for decades, where millionaires and celebrities own large lots on secluded streets near the ocean. But wealth and fame do not necessarily shield people or places from climate hazards. At the same time, the fires revealed stark differences in risk. In Altadena, the lots are smaller, the housing stock is worth far less, and warnings to evacuate were delayed. While poorer than the Palisades, Altadena has historically been a center of a particular kind of wealth in Los Angeles County—Black and Latino wealth. Facing discrimination in other locales, Black and Latino families have made their homes in this unincorporated part of the County. As a result, nearly three-quarters of Black residents and more than 60 percent of Latino residents in Altadena own their own home, far outpacing the one-third and 40 percent rates for Black and Latino residents in the county as a whole. Altadena is a rare version of stable, racially mixed, middle-class life. Yet, Black Altadena residents were far more likely than others to be in the fire perimeter, and Black homeowners were much more likely to face financial and other obstacles in the rebuilding effort. Fates are intertwined, to be sure—but risk is also quite distinct given historic and current disparities. The Los Angeles fires were a grim reminder of the region's (and our nation's) collective ecological precarity, but the contrasts between the Palisades and Altadena are also evidence of important variations in the social, political, and economic consequences of climate hazards.

In this introduction, we highlight what existing research tells us about the consequences of climate hazards for inequality. First, we explore how the risk of exposure to climate hazards is unequal across places and demographic groups. While more privileged places and people have traditionally been less impacted by hazards relative to their more disadvantaged counterparts, climate change is expanding the scale and scope of climate hazards. This means that an increasing number of places, regardless of their demographics, are more vulnerable. In other words, the riskscape—the spatial and temporal distribution of climate vulnerability—is changing. How political leaders, communities, and households respond to these changes will shape the extent to which climate hazards amplify inequality.

Second, we examine how inequalities emerge in the process of recovery after climate disasters. We highlight how climate hazards tend to affect household finances, the role of insurance in trying to mitigate against downward mobility, and the way climate hazards precipitate novel forms of migration and affect local patterns of economic development. Yet, we point out that much is still to be learned about how America's neighborhoods change in the wake of different kinds of climate disasters and how rapidly changing insurance markets will impact mobility and housing moving forward.

Third, we turn to the role of existing government policies and programs, describing how mitigation and recovery efforts fostered by the Federal Emergency Management Agency (FEMA) and other agencies have tended to reproduce or even exacerbate existing inequalities. We also trace the impacts of managed retreat policies that continue to be hotly debated within vulnerable communities.

Fourth, we explore how different political actors are affecting climate and disaster policy. We outline key institutions and describe a highly contingent policy landscape. The volatility in climate policy across presidential administrations and congressional terms—like the volatility in weather—points to just how dynamic the debate will be about how best to prepare for the future.

Finally, we highlight promising topics for future research. Climate hazards will continue to alter fundamental aspects of US society, including capital investment and economic development, housing and insurance markets, migration, economic mobility, and social solidarity. In this last section, we focus on research directions that meet the urgency of the current moment. These include the need for more work that compares outcomes like mobility and neighborhood change across different kinds of places and different kinds of hazards, as well as more life-course research that illuminates the long-term impacts of experiencing climate hazards. Additional research is also needed on how recovery resources are allocated when affluent places such as the Pacific Palisades and less advantaged places such as Altadena are devastated at the same time.

As long-term recovery from the Los Angeles

fires begins, it remains unclear whether advantaged enclaves like the Pacific Palisades will hunker down and hoard resources or, paradoxically, if the growing threat of climate hazards to privileged places will lead to more effective appeals for aid and policy change for all communities. Indeed, much of the attention Altadena has received after the fires may be due to community groups that demanded fair and equitable treatment relative to their wealthier Palisades neighbors. The articles in this issue help illuminate these contingencies and begin to provide answers to questions that will only become more essential in our climate-changed future.

THE RISING TOLL OF CLIMATE DISASTERS

There is little doubt that rising greenhouse gas concentrations are affecting the scale and scope of climate hazards. The US National Oceanic and Atmospheric Administration has tracked the type and cost of hazards that have caused over \$1 billion in damage since 1980 (NOAA 2025).¹ The data starkly illustrate not only the growing number of costly disaster events but also their increasing economic impacts (figure 1).

Across the US, these disasters are affecting a growing number of American households. According to the Federal Reserve's 2024 Survey of Household Economic Decision-Making, 21 percent of Americans were financially impacted by climate-related extreme weather (flooding, hurricanes, wildfires, or extreme temperatures) in the previous year. Of those that were exposed, almost half experienced property damage, 28 percent lost income, and 19 percent had to temporarily or permanently relocate. To mitigate against extreme weather, 18 percent of Americans reported making improvements to their property, while 14 percent said they investigated other places to live, and 5 percent purchased additional insurance. Annually, millions of US

residents face climate hazards, with millions more anticipating exposure soon. This widespread reality makes understanding the connections between climate hazards and broader social, political, and economic trends absolutely critical.

Types of Climate Hazards and Their Impacts

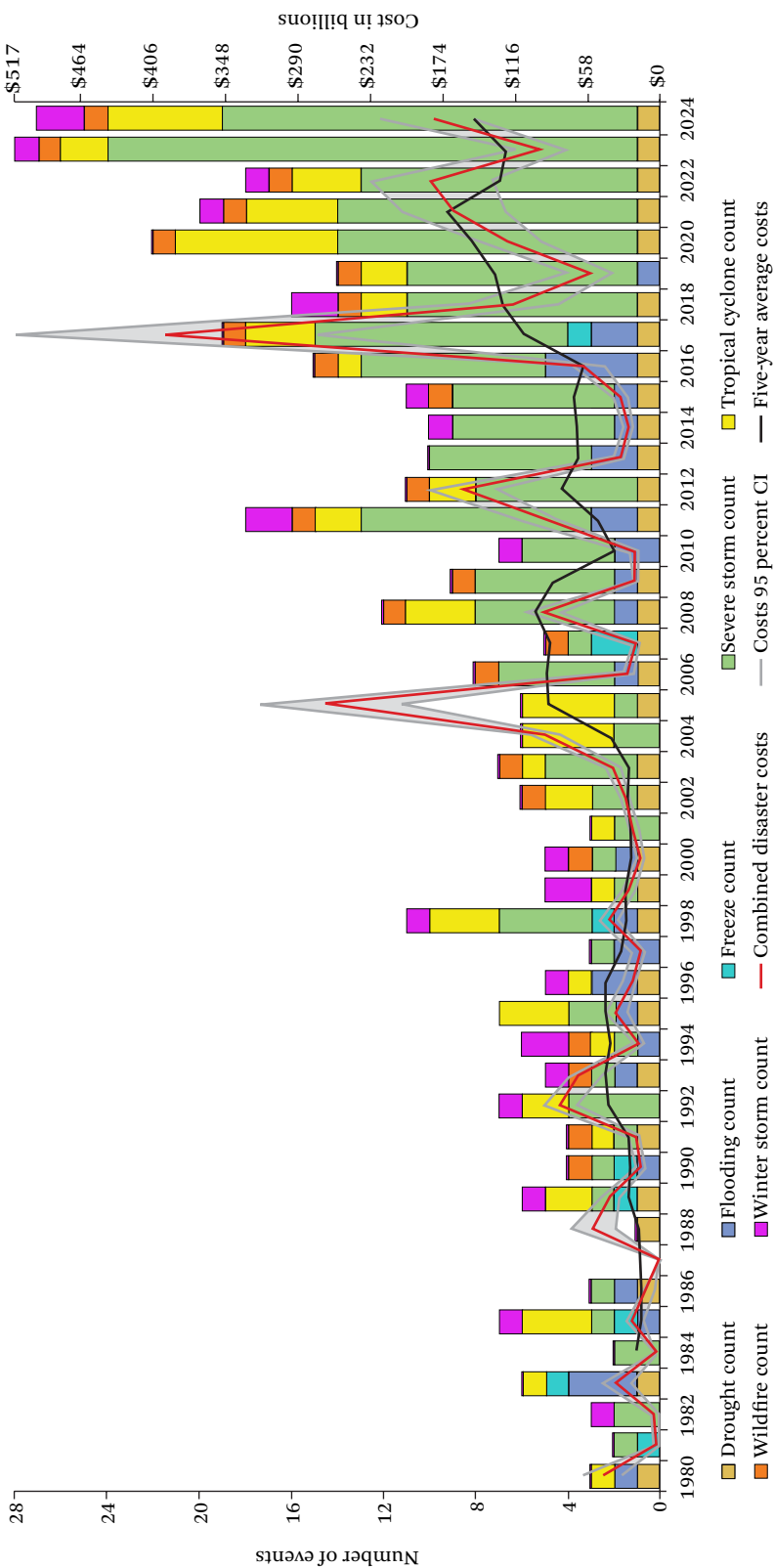
The term *climate hazards* refers to both acute and chronic weather-related risks, such as floods, wildfires, heat waves, hurricanes, and droughts, that have the potential to disrupt daily life and cause significant negative impacts. Disasters are the realization of these negative impacts on individuals and communities (Arcaya et al. 2020; Tierney 2019). In this issue, we focus specifically on climate hazards, rather than broadly considering all environmental hazards such as earthquakes or oil spills and toxic waste exposures. This narrow focus is intended to draw attention to the specific implications of climate change for understanding inequality in the US. Prior work establishes the underlying connections, showing a strong correlation between rising CO₂ levels and the number of costly climate disasters (Bhola et al. 2023), as well as a strong correlation between disaster cost and various inequalities (Howell and Elliott 2018).

Different types of hazards have distinct roots and they of course have varying effects—though some are better understood than others.² While more Americans experience flooding than any other type of hazard, extreme heat is responsible for more deaths (National Academies of Sciences, Engineering, and Medicine 2025). Drought can have a more acute impact on specific industries, such as agriculture and energy production (Sugg et al. 2020). Hurricanes and wildfires, by contrast, are most likely to lead to property damage and residential displacement—though with different implications for rebuilding, as hurricanes often leave building foundations intact while wildfires completely raze structures (Aung and Sehgal 2025).

1. The NOAA was directed to stop producing these data by the second Trump administration. Some nonprofits, such as Climate Central, have sought to fill the void (Climate Central, n.d.).

2. For example, we have clear evidence that past political and development decisions have increased the Gulf Coast's vulnerability to hurricanes (Freudenberg et al. 2012; Horowitz 2020; Pastor et al. 2006); however, we know comparatively less about why so much housing is built in fire-prone areas in the West (see Greenberg et al. 2024; Radloff et al. 2018).

Figure 1. United States Billion-Dollar Disaster Events, 1980–2024 (CPI-Adjusted)



Source: NOAA 2025.

Note: CI = confidence interval. The optimal way to view the this figure is in color. We refer readers of the print edition of this article to <https://www.rsjournal.org/content/12/4/1> to view the color version.

These varying consequences are also products of government action and policy. Federal disaster declarations are at the discretion of elected leaders under existing law. The 1974 Disaster Relief Act, which became the Stafford Act in 1988 and was amended in 2000, specifies that a governor can request that the president declare a disaster, triggering relief funds through the FEMA.³ Notably, the Stafford Act does not classify extreme heat as a disaster, leaving households experiencing heat waves ineligible for federal aid. In addition, politicians are responsible for overseeing and managing disaster recovery agencies, making political considerations inherently part of the recovery process (Garrett and Sobel 2003; Reeves 2011). Building a robust understanding of the consequences of climate hazards for inequality thus requires specific attention to the role of politics.

Before we describe these political considerations, the next two sections elaborate on how climate hazards intersect with longstanding disparities, revealing how existing inequalities shape both vulnerability and unequal recovery (Cushing et al. 2015; Cutter et al. 2012; Shonkoff et al. 2011; Tierney 2014; Thomas et al. 2019). Critically, these intersections often magnify or transform inequalities both within and between communities (Besbris 2024; Rhodes and Besbris 2022a; Klinenberg et al. 2020; Kousky 2014).

SOCIAL VULNERABILITY TO CLIMATE HAZARDS

While climate change is a problem that affects the entire global population and impacts a wide range of US communities, the risk is not shared equally. Research confirms a “climate gap”: a disproportionate and unequal risk of exposure to climate hazards for lower socioeconomic status groups and people of color (Fothergill and Peek 2015; Morello-Frosch and Obasogie 2023; National Academies of Sciences, Engineering, and Medicine 2022; Shonkoff et al. 2011). This risk is determined in part by preexisting social, economic, and political conditions that make some groups more vulnerable to harm than others. Scholarship on “social vulnerability” draws specific attention to the characteristics of peo-

ple and groups that influence their susceptibility to harm from exposure to climate hazards, as well as their adaptive capacity to respond to and recover from such events (Finch et al. 2010). Indeed, disparities in vulnerability are linked to factors such as geography, race, socioeconomic status, homeowner status, and other dimensions of social life—particularly in the US where these distinctions structure and produce various kinds of inequalities (Fothergill 1996; Fothergill et al. 1999; Fothergill and Peek 2004; Méndez et al. 2020). We believe social vulnerability offers a productive conceptual framework for understanding the relationships between preexisting inequalities and the impacts of climate hazards.

Differences in Risk

In the US, residential location is a central component of climate risk, largely determining a household’s likelihood of exposure to climate hazards. Research shows that climate hazards—both acute and chronic—disproportionately affect people living in disadvantaged locales, thereby deepening existing inequality. For example, analyses of flooding events show that lower-income households are more at risk. This is especially the case in coastal neighborhoods with higher proportions of Native American and Hispanic residents and in “hotspots” (where flood risk and social vulnerability overlap) in the American South where the proportion of Black residents tends to be higher compared to other parts of the country (Galster et al. 2024; Qiang 2019; Tate et al. 2021; Wing et al. 2022).

Poorer households are more at risk for two main reasons. First, Americans are highly segregated by income, and at-risk areas are more affordable (Hallegatte et al. 2020; Reardon and Bischoff 2011). Second, poorer places tend to be less protected, as mitigation and resilience efforts tend to favor higher-income and more politically efficacious communities (Avtar et al. 2023; Zahnw et al. 2025).

These communities not only have less protective infrastructure but also tend to contain lower-quality and less resilient housing, leading to more pervasive and severe losses when di-

3. Disaster relief may not be settled policy as the second Trump administration has suggested reducing FEMA’s funding (or eliminating it altogether) and distributing the responsibility for disaster relief to states.

sasters hit (Fothergill and Peek 2004). Furthermore, poorer households are less likely to evacuate their neighborhoods when hurricanes and flooding occur, which heightens their risk. And when they do evacuate, poorer households are more likely to head to locales with lower quality infrastructure (Crawford et al. 2023; Gladwin and Peacock 1997; Thompson et al. 2017; Yabe and Ukkusuri 2020). During heat waves, individuals more concerned with utility costs may be less likely to turn on their air conditioning (if they have it), increasing their risk of mortality (Hernández and Laird 2025; Klinenberg 2002). So, across multiple climate hazard types, the poor tend to be more vulnerable.

Meta-analyses suggest that race also remains a significant and consistent predictor of unequal risk, even more so than household income or housing value (Downey and Hawkins 2008; Ringquist 2005). This illustrates that the uneven riskscape has much to do with historic and contemporary inequities, including an imbalance of power in the decision-making process to protect (or not protect) certain communities at risk (Besbris, Elliott et al. 2024; Hamilton 1995; Lane et al. 2022). Systemic forms of racism are one key factor in structuring vulnerability. Hurricane Katrina is often cited as a particularly revealing case, demonstrating how intersecting vulnerabilities by class and race affected risk and exposure (Horowitz 2020; Pastor et al. 2006). For example, Patrick Sharkey (2007), found that while age, race, and place were all consequential factors for potential death during Hurricane Katrina, it was not residents of New Orleans's poorest neighborhoods that were most at risk of death, but residents of its most racially segregated neighborhoods.

Racial and socioeconomic disparities in vulnerability to climate hazards are shaped by a history of place-based policies related to community development, investment, and housing. For example, residential racial segregation—fostered by racist government policies such as redlining, exploitative lending and insuring practices, and discrimination by housing providers—has played a core role in shaping the unequal riskscape (Krysan and Crowder 2017; Morello-Frosch and Lopez 2006). Historically redlined neighborhoods, and segregated Black neighborhoods generally, have not received the

same investment in public parks and landscaping relative to White neighborhoods, regardless of poverty levels, with less tree canopy and more impervious surfaces that retain heat and can exacerbate flooding. This means that their residents face higher land surface temperatures and are at higher risk of exposure to extreme heat (Harlan et al. 2007; Hsu et al. 2021; Jesdale et al. 2013; Klinenberg 2002; Marx and Morales-Burnett 2022; Mitchell and Chakraborty 2018; Nardone et al. 2021; Wilson 2020).

Members of disadvantaged groups often face greater barriers in accessing resources to support recovery (more on this later). Immigrant and limited English-speaking communities, for example, have more difficulty accessing the translation support and resources they need to prepare before a disaster hits, while lack of proof of citizenship can serve as a barrier to securing recovery resources (Besbris, Dempsey et al. 2024; Fussell et al. 2018; Méndez et al. 2020; Méndez et al. 2024; Stough et al. 2010). Claudia Valencia-Urbe and colleagues (2026, this issue) highlight the role that migrant-serving organizations frequently play in filling this gap in public services, taking on the taxing task of adapting their operational foci to meet the emerging needs of migrant and undocumented community members in the aftermath of climate-related disasters.

Broadly, a useful distinction in terms of understanding risk can be made between vulnerable population groups and structurally disadvantaged communities. The first entails people such as the young, the old, those with disabilities, pregnant women, poor people, and those who are homeless. The second includes people living where exposures are cumulative, individual disadvantage is exacerbated, and interventions should arguably be place-based. Developing analyses to separate the potentially distinct mechanisms that lead from unequal risk to post-disaster inequality is an evergreen goal for social scientists.

Legacies of Environmental Injustice

The emphasis on understanding how climate-related hazards increase or change existing inequalities has grown as environmental justice activism and scholarship have moved to the fore. Environmental justice can be defined as the eq-

uitable exposure of all people to both environmental benefits and environmental harms with climate justice addressing equity around climate exposures specifically (Harlan et al. 2015; Holifield 2001; Mohai et al. 2009; Schlosberg and Collins 2014).

The earliest research in environmental justice focused on documenting disparities in proximity to hazards—usually toxic waste sites (Bullard 2000; United Church of Christ Commission for Racial Justice 1987; Taylor 2014). As the field developed, it consistently found disparate patterns of exposure to environmental hazards by race and income, often with race playing the more prominent role (Downey and Hawkings 2008; Mohai and Saha 2007; Pastor et al. 2001; Sadd et al. 1999; Saha and Mohai 2005; Taylor 2000). Environmental justice scholarship has since broadened to include access to resources for recovery from various environmental catastrophes (Bullard 2007; Bullard and Wright 2012).⁴ That is, it has described how both vulnerable population groups and structurally disadvantaged communities are put at higher risk of exposure to climate hazards and are overlooked in the distribution of recovery aid.⁵

More recently, the environmental justice framework has expanded to examine how factors like citizenship, disability, and gender identity affect vulnerability to climate hazards (Balbus and Malina 2009; Lindsay et al. 2023; Mann et al. 2024). One recent scoping review concluded that climatic changes were “having a disproportionate effect on the health of adults and chil-

dren of color” as well as noncitizen immigrants (Berberian et al. 2022, 459), while additional research has demonstrated the high-risk experiences of undocumented immigrants who move into disaster zones to find work, particularly in hazardous industries like construction (Fussell et al. 2018; Méndez et al. 2020).

Environmental justice activists and scholars have also sought to reframe core concepts in the study of hazards. For example, by incorporating ecocultural practices from Native American and Indigenous traditions (Hankins 2024; Sovacool et al. 2023), recent work has expanded definitions of who and what is at risk. This work builds on critiques that prevailing assessments of risk are overly focused on economic measures of cost-benefit and do not accurately capture the value and needs of communities with distinct histories (Balachandran et al. 2022). Shifting our frameworks, these scholars argue, can lead to more holistic definitions of key concepts such as damage and preparedness (Denig 2018), and encourage a community-centered approach to addressing local needs in the context of climate hazards.

INEQUALITIES IN RECOVERY

People and places not only vary in their risk of exposure to climate hazards, they also vary in their capacity to recover. Here we highlight these observed patterns of inequality during recovery and how they are produced.

Recovery resources are not equally distributed. Households with preexisting financial ad-

4. There is an emerging body of scholarship exploring normative questions of fairness and equity in climate hazard response. This work argues for combining climate reparations—wealth transfers to historically marginalized groups made more vulnerable by environmental racism—with rigorous equity rating systems that assess mitigation policy (Chapman and Ahmed 2021; Donoghoe and Perry 2023). This type of work will likely grow in prominence as climate hazards increase in scale and scope, and critical justice-oriented scholarship will be a key component of addressing the ways that climate change and policy responses drive inequality.

5. The environmental justice field has also become more adept at tracking the effects of disparities on health outcomes and in developing tools, such as mapping systems, to provide information for policymakers and others trying to decide how to address problems (Brulle and Pellow 2006; California Office of Environmental Health Hazard Assessment 2023; Jbaily et al. 2022). The federal government developed several national mapping tools and other resources focused on identifying environmental inequities and their links to health and social vulnerabilities in the early 2020s, including the EPA’s EJ Screen and CDC’s Environmental Justice Index. While some of these tools were dismantled by the most recent Trump administration, EJ Screen has been restored and hosted by Public Environmental Data Partners, a nongovernmental group (Public Environment Data Partners n.d.), and the Environmental Justice Index was still available on the CDC website under court order as of October 2025 (Agency for Toxic Substances and Disease Registry 2024).

vantages (such as higher incomes and more insurance coverage) and those in Whiter communities tend to receive more economic support in recovery than their less advantaged counterparts (Raker 2023). They also tend to have larger, wealthier social networks that can provide additional forms of monetary and in-kind aid during recovery (Aldrich and Meyer 2014; Rhodes and Besbris 2022a). While post-disaster migration patterns are complex and varied across places and hazards (Hoffmann et al. 2021), less advantaged households are often more likely to leave and less likely to return in the wake of climate hazards, incurring moving costs, leaving behind helpful social networks and support systems, and missing out on the benefits of reinvestment efforts that often occur after disasters (Elliott and Howell 2017; Fussell 2015; Fussell and Harris 2014; Fussell et al. 2010).⁶ Furthermore, there is growing evidence showing that lower-income households that leave their neighborhoods after exposure do not move to less risky places, while higher-income households who move do (Clark et al. 2025; Elliott et al. 2026, this issue). Finally, recovery processes tend to increase economic inequality across neighborhoods, as more advantaged places receive higher shares of aid and more economic development post-disaster (Gotham and Greenberg 2014; Raker 2023; Pais and Elliott 2008).

Household Budgets and Housing Values

Researchers examining recovery from climate disasters have often used prior inequalities to explain why post-disasters outcomes can be so disparate. Past work has posited a disaster Matthew effect—that households with preexisting economic advantages tend to increase their wealth in the wake of disaster while more disadvantaged households are more likely to face increased financial precarity (Rhodes and Besbris 2022a). Indeed, at the household level, hazards and disasters have the potential to dramatically alter budgets and socioeconomic profiles (Smith and McCarty 1996; Vigdor 2008).

The negative financial consequences for households exposed to hazards vary consider-

ably in their size and duration, as well as whether the household relocates or returns after having evacuated its home. For example, evacuees who returned to New Orleans more quickly after Hurricane Katrina had better labor market outcomes than those who did not return (Groen and Polivka 2008). Additionally, while household earnings typically fall immediately following a disaster, some research shows they rebound relatively quickly (Deryugina et al. 2018). Access to disaster aid can also play a role in household finances, as research shows that aid is associated with reduced credit card debt (Deryugina et al. 2018; Gallagher et al. 2023; McIntosh 2008; Sacerdote 2012).

Lack of access to aid can also be consequential for downward economic mobility; for example, after Hurricane Harvey, bankruptcy rates and debts in severe delinquency increased in flooded neighborhoods. They were concentrated, however, in areas outside of the floodplain, where many residents were denied government loans for rebuilding (Billings et al. 2022). Broadly, research on the economic consequences of climate hazards shows that while disasters serve as an economic shock, effective policies can help limit negative and long-term consequences for household budgets. Unfortunately, highly unequal rates of access to recovery resources persist by race and place (Raker 2023). This can result in aid increasing rather than decreasing inequality (Howell and Elliott 2019).

Climate hazards can also affect housing values, impacting both household-level wealth and community-level property tax revenue (Besbris, Robinson et al. 2024). Less valuable housing—inhabited by more economically vulnerable people—is generally more at risk of reduced value after exposure (Peacock et al. 2014; Zhang 2016). Yet all types of housing in places at risk of and affected by climate-related hazards sell for lower prices relative to comparable housing in less risky places nearby (Ortega and Taspinar 2018). For example, houses more susceptible to flooding from sea-level rise sell for substantially lower prices than comparable homes equidistant from the beach that are less exposed (Ber-

6. Evictions rise after disasters and related forced mobility is associated with myriad negative effects on household budgets, neighborhood attainment, and health (Brennan et al. 2022; DeLuca and Rosen 2022; see Graif 2016).

nstein et al. 2019; see also McAlpine and Porter 2018). Newer research is exploring the cumulative effects of repeated exposure to hazards, with lower housing prices in places that experience multiple disasters over time (Read 2025).

For renters, housing costs do not always change in the same way. As Brian Y. An and colleagues (2026, this issue) show, rents can rise after exposure to climate hazards, though the effect varies by hazard type and is mitigated by government spending on community development efforts. Changing rent costs can also increase inequality, especially when these increases are concentrated in units priced toward the bottom of the rent distribution, more directly impacting low-income renters (Brennan et al. 2024). These economic differences are often a key source of variation in how communities recover and what recovery looks like for different types of households. The concern that recovery processes can exacerbate existing inequalities has led to growing calls for a greater focus on social equity in risk management, adaptation policy, and disaster recovery funding (Domingue and Emrich 2019; Rhodes and Besbris 2022c; Siders 2019).

Private Home Insurance

One way that homeowners try to protect the value of their homes, a key asset for many Americans, is through private insurance. Homeowners' insurance can facilitate rebuilding after loss or damage to property from some climate hazards—policies typically do not cover damage from flooding. But as the risk of exposure to climate hazards grows, so too will the cost of insurance, further exacerbating inequality in the context of climate change.

Homeowners' insurance is typically required by lenders for the duration of the mortgage loan. And indeed, most American homeowners have some insurance on their property. However, an estimated 7–12 percent of homeowners are uninsured (Cornelissen et al. 2024; Insurance Information Institute 2023). Worsening inequality in the wake of climate-related disasters is driven in part by this gap in insurance coverage, as lower-income households, owners of mobile

homes, and Black and Hispanic homeowners are disproportionately among the uninsured (Cornelissen et al. 2024). Moreover, insurers do not simply assess costs according to calculations of physical risk; they also use policyholders' credit scores to determine premiums. While insurance is key to understanding differences in the material resources households have for repair, rebuilding, and relocation, it also shapes the scale and pace of recovery (Kousky 2019). Prices, however, may not serve as the risk signal insurers claim they do.

The cost of homeowners insurance is rising markedly (Mulder and Kousky 2023), with one study showing an increase of up to a third for policy prices between 2020 and 2023 (Keys and Mulder 2024). These cost increases vary by geography, with homeowners in zip codes with higher disaster risk facing the greatest increase in their premiums. In the face of these escalating insurance costs, a larger number of households are likely to go without homeowners' insurance as premiums become prohibitive (Rhodes and Besbris 2022a; Sastry et al. 2024; see also Kousky and You 2024). This can also shift the composition of homeowners in disaster-prone areas to richer borrowers with higher credit who can afford these increasing expenses (Sastry 2022), potentially amplifying socioeconomic segregation.

Some property insurance firms are exiting markets in certain states altogether or are charging higher premiums in less regulated states to make up for losses (Cignarale et al. 2017; Oh et al. 2025). In the years preceding the Los Angeles wildfires, many homeowners in California had been forced off private insurance and into a plan designated as an insurer of last resort for high-risk properties that is now itself facing significant financial strain (Birss et al. 2024).⁷ More research is needed broadly on the relationship between private insurance and government safety nets, and specifically on the types of households who rely on these state insurance programs and how they fare in recovery. While some wealthy homeowners may be able to afford to repair damaged property absent insurance or in the context of less generous insur-

7. Some official state plans, like Florida's and Louisiana's, were created after climate hazards (Kousky 2019) though some, like California's FAIR Plan, were created in the wake of urban unrest in the 1960s.

ance, a growing number of lower-income households continue to live uninsured or underinsured in increasingly vulnerable communities.

Even when households do have insurance, they are not guaranteed to receive expected payouts. This means that the courts can become a site of emerging inequality. As Hannah K. Friederich and colleagues (2026, this issue) show, litigation over insurance claims following Hurricanes Laura and Delta in Louisiana was more likely in neighborhoods with higher proportions of Black residents. In addition, these cases took longer, reflecting that systemic procedural inequalities can amplify disparities in disaster recovery. The rapidly changing private insurance landscape is a ripe area for further research (Gourevitch and Kousky 2025; Kousky et al. 2020), with implications for evolving mobility and home-buying patterns, and inequities in wealth accumulation, among other concerns.

Data for Assessing Risk

Decisions about insurance availability and cost are informed by the quality and scale of available data. Indeed, climate analytics are incredibly important, as they are also used to determine the provision of aid and the siting of mitigation and adaptation efforts. We are in a period of rapidly improving climate analytics, but much of these new data are in private hands. Even when privately held analytics rely on science from public agencies, access to them is often limited to those who can pay (Webber and Donner 2017). As such, a less explored but potentially important source of climate hazard-related inequality may be access to data. Indeed, property insurers' decisions, such as whether to renew or cancel policies, change premiums, or withdraw from some markets, are informed in part by their assessments of climate hazards and potential exposure (Boomhower et al. 2024; Condon 2023; Keys and Mulder 2024; Cignarale et al. 2017). Understanding how insurers model risk, therefore, is essential to understanding the equity of these decisions. There is a strong

rationale for making climate analytics data available as a public good, rather than treating them as a private commodity housed in commercial organizations that do not share them with those unable to pay for access (Findlater et al. 2021; Mankin 2024).⁸

National Flood Insurance

The pace of change within insurance markets raises fundamental questions regarding who should pay for damage or mitigation efforts such as relocation. As private insurers continue to pull out of areas they deem too risky for flood, fire, and other climate hazards (Boomhower et al. 2023; Cignarale et al. 2017; McConnell and Koslov 2024), the structure and availability of public insurance options through federal and state governments are becoming a larger part of the insurance landscape. Federal flood insurance through the FEMA is particularly important, since most home insurance policies do not cover damage from flooding.

Managed by the FEMA, the National Flood Insurance Program (NFIP) is the largest federal disaster insurance program offering flood coverage to property owners, renters, and businesses. Coverage is only required for homes and businesses located in high-risk flood areas with mortgages insured by the federal government. The program is heavily subsidized—its cost is less than 60 percent of private homeowner-purchased policies, and coverage has not kept pace with the growing scale of flood risk (Blessing et al. 2017; Bradt et al. 2021; Kousky 2018; Kousky et al. 2017; Smiley 2020; Wagner 2022). Even in high-risk areas, uptake is low and skewed by socioeconomic advantage, with those with higher property values and higher education more likely to be insured (Atreya et al. 2015).

In recent years, FEMA has taken steps to improve the financial stability and transparency of the NFIP, as well as to make its risk assessments more accurate. In 2021, it rolled out the Risk Rating 2.0 to provide risk assessments for each individual property, rather than relying on the relatively static maps of entire floodplains.⁹

8. Furthermore, a lack of funding and staffing in federal science agencies will exacerbate inequalities in predictive power as private firms increasingly fill the information gap with proprietary data and analysis.

9. Even as FEMA has begun to update its assessments of flood risk, homeowners, municipalities, and state-level regulators are not required to use new maps (Mulder and Kousky 2023). Moreover, rezonings are politically

FEMA's stated goal with this more specific evaluation of risk and resulting insurance pricing is to build a more equitable system for setting premiums across all policyholders. Broadly, it reflects an effort to reduce the cross-subsidization within the system, so that premiums more closely reflect actuarial risk (Elliott 2022). While many applaud this goal, it creates specific social tradeoffs and consequences. There is significant debate about whether NFIP premiums should be subsidized to encourage participation or instead set to reflect risk, which could make them less affordable and potentially reduce participation, making inequality in coverage worse (Elliott 2021; see also Gourevitch et al. 2023).¹⁰

Migration and Mobility

Another way that climate hazards can reveal or exacerbate inequality is by spurring novel patterns of mobility. Households and businesses may move, and in some cases, entire communities may relocate through managed retreat efforts.

Cross-border migration is one of the most notable effects of climate change, a pattern expected to intensify as more of the planet faces climate hazard risk. For example, nearly one-fifth of the world may become too hot for human habitation by 2070 (Xu et al. 2020), forcing many people to migrate to cooler locales. In this issue, Asad L. Asad and colleagues (2026) offer a particularly complex view of climate migration into the US from Mexico, using a unique and highly disaggregated dataset to illustrate how home-country dynamics can influence how sensitive different populations, particularly Indigenous communities, might be to climate conditions. These sorts of more nuanced approaches to who moves and why will be needed

to determine policy responses that can mitigate both climate shifts and the sort of mobility that can be disruptive in receiving-country contexts (Waters 2025).

Even within the national context, it can be difficult to identify how mobility and migration reshape the characteristics of populations living in areas impacted by climate hazards. Often the geographic boundaries of climate hazards do not align with political or official designations of the counties, cities, neighborhoods, or block groups typically used as units to measure demographic characteristics of residents. Yet climate hazards do alter the demographic profiles of affected locales (Curtis et al. 2015; Logan et al. 2016; Fussell et al. 2014; Fussell et al. 2017; Hunter et al. 2015; Raker 2020; Seltzer and Nobles 2017). Climate hazards are certainly linked to residential mobility, particularly for households that experience damage to their housing. However, evidence is mixed on exactly what these changes look like, and how they vary depending on the type of climate hazard and the period of time studied after the disaster (Hoffmann et al. 2021).¹¹

Population Dynamics and the Economy

Major sectors of the labor market and the economy more broadly, such as agriculture, are influenced heavily by climate hazards and weather fluctuations (Schlenker and Roberts 2009). For example, both extreme heat and cold lead to losses of labor supply, particularly in weather-exposed industries (Rode et al. 2022). Firms that operate in multiple locations have been shown to reallocate employment (and hence production) in response to heat-related damages (Acharya et al. 2024). This relationship manifests itself through an increase in job postings at facilities not affected by extreme heat, as well as the open-

fraught processes (Elliott 2019) and have, in the past, incorrectly assessed non-White places at lower rates of risk than White ones, thus leaving them at potentially greater risk (Weill 2023).

10. This debate is amplified by the long-term insolvency of the program—in the past twenty years Congress has both increased the NFIP's borrowing limit by tens of billions of dollars and canceled tens of billions of dollars of debt owed by the program.

11. Climate hazards have other consequences for nearby, unaffected areas as well, illustrating the complexity of measuring the effects of disasters on place. Often, they lead to disruptions or intensification of existing patterns of mobility, but they can also lead to novel mobility trends (Curtis and Schneider 2011; Fussell et al. 2010; Hauer et al. 2020; Rhodes and Besbris 2022b).

ing of new facilities in unaffected areas. Both firms and households appear to prefer moderate climates, and these preferences may be reflected in population-level mobility trends in the coming decades (Albouy et al. 2016). Northern areas may be poised for economic growth, while hotter southern areas are predicted to see a decrease in their populations and economic activity (Cruz and Rossi-Hansberg 2024). Though this is not assured, as the continued population growth in the American Sunbelt shows.

Dania Francis and Keren Horn (2026, this issue) document some overall post-hazard employment and earnings trends but also show that variability emerges across hazard types. After hurricanes, for example, short-term growth in employment is driven by construction jobs, but other major storms are not associated with the same patterns. This highlights the value of further work comparing the impacts across hazard types, as well as contrasting short- and long-term economic impacts to build a holistic picture of how climate hazards will reshape the labor market.

Aside from the makeup of populations and local economic conditions, climate-related hazards have also been shown to change other aspects of communities. These include trends in development, the density of nonprofits and social service organizations, and housing markets—with stark implications for resulting levels and types of inequality (Comerio 1998; Smiley et al. 2018). Disasters are generally understood to act as economic shocks that provide new openings for investment. This investment can, in turn, foster uneven recoveries, with some people and communities benefitting and others losing out (Gotham and Greenberg 2014).

“Growth machines”—coalitions of politicians and business interests focused on development (Logan and Molotch 1987)—form after disasters, with an increasing number of firms operating in disaster-affected locales. Local development typically increases in the wake of disasters—often in previous undeveloped parcels (Elliott and Clement 2017)—which generally creates short-term profit. Local economies overall experience long-term increased activity after a disaster, particularly when loss of life is low, relatively few people leave the area, and there is substantial damage to buildings and infrastructure to make

way for new development. However, having a preexisting capacity to rebuild is critical. Communities that lack such resources can become more impoverished after a disaster rather than less (Akao and Sakamoto 2018; Botzen et al. 2019; Hallegatte and Dumas 2009). Real estate market intermediaries like brokers and agents likely play an underappreciated role in reshaping post-disaster property values by actively steering investment in ways that increase racial and socioeconomic inequalities across neighborhoods. (Besbris 2020; Besbris and Korver-Glenn 2023; Korver-Glenn et al. 2023; Wohl and Besbris 2024).

Climate Gentrification

Post-disaster economic development can lead to climate gentrification, a process where more-advantaged households move into areas less vulnerable to climate hazards, displacing the less-advantaged households who currently reside there. This heightened demand occurs when lower-income neighborhoods become more desirable due to basic characteristics such as elevation, investment in resilience infrastructure that makes the neighborhood safer, or post-disaster development (Besbris, Robinson et al. 2024; Gould and Lewis 2017; Keenan et al. 2018; Knighton et al. 2021; Shokry et al. 2022). For example, Hurricane Sandy led to a resorting in the larger New York City metropolitan area, with wealthy White individuals moving from areas that had been damaged into the higher-amenity undamaged areas after the storm (Varela Varela 2023). But as Ingrid Gould Ellen and colleagues (2026, this issue) show, patterns of neighborhood change may not be the same across locales after similar climate hazards. While neighborhoods in New York that flooded during Hurricane Sandy but were outside the official designated flood zone seemed to get poorer, the same thing was not true for flooded neighborhoods in Harris County after Hurricane Harvey. Certainly, more work is needed to understand the spatial variation of climate gentrification.

GOVERNMENT POLICIES AND PROGRAMS

Climate policy is a critical underpinning factor in whether inequality is worsened, maintained, or reduced following climate hazards. Government programs shape the resilience of individ-

uals and communities by influencing their capacity to anticipate, plan for, recover from, and ultimately reduce hazard risk. Several government policies and programs, including the FEMA Flood Insurance Program discussed earlier, seek to assist individuals, businesses, and communities affected by climate hazards but can in practice exacerbate existing inequalities.

FEMA Assistance Programs

After a federal disaster is declared, FEMA's Individual and Households Program (IHP) plays a critical role in providing resources to households that are uninsured or underinsured. To receive cash assistance through the IHP, households file claims with FEMA, which contracts with private home inspectors to assess damage and determine the amount of aid. IHP funds are not designed to be a substitute for insurance and therefore do not cover the complete cost of the losses households experience. Instead, these funds are intended to make a home safe and habitable. The maximum direct IHP assistance is adjusted upward every year—in 2025 it was \$43,600—though households rarely receive the maximum amount. In addition to the IHP, homeowners and renters may apply for FEMA rental assistance if they cannot live in their homes due to disaster damage.

Research on the IHP shows that while applications for federal disaster aid are more likely to come from lower income communities where non-White residents are the majority, inspectors are sent to higher income Whiter communities at higher rates (Raker 2023). In addition, applications from Black and Hispanic neighborhoods are more likely to be denied, and higher income homeowners residing in Whiter communities receive a disproportionate amount of aid (Raker 2023). Related research has found that increased FEMA aid at the county level is associated with subsequent increases in racial wealth inequality (Howell and Elliott 2019). This is, of course, a troubling finding, and more work is needed to understand the mechanisms by which federal aid might lead to increasing inequality.

After federally declared disasters, FEMA also

collaborates with the Small Business Administration (SBA). When homeowners or businesses have repair expenses that are not covered by insurance, they can apply for low-interest SBA loans. These funds can facilitate the completion of repairs, but a lien is put on the property until full repayment is made. Reliance on SBA loans can therefore exacerbate inequality after disaster, with some residents able to complete repairs by using money from insurance payouts, other assets, or support from social networks, while others take on significant new debt (Rhodes and Besbris 2022a).

In addition to providing individual aid, FEMA supports disaster recovery at the community level through programs such as the Hazard Mitigation Assistance (HMA) grants. These funds are awarded to local governments, states, and tribal authorities to support community resilience through mitigation efforts such as elevating structures, dredging local waterways, and improving drainage, retrofitting buildings, and even financing home buyouts as part of managed retreat efforts. HMA can also grow the climate gap since it requires local governments to provide some cost-sharing funds, which can make grants less accessible to communities with fewer resources and lower tax bases. Wealthier communities often have the financial resources and administrative capacity to more effectively compete for these funds.

Managed Retreat

How policy can—or if it should—facilitate moving residents away from vulnerable places is a topic of considerable ongoing debate. Managed retreat (MR) is a widely used term for government-supported relocation of households and communities away from high-risk places (Koslov 2016; Mach et al. 2019; Siders 2019). The most prominent and widespread MR policy is property buyouts, where previously flooded parcels are purchased by the government and left undeveloped because they are deemed at high risk of future flooding.¹² Money for buyouts is provided through several programs administered by FEMA and the US Department of Housing and Urban Development (HUD), and buyouts

12. Though typically utilized in flood-prone areas, communities are starting to examine managed retreat as a response to other hazards such as fires.

are generally implemented by local governments.

Research on buyouts suggests they are not distributed equitably, as policymakers tend to prioritize majority-White communities for buyout offers (Elliott et al. 2020; Elliott et al. 2023). Patterns of mobility after buyouts are also disparate, with residents in more advantaged neighborhoods facing fewer tradeoffs compared to residents from less privileged communities who often move further away from their social networks (Loughran and Elliott 2019, 2022). James R. Elliott and colleagues (2026, this issue) show that in the majority-White communities where buyouts have been concentrated, homeowners are typically relocating to socioeconomically affluent neighborhoods, are staying close to their previous communities (only moving around seven miles), and moving to housing with less climate risk. This suggests potential challenges for scaling buyouts as a tool for MR, and highlights that when residents relocate, they are simply shifting risk to a new group of often less advantaged residents who are moving in (Jerolleman et al. 2024). However, much of the work on buyouts—and MR more generally—is derived from case studies, and so more comparative research is needed.

Additional work on MR efforts designed to relocate communities highlights the need for policymakers to be attentive to the value local residents place on community and relocating collectively. In some cases, these priorities can be more important than individual material gain and may be inconsistent with policymakers' assumptions if residents are not adequately consulted, as was the case for the Indigenous community of Newtok, Alaska (Rosen 2024).¹³ These potential conflicts reveal one way that policies designed to help communities and residents adapt to climate change can produce disparities in outcomes, with wealthier communities mobilizing MR in ways that leave them relatively better off than their less advantaged counterparts (Koslov 2016). Indeed, Megan Mullin (2026, this volume), finds that policymakers were more

willing to support MR for lower-income communities. While this could provide relocation resources to those who otherwise would lack them, it could also produce distinct class-based climate migration patterns if policymakers are more likely to ask disadvantaged communities to move while remaining more amenable to publicly funding physical adaptations such as sea walls or beach restoration for better-off places.

In general, past work examining the provision of government aid after disasters has shown that Whiter and wealthier communities are more likely to receive various kinds of adaptation and mitigation resources (Mach et al. 2019; Bullard and Wright 2012; Siders and Keenan 2020; Vilá et al. 2022). Given the importance of federal disaster aid to local recovery efforts, it is critical to continue assessing—and remedying—procedural inequities in the distribution of this aid (Domingue and Emrich 2019).

THE POLITICS OF CLIMATE HAZARDS AND CLIMATE CHANGE

Government policies and programs to recover from and adapt to climate hazards—and proactive efforts to mitigate climate change more generally—are born from political processes that determine, in the classic definition, “who gets what, when, and how” (Lasswell 1936). In the context of climate politics, we should add “where” to that formulation since the impacts of hazards vary widely by place. In the United States, with its federal system, policymaking is highly fragmented, with jurisdictional level and location playing a distinctly important role. Further, allocation of political power across the different branches of government, the influence of political parties, public opinion, and special interests provide both numerous veto points and arenas of potential opportunity.

Federal Executive Branch and Congress

Policymaking at the federal level has been marked by a high degree of volatility, swinging in recent years from executive branch support

13. In another location, Isle de Jean Charles, Louisiana, the state government and the community were at odds about what constituted just compensation and fair access to properties as they negotiated MR (Simms et al. 2021).

for some climate action under President Joe Biden to unprecedented executive branch hostility under President Donald Trump. Over a period of several years, the US Congress has moved from relative inaction prior to the Biden administration to considerable investment in climate policies, to the dismantling of many of these policies under the second Trump administration and the 119th Congress. Republican lawmakers have shown high deference to the executive branch as they canceled billions of dollars in renewable energy projects—including ones in their districts. These actions risk job loss and increasing utility costs, and they surrender congressional authority over federal agencies and the power of the purse. As is frequently noted, elections have consequences, and climate policymaking at the national level reflects a dramatic shift in the context of intense partisanship.

The Judiciary

The courts have also played a growing but unsettled role in determining outcomes for policies related to climate hazards. There has been an increase in climate-related lawsuits and even calls for prosecutors to consider criminal charges against fossil fuel companies (Zraick 2024; Gelles 2024). At the highest level, the US Supreme Court has generally grown more deferential to the executive branch. In its 2024 decision in *Loper Bright Enterprises et al. v. Raimondo, Secretary of Commerce, et al.*, the US Supreme Court overturned the Chevron deference precedent, a move expected to reduce the federal government's ability to regulate environmental hazards into the future.¹⁴ In 2025, the Trump administration began appealing to the judiciary in somewhat novel ways, including suing states to constrain “make polluters pay” laws. These laws set up superfund programs to require fossil fuel companies and other polluters to compensate states for the costs of climate resilience and recovery efforts. The net result of judicial action for climate policy and issues of inequality remains to be seen, and attention to the impact of key court rulings on climate-related inequality will be an important area for ongoing research.

States and Localities

Despite federally imposed policy constraints, important policy changes are occurring at the state and local levels. Responsibilities for policy development and implementation are also often shared across jurisdictional levels and with the private sector (Rabe 2008, 2025; Stokes 2020; Basseches et al. 2022; Trachtman 2023). This adds to the complexity of climate hazard-related policy development at the same time it offers both opportunity and risk. Many states—such as California, Colorado, Hawaii, New York, and Rhode Island—have been comparative innovators in policies to address climate hazards (Rabe 2023; Bromley-Trujillo and Holman 2020; Méndez 2020). California, for example, in 2025 passed a long-term extension of its cap-and-trade program, which sets limits on the total amount of greenhouse gas emissions in the state and effectively taxes high emitters (though, at the same time California increased allowances for oil drilling). Over time, states that have passed mitigation legislation tend to focus on technocratic market-based strategies, rather than broader approaches focused on equity or climate justice, such as investments in renewable energy jobs for lower-wage workers or infrastructure in disadvantaged communities (Boyle et al. 2021). Yet more work is needed on the consequences of this state-level variation in hazard mitigation.

At a more local level, city and county governments also play a critical role on the front lines of climate hazard risk. Given their direct control over key policy levers—such as zoning and building regulations—local jurisdictions are uniquely positioned to shape community resilience, as well as implement important mitigation and adaptation efforts. Yet research shows that the adoption of climate-related policies is shaped by the partisan composition of both local government and the electorate (Gerber 2013). In other words, politics and partisanship impact climate policy at all levels.

Public Opinion and Partisanship

Recent surveys suggest that support for action to address climate hazards is heavily tied to the nation's partisan polarization, and attitudes about inequality and the environment (Bugden

14. *Loper Bright Enterprises et al. v. Raimondo, Secretary of Commerce, et al.*, No. 22–451 (US June 28, 2024).

2023, 2024). While 70 percent of adults surveyed in an April 2024 national poll favored the “US taking steps to try to reduce climate change,” views diverged sharply by party affiliation, with 91 percent of Democrats favoring, 68 percent of Independents, and 48 percent of Republicans favoring such action (De Pinto et al. 2024). It’s worth noting, however, that more young Republicans (61 percent of eighteen- to forty-four-year-olds) favored climate action than older Republicans (40 percent). Other polls show that support for particular policies, like limiting pollution, can reach much higher levels across parties (Carman et al. 2025). Nearly twenty years of polling in California have shown that significantly higher shares of Black and Latino respondents consistently view climate change as a serious threat. Over time this has created incentives for politicians to address issues of disproportionate exposure and, as a result, equity is a prominent part of climate hazard policies in that state (Pastor et al. 2024).

Cadence Willse’s (2026, this issue) article explores partisanship in environmental policy-making, suggesting the need for caution against wishful thinking that experience with climate hazards will readily overcome party divides, at least among legislators. She finds that major natural disasters changed legislative behavior, but in ways that could move in opposite directions across parties. In her analysis, Democrats voted more strongly in favor of environmental policy after a disaster. In contrast, Republican legislators moved toward greater opposition to environmental policy. These findings call into question the belief that shared experience of climate hazards across geographies with both Democratic and Republican residents will necessarily lead to more unified support for climate action (Grant et al. 2026; Hazlett and Mildenberger 2020; Kang et al. 2023).

Even amidst significant partisanship regarding climate change, opportunities for cross-party support remain when issues are more narrowly framed, such as addressing disaster recovery

(Rabe 2023). This potential is crucial as climate-related risks will continue to intensify in regions across the nation, with indifference to local partisanship (Kusnetz et al. 2023). In fact, some research indicates that Republican constituencies face higher risk (Egan and Mullin 2024). This could lead to less political polarization around policies focused strictly on damage prevention from climate-related hazards—as opposed to fights against climate change (Bechtel and Mannino 2022). Yet, like Willse’s (2026) findings, results from experimental research on public opinion are not encouraging, as they tend to show that when resources are unequal and the costs of doing nothing fall more on the less advantaged, cooperation is unlikely (Burton-Chellew et al. 2013). This suggests that while opportunities remain for continued coalition building to advocate for equitable climate policy, these efforts may be most successful when focused on narrowly defined frameworks for specific aspects of recovery and hazard mitigation.

Special Interests and Political Coalitions

While the politics of climate change have been highly volatile in recent years, certain broad patterns remain relatively unchanged. Most notable are enduring tensions between resistance to robust climate action by the fossil fuel industry and related economic, political, and ideological actors. On the other side, pressure to respond to increasing climate hazards comes from public safety and health, scientific, and justice-focused actors. Each of these sets of interests works with coalitions and networks to achieve their ends (Oreskes and Conway 2011; Supran et al. 2023).¹⁵

Well-financed interests have worked for decades—with notable success—to slow, freeze, or reverse policy action through lobbying and financial contributions, advertising and public relations, funding the production of quasi-research content, and other means (Brulle and Dunlap 2021). Indeed, oil and gas companies have persistently outspent environmental and

15. Some scholars have framed policies to address disasters and other climate hazards as “policies without publics,” arguing that disaster policy has lacked an organized (and durable) constituency to vigorously engage with policy formulation (Tierney 2019). This may be true for advocacy for climate action, but advocacy against it has been enduring and forceful (Stokes 2020).

social justice actors with substantial payoff in policy results. However, while Republican-controlled state legislatures have enacted legislation hostile to clean energy (Marshall and Burgess 2022; Stokes 2020), the business and employment benefits of investments in renewable energy infrastructure—and the plummeting costs of solar and wind in particular—have contributed to its increased prevalence even in states with Republican state governments such as Texas (McKibben 2025; Rabe 2023).

The policy development process can also be shaped by activism (for example, protests, civil disobedience, boycotts, and similar actions) and media campaigns designed to impose economic, political, and reputational benefits or costs on political and private actors seen as supportive of or hostile to action to address climate hazards (Srivastav and Rafaty 2023). There have been some moments of success using activism to gain climate policy wins—such as efforts by environmental and climate justice organizers to shape the Biden administration’s executive actions and passage of the Inflation Reduction Act—but many of them have not endured.

Political Possibilities

Given that exposure to climate hazards alone is insufficient to drive effective political mobilization, several additional factors may help promote public engagement, advocacy, and political action. First, as noted above, the specificity with which policies are framed affects their political viability. Second, building on information about cost holds promise for galvanizing public opinion and political action. Highlighting potential future cost savings from government action to prepare for hazards is more politically effective as solar and onshore wind are now cheaper than fossil fuels (Bechtel and Mannino 2023; McKibben 2025). Facts about the lower cost and greater feasibility of renewables may be able to piggyback on growing economic populism and broadly felt resentment toward the wealthy (among them fossil fuel tycoons and tech billionaires), especially as energy demand and costs escalate (Hernández and Laird 2025). Indeed, some have argued that efforts to mobilize around climate action need to be more focused on shared vulnerability and growing social and economic precarity (Besbris, Elliott et al. 2024).

Third, timing also matters for public engagement in disaster policy. We have seen that in the wake of a disaster, communities develop a short-term focus on local political action, policy implementation, and spending (Gilmore et al. 2022; Rhodes and Besbris 2024). Some studies have explored significant local organizing efforts for policy responses that communities deem necessary, such as buyouts after a storm (Elliott 2017, 2019; Koslov 2016), but more work is needed to understand what can sustain longer-term community mobilizations for recovery resources.

Climate change is what the political scientist Thomas Hale (2024) calls a “long problem” with inherent deep inequities between those who are most affected now and in the future relative to those most responsible for the problem in the past and present. The challenges of solving long problems include a lack of immediate political incentive and barriers to collective action, as well as psychological difficulties for most people in acting to prevent uncertain future occurrences. But as climate hazards such as wildfires, floods, and hurricanes become more common and reach across social and economic lines, as the Los Angeles fires did, these occurrences may not seem so uncertain and future-focused, and collective action may become easier to build. The clock is ticking on an intensifying problem that affects those with the fewest resources the hardest, but ultimately hits everyone, as we saw in Pacific Palisades and Altadena.

FUTURE RESEARCH

We return to the Los Angeles fires of 2025 to highlight questions that will become even more relevant as climate change escalates and resulting hazards affect more people and communities.

California has experienced a decade of record-breaking fires and these are likely to have long-term effects that we are only starting to understand (Cunningham et al. 2025). Since higher temperatures and drier soil are a given, these areas may experience fires again soon. Indeed, the 2018 Woolsey fire was less than ten miles from the Palisades fire and places like Malibu and Butte County, California have burned multiple times in recent decades.

There are, of course, the negative health con-

sequences of repeated exposure to climate hazards including smoke and poor air quality that result from fires and excessive heat (Leppold et al. 2022; NASEM 2025). But there is room for more research on how repeated exposure may affect critical issues including household financial trajectories, migration and residential mobility patterns, or other facets of family well-being, such as children's educational outcomes. The Gulf Coast and southern Atlantic states have experienced recurring climate hazards—in this case multiple hurricanes and floods—and offer lessons about repeated exposures. Tyler W. McDaniel (2026, this issue) examines the case of children who live through multiple hurricanes and makes a strong case for the importance of work analyzing the potentially cumulative effects of multiple exposures, but also notes that repeated exposure to hazards may increase certain forms of resilience. Life-course research will become increasingly relevant in examinations of both risk to climate hazards and in understanding differential rates of recovery, adaptation, and other response.¹⁶ More generally, studies that track individuals, households, places, and populations over the long term after exposure to climate hazards are needed to build more effective mitigation and adaptation strategies.

With different demographics and housing stocks across the Palisades and Altadena, the Los Angeles fires provide a ready-made comparison of how place matters. More work such as Elliott and colleagues (2026) and Ellen and colleagues (2026) is needed to compare similar neighborhood and mobility processes across different locales. Further, two related aspects of these fires that received a great deal of public attention require more empirical investigation—housing supply and the insurance crisis. Fires and other hazards can place great strain on already unaffordable housing markets. After the

Los Angeles fires, thousands of households were suddenly pushed into one of the most expensive housing markets in the country. Some households doubled up, others reported being gouged for rents on short-term housing while at the same time receiving offers for their scorched lots from buyers eager for prime opportunities for redevelopment. There is some recent research on the effects of multiple disasters on housing values (see Read 2025), but more work is needed particularly on the local rental markets that will receive growing influxes of consumers as hazards continue to grow. Given the findings of An et al. (2026, this issue), more government oversight such as price controls—as well as simply more available and affordable housing—is clearly necessary.

In addition, California (similar to Louisiana and Florida) was in the midst of an insurance crisis, even before the fires. Home insurers were dropping policies or pulling out of the state entirely. After the fires, insurers asked California's insurance commissioner to approve increases to premiums. As a result, more households will find themselves in the position of doing battle with insurance companies. As Hannah K. Friedrich and colleagues (2026, this issue) show, these battles will reveal inequalities in access to legal resources—and resources for recourse in obtaining further recovery support more generally—across affected households.

Furthermore, it remains unclear if and how different types of hazards and the responses to them may lead to more or less economic inequality in both the short term and the long run. Research that compares economic outcomes across disaster types, as Francis and Horn (2026) do in this issue, is vital to understanding this question. Finally, the case of the Los Angeles fires brings us back to the ramifications of shared exposures in multiple places.¹⁷ The fact

16. For example, we know that age is emerging as a particularly salient characteristic for understanding recovery, with stark differences in how children and older people are able to cope (Benevolenza and DeRigne 2019; Haq et al. 2008; Sacerdote 2012; Torche et al. 2024). Much of the literature on adverse outcomes for children post-disaster shows that some of these negative effects, such as lower test scores and reduced school attendance (see Kousky 2016), abate over time and are less detrimental to children from high-resourced households (Fothergill and Peek 2017).

17. These include political coalition formations that make demands about recovery and adaptation resources or shape attitudes more generally about government efforts for mitigation and adaptation (Darr et al. 2019).

that these fires burned the Palisades as well as Altadena has seemingly enabled Altadena residents to frame their demands for aid in the language of fundamental fairness and equity. Community groups in Altadena have made potent arguments that it would be grossly unfair to focus recovery efforts disproportionately on their wealthier, coastal neighbors. It remains to be seen if the continued expansion of risk and exposure to more advantaged places allows for novel and effective claims on the state from less advantaged places. Or will recovery remain a spatially unequal endeavor?

The questions that this issue addresses are urgent, and their relevance will only grow in the coming years as temperatures rise and inimical weather increases. Understanding the problems that escalating climate hazards create for all Americans—but in particular those who are most economically and socially marginalized—is vital. We need more effective and durable policies to reduce, adapt to, and recover from the effects of climate hazards. And just as urgently, we need policies that can tackle the multiple inequalities that accompany climate hazards and that this issue identifies. Time will tell if we can muster the political will to develop and implement them.

REFERENCES

- Acharya, Viral V., Abishek Bhardwaj, and Toumas Tomunen. 2024. "Do Firms Mitigate Climate Impact on Employment? Evidence from US Heat Shocks." NBER Working Paper No. 31967. National Bureau of Economic Research. December. <https://doi.org/10.3386/w31967>.
- Agency for Toxic Substances and Disease Registry. 2024. "Environmental Justice Index." Place and Health-Geospatial Research, Analysis, and Services Program (GRASP). Centers for Disease Control and Prevention. December 2. <https://www.atsdr.cdc.gov/place-health/php/eji/index.html>.
- Akao, Ken-Ichi, and Hiroaki Sakamoto. 2018. "A Theory of Disasters and Long-Run Growth." *Journal of Economic Dynamics and Control* 95: 89–109. <https://doi.org/10.1016/j.jedc.2018.08.006>.
- Albouy, David, Walter Graf, Ryan Kellogg, and Hendrik Wolff. 2016. "Climate Amenities, Climate Change, and American Quality of Life." *Journal of the Association of Environmental and Resource Economists* 3(1): 205–46. <https://doi.org/10.1086/684573>.
- Aldrich, Daniel P., and Michelle A. Meyer. 2014. "Social Capital and Community Resilience." *American Behavioral Scientist* 59(2): 254–69. <https://doi.org/10.1177/0002764214550299>.
- An, Brian Y., Andrew Jakabovics, Anthony W. Orlando, Seva Rodnyansky, and Raphael W. Bostic. 2026. "The Trajectory of Rental Housing in the Wake of Natural Disasters: Evidence from California and Florida." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 54–76. <https://doi.org/10.7758/RSF.2026.12.4.03>.
- Arcaya, Mariana, Ethan J. Raker, and Mary C. Waters. 2020. "The Social Consequences of Disasters: Individual and Community Change." *Annual Review of Sociology* 46: 671–91. <https://doi.org/10.1146/annurev-soc-121919-054827>.
- Asad, Asad L., Filiz Garip, and Jackelyn Hwang. 2026. "Weather Extremes in Indigenous Communities in Mexico and Undocumented US Migration and Its Duration." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 102–32. <https://doi.org/10.7758/RSF.2026.12.4.05>.
- Atreya, Ajita, Susana Ferreira, and Erwann Michel-Kerjan. 2015. "What Drives Households to Buy Flood Insurance? New Evidence from Georgia." *Ecological Economics* 117: 153–61. <https://doi.org/10.1016/j.ecolecon.2015.06.024>.
- Aung, Ther W., and Ashwini R. Sehgal. 2025. "Prevalence, Correlates, and Impacts of Displacement Because of Natural Disasters in the United States from 2022 to 2023." *American Journal of Public Health* 115(1): 55–65. <https://doi.org/10.2105/AJPH.2024.307854>.
- Avtar, Ruchi, Kristian Blickle, Rajashri Chakrabarti, Janavi Janakiraman, and Maxim Pinkovskiy. 2023. "Understanding the Linkages Between Climate Change and Inequality in the United States." *Economic Policy Review* 29(1): 1–39. <http://dx.doi.org/10.2139/ssrn.4487633>.
- Balachandran, Balakrishnan, Robert B. Olshansky, and Laurie A. Johnson. 2022. "Planning for Disaster-Induced Relocation of Communities." *Journal of the American Planning Association* 88(3): 288–304. <https://doi.org/10.1080/01944363.2021.1978855>.
- Balbus, John M., and Catherine Malina. 2009. "Iden-

- tifying Vulnerable Subpopulations for Climate Change Health Effects in the United States." *Journal of Occupational and Environmental Medicine* 51(1): 33–7. <https://doi.org/10.1097/JOM.0b013e318193e12e>.
- Basseches, Joshua A., Rebecca Bromley-Trujillo, Maxwell T. Boykoff, et al. 2022. "Climate Policy Conflict in the U.S. States: A Critical Review and Way Forward." *Climatic Change* 170(32). <https://doi.org/10.1007/s10584-022-03319-w>.
- Bechtel, Michael M., and Massimo Mannino. 2022. "Retrospection, Fairness, and Economic Shocks: How Do Voters Judge Policy Responses to Natural Disasters?" *Political Science Research and Methods* 10(2): 260–78. <https://doi.org/10.1017/psrm.2020.39>.
- Bechtel, Michael M., and Massimo Mannino. 2023. "Ready When the Big One Comes? Natural Disasters and Mass Support for Preparedness Investment." *Political Behavior* 45: 1045–70. <https://doi.org/10.1007/s11109-021-09738-2>.
- Benevolenza, Mia A., and LeaAnne DeRigne. 2019. "The Impact of Climate Change and Natural Disasters on Vulnerable Populations: A Systematic Review of Literature." *Journal of Human Behavior in the Social Environment* 29(2): 266–81. <https://doi.org/10.1080/10911359.2018.1527739>.
- Berberian, Alique G., David J.X. Gonzalez, and Lara J. Cushing. 2022. "Racial Disparities in Climate Change-Related Health Effects in the United States." *Current Environmental Health Reports* 9(3): 451–64. <https://doi.org/10.1007/s40572-022-00360-w>.
- Bernstein, Asaf, Matthew T. Gustafson, and Ryan Lewis. 2019. "Disaster on the Horizon: The Price Effect of Sea Level Rise." *Journal of Financial Economics* 134(2): 253–72. <https://doi.org/10.1016/j.jfineco.2019.03.013>.
- Besbris, Max. 2020. *Upsold: Real Estate Agents, Prices, and Neighborhood Inequality*. University of Chicago Press.
- Besbris, Max. 2024. "What Is Sociological About Environmental Sociology? Qualitative Methods in an Era of Rapid Environmental Change." *Qualitative Sociology* 47(3): 405–11. <https://doi.org/10.1007/s11133-024-09579-5>.
- Besbris, Max, Sadie Dempsey, Brian McCabe, and Eva Rosen. 2024. "Pandemic Housing: The Role of Landlords, Social Networks, and Social Policy in Mitigating Housing Insecurity During the COVID-19 Pandemic." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 10(4): 207–24. <https://doi.org/10.7758/RSF.2024.10.4.10>.
- Besbris, Max, Rebecca Elliott, Daniel Aldana Cohen, and Ruthy Gourevitch. 2024. "The Housing Regime as a Barrier to Climate Action." *NPJ Climate Action* 3: 66. <https://doi.org/10.1038/s44168-024-00150-0>.
- Besbris, Max, and Elizabeth Korver-Glenn. 2023. "Value Fluidity and Value Anchoring: Race, Intermediaries, and Valuation in Two Housing Markets." *Socio-Economic Review* 21(1): 79–98. <https://doi.org/10.1093/ser/mwac012>.
- Besbris, Max, John N. Robinson, and Hillary Angelo. 2024. "A Sociology of Real Estate: Polanyi, Du Bois, and the Relational Study of Commodified Land in a Climate-Changed Future." *Annual Review of Sociology* 50: 365–83. <https://doi.org/10.1146/annurev-soc-033022-035124>.
- Bhola, Vijai, Attila Hertelendy, Alexander Hart, Syafwan Bin Adnan, and Gregory Ciotto. 2023. "Escalating Costs of Billion-Dollar Disasters in the US: Climate Change Necessitates Disaster Risk Reduction." *Journal of Climate Change and Health* 10: 100201. <https://doi.org/10.1016/j.joclim.2022.100201>.
- Billings, Stephen B., Emily A. Gallagher, and Lowell Ricketts. 2022. "Let the Rich Be Flooded: The Distribution of Financial Aid and Distress After Hurricane Harvey." *Journal of Financial Economics* 146(2): 797–819. <https://doi.org/10.1016/j.jfineco.2021.11.006>.
- Birss, Moira, Alex Casey, Michael Esposito, et al. 2024. *Shared Fates: A Housing Resilience Policy Vision for the Home Insurance Crisis*. Climate and Community Institute. September. https://climateandcommunity.org/wp-content/uploads/2024/09/Shared-Fates_10-09-24_3.pdf.
- Blessing, Russell, Antonia Sebastian, and Samuel D. Brody. 2017. "Flood Risk Delineation in the United States: How Much Loss Are We Capturing?" *Natural Hazards Review* 18(3): 04017002. [https://doi.org/10.1061/\(ASCE\)NH.1527-6996.0000242](https://doi.org/10.1061/(ASCE)NH.1527-6996.0000242).
- Boomhower, Judson, Meredith Fowlie, Jacob Gellman, and Andrew 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. June. <https://www.nber.org/papers/w32625>.

- Boomhower, Judson, Meredith Fowlie, and Andrew J. Plantinga. 2023. "Wildfire Insurance, Information, and Self-Protection." *AEA Papers and Proceedings* 113: 310–15. <https://doi.org/10.1257/pandp.20231104>.
- Botzen, W.J. Wouter, Olivier Deschenes, and Mark Sanders. 2019. "The Economic Impacts of Natural Disasters: A Review of Models and Empirical Studies." *Review of Environmental Economics and Policy* 13(2): 167–88. <https://doi.org/10.1093/reep/rez004>.
- Boyle, Alaina D., Graham Leggat, Larissa Morikawa, Yanni Pappas, and Jennie C. Stephens. 2021. "Green New Deal Proposals: Comparing Emerging Transformational Climate Policies at Multiple Scales." *Energy Research & Social Science* 81: 102259. <https://doi.org/10.1016/j.erss.2021.102259>.
- Bradt, Jacob T., Carolyn Kousky, and Oliver E. J. Wing. 2021. "Voluntary Purchases and Adverse Selection in the Market for Flood Insurance." *Journal of Environmental Economics and Management* 110: 102515. <https://doi.org/10.1016/j.jeem.2021.102515>.
- Brennan, Mark, Tanaya Srini, and Justin Steil. 2024. "High and Dry: Rental Markets After Flooding Disasters." *Urban Affairs Review* 60(6): 1806–38. <https://doi.org/10.1177/10780874241243355>.
- Brennan, Mark, Tanaya Srini, Justin Steil, Miho Mazereeuw, and Larisa Ovalles. 2022. "A Perfect Storm? Disasters and Evictions." *Housing Policy Debate* 32(1): 52–83. <https://doi.org/10.1080/10511482.2021.1942131>.
- Bromley-Trujillo, Rebecca, and Mirya R. Holman. 2020. "Climate Change Policymaking in the States: A View at 2020." *Publius: The Journal of Federalism* 50(3): 446–72. <https://doi.org/10.1093/publius/pjaa008>.
- Brulle, Robert J., and Riley E. Dunlap. 2021. "A Sociological View of the Effort to Obstruct Action on Climate Change." *ASA Footnotes*, vol. 49, no. 3. <https://www.asanet.org/footnotes-article/sociological-view-effort-obstruct-action-climate-change/>.
- Brulle, Robert J., and David N. Pellow. 2006. "Environmental Justice: Human Health and Environmental Inequalities." *Annual Review of Public Health* 27(1): 103–24. <https://doi.org/10.1146/annurev.publhealth.27.021405.102124>.
- Bugden, Dylan. 2023. "Color-Blind Racial Ideology and Beliefs About Environmental Inequality Among Local US Government Officials." *Environmental Politics* 33(4): 635–56. <https://doi.org/10.1080/09644016.2023.2265278>.
- Bugden, Dylan. 2024. "Environmental Inequality in the American Mind: The Problem of Color-Blind Environmental Racism." *Social Problems* 71(1): 106–27. <https://doi.org/10.1093/socpro/spac005>.
- Bullard, Robert D. 2000. *Dumping in Dixie: Race, Class, and Environmental Quality*. 3rd ed. Westview Press.
- Bullard, Robert D., ed. 2007. *Growing Smarter: Achieving Livable Communities, Environmental Justice, and Regional Equity*. MIT Press.
- Bullard, Robert D., and Beverly Wright. 2012. *The Wrong Complexion for Protection: How the Government Response to Disaster Endangers African American Communities*. NYU Press.
- Burton-Chellew, Maxwell N., Robert M. May, and Stuart A. West. 2013. "Combined Inequality in Wealth and Risk Leads to Disaster in the Climate Change Game." *Climatic Change* 120: 815–30. <https://doi.org/10.1007/s10584-013-0856-7>.
- California Office of Environmental Health Hazard Assessment. 2023. "CalEnviroScreen 4.0." OEHHA. May 1. <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40>.
- Carman, Jennifer P., Danning Lu, Matthew Ballew, et al. 2025. "Americans' Support for Climate Justice." *Environmental Science & Policy* 163: 103976. <https://doi.org/10.1016/j.envsci.2024.103976>.
- Chapman, Audrey R., and A. Karim Ahmed. 2021. "Climate Justice, Humans Rights, and the Case for Reparations." *Health and Human Rights* 23(2): 81–94.
- Cignarale, Tony, Joel Laucher, Kenneth Allen, and Lisbeth Landsman-Smith. 2017. *The Availability and Affordability of Coverage for Wildfire Loss in Residential Property Insurance in Wildland-Urban Interface and Other High-Risk Areas of California: CDI Summary and Proposed Solutions*. Technical report, California Department of Insurance. December. <https://www.insurance.ca.gov/0400-news/0100-press-releases/2018/upload/nr002-2018AvailabilityandAffordabilityofWildfireCoverage.pdf>.
- Clark, Mahalia B., Ephraim Knonya, and Gillian L. Galford. 2025. "Exodus of the Affluent? Examining Climate Hazards, Migration, and Household Income in the U.S." *Population and Environment*

- 47(28). <https://doi.org/10.1007/s11111-025-00496-5>.
- Climate Central. n.d. "U.S. Billion-Dollar Weather and Climate Disasters." Accessed May 21, 2026. <https://www.climatecentral.org/climate-services/billion-dollar-disasters>.
- Comerio, Mary C. 1998. *Disaster Hits Home: New Policy for Urban Housing Recovery*. University of California Press.
- Condon, Madison. 2023. "Climate Services: The Business of Physical Risk." *Arizona State Law Journal* 55: 147–209.
- Cornelissen, Sharon, Douglas Heller, and Michael Delong. 2024. *Exposed: A Report on 1.6 Trillion Dollars of Uninsured American Homes*. Consumer Federation of America. March 12. <https://consumerfed.org/reports/exposed-a-report-on-1-6-trillion-dollars-of-uninsured-american-homes/>.
- Crawford, Margaret C., Anamaria Bukvic, Santosh Rijal, and Julia M. Gohlke. 2023. "The Exposure of Vulnerable Coastal Populations to Flood-Induced Natchez Events in Hampton Roads, Virginia." *Natural Hazards* 119(3): 1633–63. <https://doi.org/10.1007/s11069-023-06148-x>.
- Cruz, José-Luis, and Esteban Rossi-Hansberg. 2024. "The Economic Geography of Global Warming." *Review of Economic Studies* 91(2): 899–939. <https://doi.org/10.1093/restud/rdad042>.
- Cunningham, Calum X., John T. Abatzoglou, Crystal A. Kolden, Grant J. Williamson, Markus Steuer, and David M. J. S. Bowman. 2025. "Climate-Linked Escalation of Societally Disastrous Wildfires." *Science* 390(6769): 53–8. <https://doi.org/10.1126/science.adr5127>.
- Curtis, Katherine J., Elizabeth Fussell, and Jack De-Waard. 2015. "Recovery Migration After Hurricanes Katrina and Rita: Spatial Concentration and Intensification in the Migration System." *Demography* 52(4): 1269–93. <https://doi.org/10.1007/s13524-015-0400-7>.
- Curtis, Katherine J., and Annemarie Schneider. 2011. "Understanding the Demographic Implications of Climate Change: Estimates of Localized Population Predictions Under Future Scenarios of Sea-Level Rise." *Population and Environment* 33: 28–54. <https://doi.org/10.1007/s11111-011-0136-2>.
- Cushing, Lara, Rachel Morello-Frosch, Madeline Wander, and Manuel Pastor. 2015. "The Haves, the Have-Nots, and the Health of Everyone: The Relationship Between Social Inequality and Environmental Quality." *Annual Review of Public Health* 36(1): 193–209. <https://doi.org/10.1146/annurev-publhealth-031914-122646>.
- Cutter, Susan L., Bryan J. Boruff, and W. Lynn Shirley. 2012. "Social Vulnerability to Environmental Hazards." In *Hazards Vulnerability and Environmental Justice*, edited by Susan L. Cutter. Routledge.
- Darr, Joshua P., Sarah D. Cate, and Daniel S. Moak. 2019. "Who'll Stop the Rain? Repeated Disasters and Attitudes Toward Government." *Social Science Quarterly* 100(7): 2581–93. <https://doi.org/10.1111/ssqu.12633>.
- DeLuca, Stefanie, and Eva Rosen. 2022. "Housing Insecurity Among the Poor Today." *Annual Review of Sociology* 48: 343–71. <https://doi.org/10.1146/annurev-soc-090921-040646>.
- Dennig, Francis. 2018. "Climate Change and the Re-Evaluation of Cost-Benefit Analysis." *Climatic Change* 151(1): 43–54. <https://doi.org/10.1007/s10584-017-2047-4>.
- Deryugina, Tatyana, Laura Kawano, and Steven Levitt. 2018. "The Economic Impact of Hurricane Katrina on Its Victims: Evidence from Individual Tax Returns." *American Economic Journal: Applied Economics* 10(2): 202–33. <https://doi.org/10.1257/app.20160307>.
- Domingue, Simone J., and Christopher T. Emrich. 2019. "Social Vulnerability and Procedural Equity: Exploring the Distribution of Disaster Aid Across Counties in the United States." *American Review of Public Administration* 49(8): 897–913. <https://doi.org/10.1177/0275074019856122>.
- Donoghoe, Manann, and Andre M. Perry. 2023. "The Case for Climate Reparations in the United States." Brookings Institution. March. <https://www.brookings.edu/articles/the-case-for-climate-reparations-in-the-united-states/>.
- Downey, Liam, and Brian Hawkings. 2008. "Race, Income, and Environmental Inequality in the United States." *Sociological Perspectives* 51(4): 759–81. <https://doi.org/10.1525/sop.2008.51.4.759>.
- Egan, Patrick J., and Megan Mullin. 2024. "US Partisan Polarization on Climate Change: Can Stalemate Give Way to Opportunity?" *PS: Political Science & Politics* 57(1): 30–5. <https://doi.org/10.1017/S1049096523000495>.
- Ellen, Ingrid Gould, Katharine Harwood, and Rachel Meltzer. 2026. "Tale of Two Storms: Neighborhood Racial Change After Hurricanes Sandy and

- Harvey." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 77–101. <https://doi.org/10.7758/RSF.2026.12.4.04>.
- Elliott, James R., Phylcia Lee Brown, and Kevin Loughran. 2020. "Racial Inequities in Federal Buyouts of Flood-Prone Homes: A Nationwide Assessment of Environmental Adaptation" *Socius: Sociological Research for a Dynamic World* 6: 1–15. <https://doi.org/10.1177/2378023120905439>.
- Elliott, James R., and Junia Howell. 2017. "Beyond Disasters: A Longitudinal Analysis of Natural Hazards' Unequal Impacts on Residential Instability." *Social Forces* 95(3): 1181–207. <https://doi.org/10.1093/sf/sow086>.
- Elliott, James R., Kevin Loughran, and Phylcia Lee Brown. 2023. "Divergent Residential Pathways from Flood-Prone Areas: How Neighborhood Inequalities Are Shaping Urban Climate Adaptation." *Social Problems* 70(4): 869–92. <https://doi.org/10.1093/socpro/spab059>.
- Elliott, James R., Kevin Loughran, A. Alexander Priest, and Phylcia Lee Brown. 2026. "The Revolving Door of Risk: Climate Hazards, Risk Containment, and the Hidden Social Dynamics of Managed Retreat." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 34–53. <https://doi.org/10.7758/RSF.2026.12.4.02>.
- Elliott, James R., and Matthew Thomas Clement. 2017. "Natural Hazards and Local Development: The Successive Nature of Landscape Transformation in the United States." *Social Forces* 96(2): 851–76. <https://doi.org/10.1093/sf/sox054>.
- Elliott, Rebecca. 2017. "Who Pays for the Next Wave? The American Welfare State and Responsibility for Flood Risk." *Politics & Society* 45(3): 415–40. <https://doi.org/10.1177/0032329217714785>.
- Elliott, Rebecca. 2019. "'Scarier than Another Storm': Values at Risk in the Mapping and Insuring of US Floodplains." *British Journal of Sociology* 70(3): 1067–90. <https://doi.org/10.1111/1468-4446.12381>.
- Elliott, Rebecca. 2021. *Underwater: Loss, Flood Insurance, and the Moral Economy of Climate Change in the United States*. Columbia University Press.
- Elliott, Rebecca. 2022. "Stopping the Flow: The Aspirational Elimination of Flood Insurance Cross-Subsidies in the United States and the United Kingdom." In *Climate, Society and Elemental Insurance*, edited by Kate Booth, Chloe Lucas, and Shaun French. Routledge.
- Finch, Christina, Christopher T. Emrich, and Susan L. Cutter. 2010. "Disaster Disparities and Differential Recovery in New Orleans." *Population and Environment* 31: 179–202. <https://doi.org/10.1007/s11111-009-0099-8>.
- Findlater, Kieran, Sophie Webber, Milind Kandlikar, and Simon Donner. 2021. "Climate Services Promise Better Decisions but Mainly Focus on Better Data." *Nature Climate Change* 11: 731–37. <https://doi.org/10.1038/s41558-021-01125-3>.
- Fothergill, Alice. 1996. "Gender, Risk, and Disaster." *International Journal of Mass Emergencies & Disasters* 14(1): 33–56. <https://doi.org/10.1177/028072709601400103>.
- Fothergill, Alice, and Lori A. Peek. 2004. "Poverty and Disasters in the United States: A Review of Recent Sociological Findings." *Natural Hazards* 32: 89–110. <https://doi.org/10.1023/B:NHAZ.0000026792.76181.d9>.
- Fothergill, Alice, and Lori Peek. 2015. *Children of Katrina*. University of Texas Press.
- Fothergill, Alice, and Lori Peek. 2017. "Kids, Creativity, and Katrina." *Contexts* 16(2): 65–7. <https://doi.org/10.1177/1536504217714263>.
- Fothergill, Alice, Enrique G. M. Maestas, and JoAnne DeRouen Darlington. 1999. "Race, Ethnicity and Disasters in the United States: A Review of the Literature." *Disasters* 23(2): 156–73. <https://doi.org/10.1111/1467-7717.00111>.
- Francis, Dania V., and Keren M. Horn. 2026. "Impacts of Climate Hazards on Employment and Earnings by Hazard Type, Industry, Race, and Ethnicity." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 134–55. <https://doi.org/10.7758/RSF.2026.12.4.06>.
- Freudenberg, William R., Robert Gramling, Shirley B. Laska, and Kai T. Erikson. 2012. *Catastrophe in the Making: The Engineering of Katrina and the Disasters of Tomorrow*. Island Press.
- Friedrich, Hannah K., Beth Tellmen, Jason R. Jurjevich, Mark Kear, and Laura Bakkensen. 2026. "'Do Battle with Insurance': Post-Hurricane Insurance Litigation in Southwest Louisiana." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 178–203. <https://doi.org/10.7758/RSF.2026.12.4.08>.
- Fussell, Elizabeth. 2015. "The Long-Term Recovery of New Orleans' Population After Hurricane Katrina." *American Behavioral Scientist* 59(10): 1111–28.

- 1231–45. <https://doi.org/10.1177/0002764215591181>.
- Fussell, Elizabeth, and Elizabeth Harris. 2014. "Homeownership and Housing Displacement After Hurricane Katrina Among Low-Income African-American Mothers in New Orleans." *Social Science Quarterly* 95(4): 1086–100. <https://doi.org/10.1111/ssqu.12114>.
- Fussell, Elizabeth, Lori M. Hunter, and Clark L. Gray. 2014. "Measuring the Environmental Dimensions of Human Migration: The Demographer's Toolkit." *Global Environmental Change* 28: 182–91. <https://doi.org/10.1016/j.gloenvcha.2014.07.001>.
- Fussell, Elizabeth, Sara R. Curran, Matthew D. Dunbar, Michael A. Babb, Luanne Thompson, and Jacqueline Meijer-Irons. 2017. "Weather-Related Hazards and Population Change: A Study of Hurricanes and Tropical Storms in the United States, 1980–2012." *Annals of the American Academy of Political and Social Sciences* 669(1): 146–67. <https://doi.org/10.1177/0002716216682942>.
- Fussell, Elizabeth, Linda Delp, Kevin Riley, Sergio Chávez, and Abel Valenzuela Jr. 2018. "Implications of Social and Legal Status on Immigrants' Health in Disaster Zones." *American Journal of Public Health* 108(12): 1617–20. <https://doi.org/10.2105/AJPH.2018.304554>.
- Fussell, Elizabeth, Narayan Sastry, and Mark VanLandingham. 2010. "Race, Socioeconomic Status, and Return Migration to New Orleans After Hurricane Katrina." *Population and Environment* 31(1–2): 20–42. <https://doi.org/10.1007/s11111-009-0092-2>.
- Gallagher, Justin, Daniel Hartley, and Shawn Rohlin. 2023. "Weathering an Unexpected Financial Shock: The Role of Federal Disaster Assistance on Household Finance and Business Survival." *Journal of the Association of Environmental and Resource Economists*, 10(2): 525–67. <https://doi.org/10.1086/721654>.
- Galster, George C., Joshua Galster, and Karl Vachuska. 2024. "The Color of Water: Racial and Income Differences in Exposure to Floods Across US Neighborhoods." *Real Estate Economics* 52(3): 753–93. <https://doi.org/10.1111/1540-6229.12480>.
- Garrett, Thomas A., and Russell S. Sobel. 2003. "The Political Economy of FEMA Disaster Payments." *Economic Inquiry* 41(3): 496–509. <https://doi.org/10.1093/ei/cbg023>.
- Gelles, David. 2024. "Hawaii Settles with Young Plaintiffs in Climate Case." *New York Times*, June 21, 2024. <https://www.nytimes.com/2024/06/21/climate/hawaii-youth-climate-lawsuit.html>.
- Gerber, Elisabeth R. 2013. "Partisanship and Local Climate Policy." *Cityscape* 15(1): 107–24.
- Gilmore, Elisabeth A., Carolyn Kousky, and Travis St. Clair. 2022. "Climate Change Will Increase Local Government Fiscal Stress in the United States." *Nature Climate Change* 12: 216–18. <https://doi.org/10.1038/s41558-022-01311-x>.
- Gladwin, Hugh, and Walter Gillis Peacock. 1997. "Warning and Evacuation: A Night for Hard Houses." In *Hurricane Andrew: Ethnicity, Gender, and the Sociology of Disasters*, edited by Walter Gillis Peacock, Hugh Gladwin, and Betty Hearn Morrow. Routledge.
- Gotham, Kevin Fox, and Miriam Greenberg. 2014. *Crisis Cities: Disaster and Redevelopment in New York and New Orleans*. Oxford University Press.
- Gould, Kenneth Alan, and Tammy L. Lewis. 2017. *Green Gentrification: Urban Sustainability and the Struggle for Environmental Justice*. Routledge.
- Gourevitch, Jesse D., and Carolyn Kousky. 2025. "New Homeowners Insurance Data Reveals Insights into Market Trends and Suggests Future Research Needs." *Risk Management and Insurance Review* 28(2): 324–38. <https://doi.org/10.1111/rmir.70010>.
- Gourevitch, Jesse D., Carolyn Kousky, Yanjun (Penny) Liao, et al. 2023. "Unpriced Climate Risk and the Potential Consequences of Overvaluation in US Housing Markets." *Nature Climate Change* 13(3): 250–57. <https://doi.org/10.1038/s41558-023-01594-8>.
- Graif, Corina. 2016. "(Un)natural Disaster: Vulnerability, Long-Distance Displacement, and the Extended Geography of Neighborhood Distress and Attainment After Katrina." *Population and Environment* 37: 288–318. <https://doi.org/10.1007/s11111-015-0243-6>.
- Grant, Don, Andrew Jorgeson, Wesley Longhofer, and Ion Bogdan ("Bodi") Vasi. 2026. "The Long Shadow of Partisan Hostility: How Affective Polarization Hinders Democracies' Ability to Mitigate Climate Change." *American Sociological Review* 91(1): 19–64. <https://doi.org/10.1177/00031224251396518>.
- Greenberg, Miriam, Hillary Angelo, Elena Losada, and Christopher C. Wilmers. 2024. "Relational Geographies of Urban Unsustainability: The En-

- tanglement of California's Housing Crisis with WUI Growth and Climate Change" *Proceedings of the National Academy of Sciences* 121(32): e2310080121. <https://doi.org/10.1073/pnas.2310080121>.
- Groen, Jeffrey A., and Anne E. Polivka. 2008. "The Effect of Hurricane Katrina on the Labor Market Outcomes of Evacuees." *American Economic Review* 98(2): 43–8. <https://doi.org/10.1257/aer.98.2.43>.
- Hale, Thomas. 2024. *Long Problems: Climate Change and the Challenge of Governing Across Time*. Princeton University Press.
- Hallegatte, Stéphane, and Patrice Dumas. 2009. "Can Natural Disasters Have Positive Consequences? Investigating the Role of Embodied Technical Change." *Ecological Economics* 68(3): 777–86. <https://doi.org/10.1016/j.ecolecon.2008.06.011>.
- Hallegatte, Stéphane, Adrien Vogt-Schilb, Julie Rozenberg, Mook Bangalore, and Chloé Beaudet. 2020. "From Poverty to Disaster and Back: A Review of the Literature." *Economics of Disasters and Climate Change* 4: 223–47. <https://doi.org/10.1007/s41885-020-00060-5>.
- Hamilton, James T. 1995. "Testing for Environmental Racism: Prejudice, Profits, Political Power?" *Journal of Policy Analysis and Management* 14(1): 107–32. <https://doi.org/10.2307/3325435>.
- Hankins, Don L. 2024. "Climate Resilience Through Ecocultural Stewardship." *Proceedings of the National Academy of Sciences* 121(32): e2310072121. <https://doi.org/10.1073/pnas.2310072121>.
- Haq, Gary, John Whitelegg, and Mervyn Kohler. 2008. *Growing Old in a Changing Climate: Meeting the Challenges of an Ageing Population and Climate Change*. Stockholm Environment Institute. https://www.sei.org/mediamanager/documents/Publications/Climate/climate_change_growing_old.pdf.
- Harlan, Sharon L., Anthony J. Brazel, G. Darrel Jenerette, et al. 2007. "In the Shade of Affluence: The Inequitable Distribution of the Urban Heat Island." In *Research in Social Problems and Public Policy: Equity and the Environment*, vol. 15, edited by Robert C. Wilkinson and William R. Freudenburg. Emerald Group Publishing Limited.
- Harlan, Sharon L., David N. Pellow, J. Timmons Roberts, Shannon Elisabeth Bell, William G. Holt, and Joane Nagel. 2015. "Climate Justice and Inequality." In *Climate Change and Society: Sociological Perspectives*, edited by Riley E. Dunlap and Robert J. Brulle. Oxford Academic.
- Hauer, Matthew E., Elizabeth Fussell, Valerie Mueller, et al. 2020. "Sea-Level Rise and Human Migration." *Nature Reviews Earth & Environment* 1: 28–39. <https://doi.org/10.1038/s43017-019-0002-9>.
- Hazlett, Chad, and Matto Mildenberger. 2020. "Wild-fire Exposure Increases Pro-Environment Voting Within Democratic but Not Republican Areas." *American Political Science Review* 114(4): 1359–65. <https://doi.org/10.1017/S0003055420000441>.
- Hernández, Diana, and Jennifer Laird. 2025. *Powerless: The People's Struggle for Energy*. Russell Sage Foundation.
- Hoffmann, Roman, Barbara Šedová, and Kira Vinke. 2021. "Improving the Evidence Base: A Methodological Review of the Quantitative Climate Migration Literature." *Global Environmental Change* 71: 102367. <https://doi.org/10.1016/j.gloenvcha.2021.102367>.
- Holifield, Ryan. 2001. "Defining Environmental Justice and Environmental Racism." *Urban Geography* 22(1): 78–90. <https://doi.org/10.2747/0272-3638.22.1.78>.
- Horowitz, Andy. 2020. *Katrina: A History, 1915–2015*. Harvard University Press.
- Howell, Junia, and James R. Elliott. 2018. "As Disaster Costs Rise, So Does Inequality." *Socius: Sociological Research for a Dynamic World* 4: 1–3. <https://doi.org/10.1177/2378023118816795>.
- Howell, Junia, and James R. Elliott. 2019. "Damages Done: The Longitudinal Impacts of Natural Hazards on Wealth Inequality in the United States." *Social Problems* 66(3): 448–67. <https://doi.org/10.1093/socpro/spy016>.
- Hsu, Angel, Glenn Sheriff, Tirthankar Chakraborty, and Diego Manya. 2021. "Disproportionate Exposure to Urban Heat Island Intensity Across Major US Cities." *Nature Communications* 12: 2721. <https://doi.org/10.1038/s41467-021-22799-5>.
- Hunter, Lori M., Jessie K. Luna, and Rachel M. Norton. 2015. "Environmental Dimensions of Migration." *Annual Review of Sociology* 41(1): 377–97. <https://doi.org/10.1146/annurev-soc-073014-112223>.
- Insurance Information Institute. 2023. *Homeowners Perception of Weather Risks: 2023Q2 Consumer Survey*. <https://www.iii.org/sites/default/files>

- /docs/pdf/2023_q2_ho_perception_of_weather_risks.pdf.
- Jbaily, Abdulrahman, Xiaodan Zhou, Jie Liu, et al. 2022. "Air Pollution Exposure Disparities Across US Population and Income Groups." *Nature* 601: 228–33. <https://doi.org/10.1038/s41586-021-04190-y>.
- Jerolleman, Alessandra, Elizabeth Marino, Nathan Jessee, et al. 2024. *People or Property: Legal Contradictions, Climate Resettlement, and the View from Shifting Ground*. Palgrave Macmillan.
- Jesdale, Bill M., Rachel Morello-Frosch, and Lara Cushing. 2013. "The Racial/Ethnic Distribution of Heat Risk-Related Land Cover in Relation to Residential Segregation." *Environmental Health Perspectives* 121(7): 811–17. <https://pmc.ncbi.nlm.nih.gov/articles/PMC3701995/pdf/ehp.1205919.pdf>.
- Kang, Susan, Jonathan Havercroft, Jacob Eisler, Antje Wiener, and Jo Shaw. 2023. "Climate Change and the Challenge to Liberalism." *Global Constitutionalism* 12(1): 1–10. <https://doi.org/10.1017/S2045381722000314>.
- Keenan, Jesse M., Thomas Hill, and Anurag Gumber. 2018. "Climate Gentrification: From Theory to Empiricism in Miami-Dade County, Florida." *Environmental Research Letters* 13(5): 054001. <https://doi.org/10.1088/1748-9326/aabb32>.
- Keys, Benjamin J., and Philip Mulder. 2024. "Property Insurance and Disaster Risk: New Evidence from Mortgage Escrow Data" NBER Working Paper No. 32579. National Bureau of Economic Research. <https://www.nber.org/papers/w32579>.
- Klinenberg, Eric. 2002. *Heat Wave: A Social Autopsy of Disaster in Chicago*. University of Chicago Press.
- Klinenberg, Eric, Malcolm Aroas, and Liz Koslov. 2020. "Sociology and the Climate Crisis." *Annual Review of Sociology* 46: 694–69. <https://doi.org/10.1146/annurev-soc-121919-054750>.
- Knighton, James, Kelly Hondula, Cielo Sharkus, and Rebecca Elliott. 2021. "Flood Risk Behaviors of United States Riverine Metropolitan Areas Are Driven by Local Hydrology and Shaped by Race." *Proceedings of the National Academy of Sciences* 118(13): e2016839118. <https://doi.org/10.1073/pnas.2016839118>.
- Korver-Glenn, Elizabeth, Robin Bartram, and Max Besbris. 2023. "Housing Market Intermediaries." In *The Sociology of Housing: How Homes Shape Our Social Lives*, edited by Brian J. McCabe and Eva Rosen. University of Chicago Press.
- Koslov, Liz. 2016. "The Case for Retreat." *Public Culture* 28(2): 359–87. <https://doi.org/10.1215/08992363-3427487>.
- Kousky, Carolyn. 2014. "Informing Climate Adaptation: A Review of the Economic Costs of Natural Disasters." *Energy Economics* 46: 576–92. <https://doi.org/10.1016/j.eneco.2013.09.029>.
- Kousky, Carolyn. 2016. "Impacts of Natural Disasters on Children." *Future of Children* 26(1): 73–92.
- Kousky, Carolyn. 2018. "Financing Flood Losses: A Discussion of the National Flood Insurance Program." *Risk Management and Insurance Review* 21(1): 11–32. <https://doi.org/10.1111/rmir.12090>.
- Kousky, Carolyn. 2019. "The Role of Natural Disaster Insurance in Recovery and Risk Reduction." *Annual Review of Resource Economics* 11: 399–418. <https://doi.org/10.1146/annurev-resource-100518-094028>.
- Kousky, Carolyn, Howard Kunreuther, Michael LaCour-Little, and Susan Wachter. 2020. "Flood Risk and the U.S. Housing Market." *Journal of Housing Research* 29(sup1): S3–S24. <https://doi.org/10.1080/10527001.2020.1836915>.
- Kousky, Carolyn, Brett Lingle, and Leonard Shabman. 2017. "The Pricing of Flood Insurance." *Journal of Extreme Events* 4(2): 1750001. <https://doi.org/10.1142/S2345737617500014>.
- Kousky, Carolyn, and Xuesong You. 2024. "The Role of Insurers in Driving Post-Hurricane Risk Reduction Investments." *NPJ Natural Hazards* 1: 36. <https://doi.org/10.1038/s44304-024-00035-6>.
- Krysan, Maria, and Kyle Crowder. 2017. *Cycle of Segregation: Social Processes and Residential Stratification*. Russell Sage Foundation.
- Kusnetz, Nicholas, Lee Hedgepeth, Amy Green, et al. 2023. "US Regions Will Suffer a Stunning Variety of Climate-Caused Disasters, Report Finds." *Inside Climate News*. November 16. https://insideclimatenews.org/news/16112023/fifth-national-climate-assessment-regional-impacts/?gad_source=1&gclid=CjwKCAiA74G9BhAEEiwA8kNfpTeVJrmwCKNrYwtmone7b-vJ4IsLnGKj5xfL6RAFsZrPrps8CVtc_xoCgZYQAvD_BwE.
- Lane, Haley M., Rachel Morello-Frosch, Julian D. Marshall, and Joshua S. Apte. 2022. "Historical Redlining Is Associated with Present-Day Air Pollution Disparities in U.S. Cities." *Environmental Science & Technology Letters* 9(4): 345–50. <https://doi.org/10.1021/acs.estlett.1c01012>.

- Lasswell, Harold D. 1936. *Politics: Who Gets What, When, How*. Whittlesey House.
- Leppold, Claire, Lisa Gibbs, Karen Block, Lennart Reifels, and Phoebe Quinn. 2022. "Public Health Implications of Multiple Disaster Exposures." *Lancet Public Health* 7(3): e274–e286.
- Lindsay, Sally, Shaelynn Hsu, Sharmigaa Ragunathan, and John Lindsay. 2023. "The Impact of Climate Change Related Extreme Weather Events on People with Pre-Existing Disabilities and Chronic Conditions: A Scoping Review." *Disability and Rehabilitation* 45(25): 4338–58. <https://doi.org/10.1080/09638288.2022.2150328>.
- Logan, John R., Sukriti Issar, and Zengweng Xu. 2016. "Trapped in Place? Segmented Resilience to Hurricane in the Gulf Coast, 1970–2005." *Demography* 53(5): 1511–34. <https://doi.org/10.1007/s13524-016-0496-4>.
- Logan, John R., and Harvey Molotch. 1987. *Urban Fortunes: The Political Economy of Place*. University of California Press.
- Loughran, Kevin, and James R. Elliott. 2019. "Residential Buyouts as Environmental Mobility: Examining Where Homeowners Move to Illuminate Social Inequities in Climate Adaptation." *Population and Environment* 41: 52–70. <https://doi.org/10.1007/s11111-019-00324-7>.
- Loughran, Kevin, and James R. Elliott. 2022. "Unequal Retreats: How Racial Segregation Shapes Climate Adaptation." *Housing Policy Debate* 32(1): 171–89. <https://doi.org/10.1080/10511482.2021.1931928>.
- Mach, Katharine J., Caroline M. Kraan, Miyuki Hino, A. R. Siders, Erica M. Johnston, and Christopher B. Field. 2019. "Managed Retreat Through Voluntary Buyouts of Flood-Prone Properties." *Science Advances* 5(10): eaax8995. <https://doi.org/10.1126/sciadv.aax8995>.
- Mankin, Justin S. 2024. "The People Have a Right to Climate Data." *New York Times*, January 20, 2024. <https://www.nytimes.com/2024/01/20/opinion/climate-risk-disasters-data.html>.
- Mann, Samuel, Tara McKay, and Gilbert Gonzales. 2024. "Climate Change-Related Disasters and the Health of LGBTQ+ Populations." *Journal of Climate Change and Health* 18: 100304. <https://doi.org/10.1016/j.joclim.2024.100304>.
- Marshall, Renae, and Matthew G. Burgess. 2022. "Advancing Bipartisan Decarbonization Policies: Lessons from State-Level Successes and Failures." *Climatic Change* 171: 17. <https://doi.org/10.1007/s10584-022-03335-w>.
- Marx, Rebecca, and Jorge Morales-Burnett. 2022. *Centering Equity to Address Extreme Heat: Preparing Communities for Hotter Days*. Urban Institute. February 16. <https://www.urban.org/research/publication/centering-equity-address-extreme-heat>.
- McAlpine, Steven A., and Jeremy R. Porter. 2018. "Estimating Recent Local Impacts of Sea-Level Rise on Current Real-Estate Losses: A Housing Market Case Study in Miami-Dade, Florida." *Population Research and Policy Review* 37(6): 871–95. <https://doi.org/10.1007/s11113-018-9473-5>.
- McConnell, Kathryn, and Liz Koslov. 2024. "Critically Assessing the Idea of Wildfire Managed Retreat." *Environmental Research Letters* 19(4): 041005. <https://doi.org/10.1088/1748-9326/ad31d9>.
- McDaniel, Tyler W. 2026. "The Impacts of Repeated Disasters on School Attendance and Learning." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 156–77. <https://doi.org/10.7758/RSF.2026.12.4.07>.
- McIntosh, Molly Fifer. 2008. "Measuring the Labor Market Impacts of Hurricane Katrina Migration: Evidence from Houston, Texas." *American Economic Review* 98(2): 54–7. <https://doi.org/10.1257/aer.98.2.54>.
- McKibben, Bill. 2025. *Here Comes the Sun: A Last Chance for the Climate and a Fresh Chance for Civilization*. W.W. Norton & Company.
- Méndez, Michael. 2020. *Climate Change from the Streets: How Conflict and Collaboration Strengthen the Environmental Justice Movement*. Yale University Press.
- Méndez, Michael, Genevieve Flores-Haro, and Lucas Zucker. 2020. "The (In)Visible Victims of Disaster: Understanding the Vulnerability of Undocumented Latino/a and Indigenous Immigrants." *GeoForum* 116: 50–62. <https://doi.org/10.1016/j.geoforum.2020.07.007>.
- Méndez, Michael, Manuel Pastor, and Angelu C. Lesaca. 2024. "Climate Change, Migration, and Health Disparities at and Beyond the US-Mexico Border." *JAMA* 331(8): 696–97. <https://doi.org/10.1001/jama.2024.0228>.
- Mitchell, Bruce Coffyn, and Jayajit Chakraborty. 2018. "Exploring the Relationship Between Residential Segregation and Thermal Inequity in 20 U.S. Cities." *Local Environment* 23(8): 796–813. <https://doi.org/10.1080/13549839.2018.1474861>.

- Mohai, Paul, David Pellow, and J. Timmons Roberts. 2009. "Environmental Justice." *Annual Review of Environment and Resources* 34: 405–30. <https://doi.org/10.1146/annurev-environ-082508-094348>.
- Mohai, Paul, and Robin Saha. 2007. "Racial Inequality in the Distribution of Hazardous Waste: A National-Level Reassessment." *Social Problems* 54(3): 343–70. <https://doi.org/10.1525/sp.2007.54.3.343>.
- Morello-Frosch, Rachel, and Russ Lopez. 2006. "The Riskscape and the Color Line: Examining the Role of Segregation in Environmental Health Disparities." *Environmental Research* 102(2): 181–96. <https://doi.org/10.1016/j.envres.2006.05.007>.
- Morello-Frosch, Rachel, and Osagie K. Obasogie. 2023. "The Climate Gap and the Color Line—Racial Health Inequities and Climate Change." *New England Journal of Medicine* 388(10): 943–49. <https://doi.org/10.1056/nejmsb2213250>.
- Mulder, Philip, and Carolyn Kousky. 2023. "Risk Rating Without Information Provision." *AEA Papers and Proceedings* 113: 299–303. <https://doi.org/10.1257/pandp.20231102>.
- Mullin, Megan. 2026. "Social Class Targeting of Property Buyouts." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 254–71. <https://doi.org/10.7758/RSF.2026.12.4.11>.
- Nardone, Anthony, Kara E. Rudolph, Rachel Morello-Frosch, and Joan A. Casey. 2021. "Redlines and Greenspace: The Relationship Between Historical Redlining and 2010 Greenspace Across the United States." *Environmental Health Perspectives* 129(1): 017006.
- National Academies of Sciences, Engineering, and Medicine (NASEM). 2022. *Communities, Climate Change, and Health Equity: Proceedings of a Workshop—in Brief*. National Academies Press.
- National Academies of Sciences, Engineering, and Medicine (NASEM). 2025. *Effects of Human-Caused Greenhouse Gas Emissions on U.S. Climate, Health, and Welfare*. National Academies Press.
- National Oceanic and Atmospheric Administration (NOAA). 2025. "National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters." <https://doi.org/10.25921/stkw-7w73>.
- Oh, Sangmin, Ishita Sen, and Ana-Maria Tenekedjieva. Forthcoming. "Pricing of Climate Risk Insurance: Regulation and Cross-Subsidies." *Journal of Finance*. <http://dx.doi.org/10.2139/ssrn.3762235>.
- Oreskes, Naomi, and Erik M. Conway. 2011. *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Climate Change*. Bloomsbury Publishing.
- Ortega, Francesc, and Süleyman Taşpınar. 2018. "Rising Sea Levels and Sinking Property Values: Hurricane Sandy and New York's Housing Market." *Journal of Urban Economics* 106: 81–100. <https://doi.org/10.1016/j.jue.2018.06.005>.
- Pais, Jeremy F., and James R. Elliott. 2008. "Places as Recovery Machines: Vulnerability and Neighborhood Change After Major Hurricanes." *Social Forces* 86(4): 1415–53. <https://doi.org/10.1353/sof.0.0047>.
- Pastor, Manuel, Robert D. Bullard, James K. Boyce, Alice Fothergill, Rachel Morello-Frosch, and Beverly Wright. 2006. *In the Wake of the Storm: Environment, Disaster, and Race After Katrina*. Russell Sage Foundation.
- Pastor, Manuel, J. Mijin Cha, Michael Méndez, and Rachel Morello-Frosch. 2024. "California Dreaming: Why Environmental Justice Is Integral to the Success of Climate Change Policy." *Proceedings of the National Academy of Sciences* 121(32): e2310073121. <https://doi.org/10.1073/pnas.2310073121>.
- Pastor, Manuel, Jim Sadd, and John Hipp. 2001. "Which Came First? Toxic Facilities, Minority Move-In, and Environmental Justice." *Journal of Urban Affairs* 23(1): 1–21. <https://doi.org/10.1111/0735-2166.00072>.
- Peacock, Walter Gillis, Shannon Van Zandt, Yang Zhang, and Wesley E. Highfield. 2014. "Inequities in Long-Term Housing Recovery After Disasters." *Journal of the American Planning Association* 80(4): 356–71. <https://doi.org/10.1080/01944363.2014.980440>.
- Public Environmental Data Partners. n.d. "EJ Screen." *Data & Screening Tools*. <https://screening-tools.com/>.
- Qiang, Yi. 2019. "Disparities of Population Exposed to Flood Hazards in the United States." *Journal of Environmental Management* 232: 295–304. <https://doi.org/10.1016/j.jenvman.2018.11.039>.
- Rabe, Barry G. 2008. "States on Steroids: The Inter-governmental Odyssey of American Climate Policy." *Review of Policy Research* 25(2): 105–28. <https://doi.org/10.1111/j.1541-1338.2007.00314.x>.
- Rabe, Barry G. 2023. "Racing to the Top, the Bottom,

- or the Middle of the Pack? The Evolving State Government Role in Environmental Protection," In *Environmental Policy: New Directions for the Twenty-First Century*, 12th ed., edited by Michael E. Kraft, Barry G. Rabe, and Normal J. Vig. CQ Press.
- Radeloff, Volker C., David P. Helmers, H. Anu Kramer, et al. 2018. "Rapid Growth of the US Wildland-Urban Interface Raises Wildfire Risk." *Proceedings of the National Academy of Sciences* 115(13): 3314–19. <https://doi.org/10.1073/pnas.1718850115>.
- Raker, Ethan J. 2020. "Natural Hazards, Disasters, and Demographic Change: The Case of Severe Tornadoes in the United States, 1980–2010." *Demography* 57(2): 653–74. <https://doi.org/10.1007/s13524-020-00862-y>.
- Raker, Ethan J. 2023. "Stratifying Disaster: State Aid, Institutional Processes, and Inequality in American Communities." *Social Forces* 102(2): 430–53. <https://doi.org/10.1093/sf/soad050>.
- Read, Amy. 2025. "Repeated Disaster and the Economic Valuation of Place: Temporal Dynamics of Tornado Effects on Housing Prices in the United States, 1980–2010." *Population and Environment* 47: 29. <https://doi.org/10.1007/s11111-025-00502-w>.
- Reardon, Sean F., and Kendra Bischoff. 2011. "Income Inequality and Income Segregation." *American Journal of Sociology* 116(4): 1092–1153. <https://doi.org/10.1086/657114>.
- Reeves, Andrew. 2011. "Political Disaster: Unilateral Powers, Electoral Incentives, and Presidential Disaster Declarations." *Journal of Politics* 73(4): 1142–51. <https://doi.org/10.1017/s0022381611000843>.
- Rhodes, Anna, and Max Besbris. 2022a. *Soaking the Middle Class: Suburban Inequality and Recovery from Disaster*. Russell Sage Foundation.
- Rhodes, Anna, and Max Besbris. 2022b. "Best Laid Plans: How the Middle-Class Make Residential Decisions Post-Disaster." *Social Problems* 69(4): 1137–53. <https://doi.org/10.1093/socpro/spab026>.
- Rhodes, Anna, and Max Besbris. 2022c. "Losing Your Neighborhood to Climate Change Is Sometimes Necessary." *New York Times*, August 24. <https://www.nytimes.com/2022/08/24/opinion/houston-flooding-climate-change.html>.
- Rhodes, Anna, and Max Besbris. 2024. "A Rapidly Changing Ecology of Aid: Accepting Help and Stigma in the Aftermath of Disaster." *Qualitative Sociology* 47(3): 465–92. <https://doi.org/10.1007/s11133-024-09568-8>.
- Ringquist, Evan J. 2005. "Assessing Evidence of Environmental Inequities: A Meta-Analysis." *Journal of Policy Analysis and Management* 24(2): 223–47. <https://doi.org/10.1002/pam.20088>.
- Rode, Ashwin, Rachel E. Baker, Tamma Carleton, et al. 2022. "Labor Disutility in a Warmer World: The Impact of Climate Change on the Global Workforce." *Social Science Research Network*. September 28. <https://doi.org/10.2139/ssrn.4221478>.
- Rosen, Yereth. 2024. "Relocation of Eroding Alaska Native Village Seen as a Test Case." *Alaska Public Media*, April 22. <https://alaskapublic.org/news/2024-04-22/relocation-of-eroding-alaska-native-village-seen-as-a-test-case>.
- Sacerdote, Bruce. 2012. "When the Saints Go Marching Out: Long-Term Outcomes for Student Evacuees from Hurricanes Katrina and Rita." *American Economic Journal: Applied Economics* 4(1): 109–35. <https://doi.org/10.1257/app.4.1.109>.
- Sadd, James L., Manuel Pastor Jr., J. Thomas Boer, and Lori D. Snyder. 1999. "Every Breath You Take. . .: The Demographics of Toxic Air Releases in Southern California." *Economic Development Quarterly* 13(2): 107–23. <https://doi.org/10.1177/089124249901300201>.
- Saha, Robin, and Paul Mohai. 2005. "Historical Context and Hazardous Waste Facility Siting: Understanding Temporal Patterns in Michigan." *Social Problems* 52(4): 681–48. <https://doi.org/10.1525/sp.2005.52.4.618>.
- Sastry, Parinitha. 2022. "Who Bears Flood Risk? Evidence from Mortgage Markets in Florida." *Social Science Research Network*. December 28. <https://doi.org/10.2139/ssrn.4306291>.
- Sastry, Parinitha, Ishita Sen, Ana-Maria Tenekedjiev, and Therese C. Scharlemann. 2024. "The Insurance Protection Gap." *Social Science Research Network*. September 4. <https://ssrn.com/abstract=4909444>.
- Schlenker, Wolfram, and Michael J. Roberts. 2009. "Nonlinear Temperature Effects Indicate Severe Damages to U.S. Crop Yields Under Climate Change." *Proceedings of the National Academy of Sciences* 106(37): 15594–98. <https://doi.org/10.1073/pnas.0906865106>.
- Schlosberg, David, and Lisette B. Collins. 2014. "From Environmental to Climate Justice: Climate

- Change and the Discourse of Environmental Justice." *Wires Climate Change* 5(3): 359–74. <https://doi.org/10.1002/wcc.275>.
- Seltzer, Nathan, and Jenna Nobles. 2017. "Post-Disaster Fertility: Hurricane Katrina and the Changing Racial Composition of New Orleans." *Population and Environment* 38: 465–90. <https://doi.org/10.1007/s11111-017-0273-3>.
- Sharkey, Patrick. 2007. "Survival and Death in New Orleans: An Empirical Look at the Human Impact of Katrina." *Journal of Black Studies* 37(4): 482–501. <https://doi.org/10.1177/0021934706296188>.
- Shokry, Galia, Isabelle Anguelovski, James J. T. Connolly, Andrew Maroko, and Hamil Pearsall. 2022. "'They Didn't See It Coming': Green Resilience Planning and Vulnerability to Future Climate Gentrification." *Housing Policy Debate* 32(1): 211–45. <https://doi.org/10.1080/10511482.2021.1944269>.
- Shonkoff, Seth B., Rachel Morello-Frosch, Manuel Pastor, and James Sadd. 2011. "The Climate Gap: Environmental Health and Equity Implications of Climate Change and Mitigation Policies in California—a Review of the Literature." *Climatic Change* 109(sup1): 485–503. <https://doi.org/10.1007/s10584-011-0310-7>.
- Siders, Anne R. 2019. "Social Justice Implications of US Managed Retreat Buyout Programs." *Climatic Change* 152: 239–57. <https://doi.org/10.1007/s10584-018-2272-5>.
- Siders, Anne R., and Jesse M. Keenan. 2020. "Variables Shaping Coastal Adaptation Decisions to Armor, Nourish, and Retreat in North Carolina." *Ocean & Coastal Management* 183: 105023. <https://doi.org/10.1016/j.ocecoaman.2019.105023>.
- Simms, Jessica R. Z., Hellen L. Waller, Chris Brunet, and Pamela Jenkins. 2021 "The Long Goodbye on a Disappearing, Ancestral Island: A Just Retreat from Isle de Jean Charles." *Journal of Environmental Studies and Sciences* 11: 316–28. <https://doi.org/10.1007/s13412-021-00682-5>.
- Smiley, Kevin T. 2020. "Social Inequalities in Flooding Inside and Outside of Floodplains During Hurricane Harvey." *Environmental Research Letters* 15(9): 0940b3. <https://doi.org/10.1088/1748-9326/aba0fe>.
- Smiley, Kevin T., Junia Howell, and James R. Elliott. 2018. "Disasters, Local Organizations, and Poverty in the USA, 1998 to 2015." *Population and Environment* 40: 115–35. <https://doi.org/10.1007/s11111-018-0304-8>.
- Smith, Stanley K., and Christopher McCarty. 1996. "Demographic Effects of Natural Disasters: A Case Study of Hurricane Andrew." *Demography* 33(2): 265–75. <https://doi.org/10.2307/2061876>.
- Sovacool, Benjamin K., Shannon Elizabeth Bell, Cara Daggett, et al. 2023. "Pluralizing Energy Justice: Incorporating Feminist, Anti-Racist, Indigenous, and Postcolonial Perspectives." *Energy Research & Social Science* 97: 102996. <https://doi.org/10.1016/j.erss.2023.102996>.
- Srivastav, Sugandha, and Ryan Rafaty. 2023. "Political Strategies to Overcome Climate Policy Obstructionism." *Perspectives on Politics* 21(2): 640–50. <https://doi.org/10.1017/S1537592722002080>.
- Stokes, Leah C. 2020. *Short Circuiting Policy: Interest Groups and the Battle over Clean Energy and Climate Policy in the American States*. Oxford Academic.
- Stough, Laura M., Edgar Villarreal, and Linda G. Castillo. 2010. "Disaster and Social Vulnerability: The Case of Undocumented Mexican Migrant Workers." In *How Ethnically Marginalized Americans Cope with Catastrophic Disasters: Studies in Suffering and Resiliency*, edited by Jason D. Rivera and DeMond S. Miller. Edwin Mellen Press.
- Sugg, Margaret, Jennifer Runkle, Ronnie Leeper, et al. 2020. "A Scoping Review of Drought Impacts on Health and Society in North America." *Climatic Change* 162: 1177–95. <https://doi.org/10.1007/s10584-020-02848-6>.
- Supran, Geoffrey, Stefan Rahmstorf, and Naomi Oreskes. 2023. "Assessing ExxonMobil's Global Warming Projections." *Science* 379: eabk6628. <https://doi.org/10.1126/science.abk0063>.
- Tate, Eric, Md Asif Rahman, Christopher T. Emrich, and Christopher C. Sampson. 2021. "Flood Exposure and Social Vulnerability in the United States." *Natural Hazards* 106: 435–57. <https://doi.org/10.1007/s11069-020-04470-2>.
- Taylor, Dorceta E. 2000. "The Rise of the Environmental Justice Paradigm: Injustice Framing and the Social Construction of Environmental Discourses." *American Behavioral Scientist* 43(4): 508–80. <https://doi.org/10.1177/0002764200043004003>.
- Taylor, Dorceta E. 2014. *Toxic Communities: Environ-*

- mental Racism, Industrial Pollution, and Residential Mobility*. NYU Press.
- Tierney, Kathleen. 2014. *The Social Roots of Risk: Producing Disasters, Promoting Resilience*. Stanford University Press.
- Tierney, Kathleen. 2019. *Disasters: A Sociological Approach*. Polity Press.
- Thomas, Kimberley, R. Dean Hardy, Heather Lazrus, et al. 2019. "Explaining Differential Vulnerability to Climate Change: A Social Science Review." *Wires Climate Change* 10(2): e565. <https://doi.org/10.1002/wcc.565>.
- Thompson, Rebecca R., Dana Rose Garfin, and Roxane Cohen Silver. 2017. "Evacuation from Natural Disasters: A Systemic Review of the Literature." *Risk Analysis* 37(4): 812–39. <https://doi.org/10.1111/risa.12654>.
- Torche, Florencia, Jason Fletcher, and Jennie E. Brand. 2024. "Disparate Effects of Disruptive Events on Children." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 10(1): 1–30. <https://doi.org/10.7758/rsf.2024.10.1.01>.
- Trachtman, Samuel. 2023. "Policy Feedback and Interdependence in American Federalism: Evidence from Rooftop Solar Politics." *Perspectives on Politics* 21(2): 462–77. <https://doi.org/10.1017/S153759272100092X>.
- United Church of Christ Commission for Racial Justice. 1987. *Toxic Wastes and Race in the United States: A National Report on the Racial and Socio-Economic Characteristics of Communities with Hazardous Waste Sites*. United Church of Christ Commission for Racial Justice. <https://www.nrc.gov/docs/ml1310/ml13109a339.pdf>.
- Valencia-Uribe, Claudia, Carlo A. Chunga Pizzaro, and Michael Méndez. 2026. "Growing Adaptability Among Undocumented Communities During Climate-Induced Disasters: An Analysis of the Role of Migrant-Serving Organizations." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 206–31. <https://doi.org/10.7758/RSF.2026.12.4.09>.
- Varela Varela, Ana. 2023. "Surge of Inequality: How Different Neighborhoods React to Flooding." Social Science Research Network. April 3. <https://ssrn.com/abstract=4396481>.
- Vigdor, Jacob. 2008. "The Economic Aftermath of Hurricane Katrina." *Journal of Economic Perspectives* 22(4): 135–54. <https://doi.org/10.1257/jep.22.4.135>.
- Vilá, Olivia, Gavin Smith, Bethany Cutts, Samata Gyawali, and Samiksha Bhattarai. 2022. "Equity in FEMA Hazard Mitigation Assistance Programs: The Role of State Hazard Mitigation Offices." *Environmental Science & Policy* 136: 632–41. <https://doi.org/10.1016/j.envsci.2022.07.027>.
- Wagner, Katherine R. H. 2022. "Adaptation and Adverse Selection in Markets for Natural Disaster Insurance." *American Economic Journal: Economic Policy* 14(3): 380–421. <https://doi.org/10.1257/pol.20200378>.
- Waters, Mary C. 2025. "Preparing for Climate Migration and Integration: A Policy and Research Agenda." *Journal of Ethnic and Migration Studies* 51(1): 4–23. <https://doi.org/10.1080/1369183X.2024.2438449>.
- Webber, Sophie, and Simon D. Donner. 2017. "Climate Service Warnings: Cautions About Commercializing Climate Science for Adaptation in the Developing World." *Wires Climate Change* 8(1): e424. <https://doi.org/10.1002/wcc.424>.
- Weill, Joakim A. 2023. "Flood Risk Mapping and the Distributional Impacts of Climate Information." *Finance and Economics Discussion Series*, no. 2023–066: 1–95. <https://dx.doi.org/10.17016/FEDS.2023.066>.
- Willse, Cadence. 2026. "Navigating the Storm: Natural Disasters and the Policy Process." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 232–53. <https://doi.org/10.7758/RSF.2026.12.4.10>.
- Wilson, Bev. 2020. "Urban Heat Management and the Legacy of Redlining." *Journal of the American Planning Association* 86(4): 443–57. <https://doi.org/10.1080/01944363.2020.1759127>.
- Wing, Oliver E. J., William Lehman, Paul D. Bates, et al. 2022. "Inequitable Patterns of US Flood Risk in the Anthropocene." *Nature Climate Change* 12: 156–62. <https://doi.org/10.1038/s41558-021-01265-6>.
- Wohl, Hannah, and Max Besbris. 2024. "Relational Brokerage: Interaction and Valuation in Two Markets." *Qualitative Sociology* 47: 1–21. <https://doi.org/10.1007/s11133-023-09553-7>.
- Xu, Chi, Timothy A. Kohler, Timothy M. Lenton, Jens-Christian Svenning, and Marten Scheffer. 2020. "Future of the Human Climate Niche." *Proceedings of the National Academy of Sciences* 117(21): 11350–55. <https://doi.org/10.1073/pnas.1910114117>.
- Yabe, Takahiro, and Satish V. Ukkusuri. 2020. "Effects of Income Inequality on Evacuation, Reentry

- and Segregation After Disaster." *Transportation Part D: Transport and Environment* 82: 102260. <https://doi.org/10.1016/j.trd.2020.102260>.
- Zahnow, Renee, Ali Rad Yousefnia, Mahnoosh Has-sankhani, and Ali Cheshmehzangi. 2025. "Climate Change Inequalities: A Systematic Review of Disparities in Access to Mitigation and Adaptation Measures." *Environmental Science & Policy* 165: 104021. <https://doi.org/10.1016/j.envsci.2025.104021>.
- Zhang, Lei. 2016. "Flood Hazards Impact on Neighborhood House Prices: A Spatial Quantile Regression Analysis." *Regional Science and Urban Economics* 60: 12–9. <https://doi.org/10.1016/j.regsciurbeco.2016.06.005>.
- Zraick, Karen. 2024. "Climate Lawsuits Are Exploding. Are Homicide Charges Next?" *New York Times*, September 12. <https://www.nytimes.com/2024/09/12/climate/climate-lawsuits-major-cases.html>.

PART I

Housing, Neighborhoods, and Mobility

The Revolving Door of Risk: Climate Hazards, Risk Containment, and the Hidden Social Dynamics of Managed Retreat



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Nationwide, flood risks are encouraging local authorities to implement a federal policy known as managed retreat. The program offers homeowners a fair market price to voluntarily relinquish their properties for demolition and move elsewhere, thereby subsidizing residential relocation as a means of climate adaptation. Despite widespread implementation, we know little about how people move or how many move from places where the program intervenes. To illuminate these dynamics, we review sociological theories of residential mobility. We then analyze novel address-level data on residential relocation and home flood risk in majority-White areas where managed retreat has predominated. Results indicate that most moves in these zones of retreat occur through the market, not through the program; they are also disproportionately undertaken by households able to relocate to safer housing in more affluent neighborhoods nearby. The result is a revolving door of risk that has major implications for local resilience.

Keywords: climate change, adaptation, managed retreat, residential mobility, climate policy, social inequality

A growing body of research, including popular books such as *The Great Displacement* (Bittle 2024) and *On the Move* (Lustgarten 2024), argues that it is no longer a matter of if, but when mil-

lions of Americans will move from homes threatened by our growing climate crisis (see also Shu et al. 2023). In many places that “when” has already arrived, assisted by an ascendant policy

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known as managed retreat (US Government Accountability Office 2022). The policy's intent is to remove housing in particularly risky areas by paying owners a fair market price and then demolishing their property, often after a major disaster—think residential relocation with risk elimination. The Federal Emergency Management Agency's (FEMA) property acquisition, or buyout, program constitutes the largest such effort. Now implemented in more than five hundred cities and towns in every state in the country, the initiative empowers local authorities to conduct cost-benefit assessments of likely losses from future flooding and then apply for funds to purchase and raze housing in the most precarious places (Elliott et al. 2020). Policymakers frame these buyouts as a “cost-effective” tool for reducing local climate risks, especially in places where investments in hard infrastructure such as dikes, flood walls, and levees vastly exceed the economic value of nearby housing (Siders and Keenan 2020; see also Besbris and Elliott et al. 2024; Ehrenfeucht and Nelson 2022; Jerolleman et al. 2024).

The present study takes a closer look at the climate mobilities emerging from these zones of retreat (Boas et al. 2022). Such investigation is necessary, we think, for a couple of reasons. One is that the bulk of existing research on the subject remains case-oriented in design, which while valuable, limits understanding of how the federal policy is unfolding nationwide. Another reason is that most existing work focuses on the politics and procedures of home acquisition rather than on the residential relocations that result. The present study aims to fill both gaps and, in the process, illuminate some of the hidden social dynamics of retreat as a form of climate mobility. We do this by developing and empirically assessing three propositions derived from prior sociological work on risk containment, community, and residential mobility. The first proposition is that when it comes to reducing environmental risk, the policy of managed retreat is more symbolic than comprehensive. This is because the federal government cannot afford to buy out all flood-prone housing, leaving most movers instead to exit through the market rather than through managed retreat programs, even in places where the latter are implemented. As a result, most housing in des-

ignated zones of retreat simply shifts from one round of residents to the next, rather than being removed altogether. The second proposition is that such moves, regardless of how they occur, bear the social imprint of attached attainment, which favors more privileged residents who can afford to move up socioeconomically as they relocate to safer housing nearby. The final proposition is that these dynamics are not just suppressing the number of residents in retreat; they are also interlocking with new climate signals to influence how potential movers view and vet their housing alternatives.

To develop these propositions, we first review how managed retreat works along with its associated elements of risk containment. Next, we draw on canonical theories of urban and community sociology to illuminate the hidden social dynamics that shape residential relocation broadly, including, we suspect, in zones of retreat. Because related insights come primarily from White scholars researching White communities (Morris 2017), and because managed retreat has thus far concentrated in such communities (Elliott et al. 2020), we scope ensuing analyses to majority-White communities only. For these analyses, we assemble for the first time, consumer reference data that allow us to identify and follow policy participants and nearby market movers, as managed retreat unfolds in their area. With this more granular and complete accounting approach, we are able to develop a fuller view of climate mobilities emerging from zones of retreat nationwide, while also using tract-level census data and address-specific flood risk estimates at origin and destination to refine related insights.

Results reveal that, even in places where local and federal authorities are working together to remove flood-prone housing, most residents are instead retreating through conventional market means that simply transfer rather than remove their home's future risk. Results also indicate that most of these moves—whether through the market or through managed retreat—are conditioned by residents' ability to “filter up” into safer housing in more affluent neighborhoods nearby. Thus, the current, early phase of climate retreat appears to be less of a one-way exodus of housing and people from harm's way than a revolving door of risk that is

reshaping who leaves and subsequently lives in communities at high and rising climate risk.

WHAT IS MANAGED RETREAT ACTUALLY MANAGING?

In the United States, FEMA's home buyout initiative is not the only government program encouraging managed retreat, but it is the largest by far (Mach et al. 2019). Started in 1993 mainly to assist rural farming communities, the program has since expanded into metropolitan areas, where total expenditures to date have reached nearly \$4 billion to purchase and demolish approximately 45,000 housing units nationwide (Horn 2025; Elliott et al. 2020). According to official framings, what is being managed by these expenditures is broadly twofold. For participating homeowners, rising flood risks and impacts threaten property values. The buyout program manages this threat by offering a fair, pre-disaster price for a given property, even if that property has been recently damaged (see Siders 2022; Siders and Gerber-Chavez 2021). For FEMA, the threat being managed is rising costs to its National Flood Insurance Program (NFIP), which has been financially insolvent for decades. In 2017, Congress canceled more than \$16 billion in debt so that the program could continue covering claims for that year alone. The program's debt has since ballooned again to more than \$20 billion, with the devastating hurricane season of 2024 expected to dig that financial hole even deeper (FEMA 2022).

To accomplish its aims, FEMA also manages how its buyout program works. First, it mandates that flooded areas do not automatically receive associated funds, even after a federally declared disaster; instead, local authorities must apply for those funds. Second, respective applications must include complex cost-benefit calculations showing where and how the requested funds, if awarded, will result in future savings to the NFIP through foregone claims achieved by the proposed purchase and demolition of homes in designated areas. Finally, FEMA requires that all homeowner participation in these areas be voluntary. This provision minimizes political backlash that can arise from the exercise of eminent domain by local officials using federal funds. Notably, there is no requirement to track where participating property own-

ers (or their tenants) move once a deal is struck, or to assess if those moves lead to safer housing. Instead, program evaluation focuses overwhelmingly on property acquisition, demolition, and cost savings.

Behind these official framings, however, lies a larger, unspoken reality: FEMA cannot possibly afford to purchase all homes at elevated flood risk, no matter how large the projected savings to its NFIP. This is partly the government's own doing. Since the NFIP was established under the Department of Housing and Urban Development in 1968, it has subsidized the construction of more than four million homes within its designated floodplains, which experts now consider to be woefully inadequate as currently mapped (First Street Foundation 2023). Even if the count of four million homes is believable, at an average price of \$420,400 nationwide, the aggregate cost to purchase them all would sum to approximately \$1.7 trillion—420 times what FEMA has spent on its managed retreat program to date. This realization means that the program is also working to manage something much larger and more symbolic than its stated aims: namely, the government's legitimacy in the face of climate challenges that continue to grow steadily beyond its control.

In this vein and borrowing from Scott Frickel and James R. Elliott (2018), we propose that managed retreat may be usefully viewed as a policy of "risk containment." Here, risk containment refers to what federal agencies do politically when they cannot possibly address the full scale and scope of the environmental challenge they face. So, instead they develop practices to contain the perceived risks of the challenge rather than directly engage its fuller material reality. One way that government actors do such risk containment is by focusing their interventions on the most obvious, or visible, sites of concern. This practice redirects public attention away from the outsized scale of the broader environmental challenge and focuses it instead on a few discrete, or contained, sites of acknowledged concern. Here, public attention can then be channeled into smaller, more technical conversations about related rules, procedures and site selection, all while projecting a sense that something larger and more meaningful is being done.

To illuminate this dynamic, Frickel and El-

liott (2018) focus their research on the US Environmental Protection Agency's (EPA) regulation of urban brownfields. Their analyses show that the agency only recognizes approximately 12 percent of all likely polluted sites, at best. We extend this thinking beyond sites polluted by former industrial activities to sites threatened by future flooding, and in the process from the EPA to FEMA as a federal agency of growing environmental significance. In making this extension, we maintain the view that the elements of risk containment that managed retreat represent need not be deliberate or ill-willed. They can arise simply as an unintended consequence of being outmatched financially and programmatically by the daunting environmental challenge flooding and other climate hazards now present. What we do modify, however, is our analytical scope. Instead of spotlighting all sites of concern (in our case, all housing units located within local zones of retreat), we focus only on residents who voluntarily move from these areas following policy implementation. In taking this approach, we deliberately reframe managed retreat as a mode of climate mobility rather than property acquisition.

INFLUENCES OF COMMUNITY ATTAINMENT AND ATTACHMENT ON MOBILITY

As we turn attention from property acquisition to residential mobility, it is vital to do so in sociologically informed ways. The first way, we contend, is by moving away from the imagery of isolated homeowners making atomistic decisions about if and where to move in the face of rising climate risks and related policy interventions. In such situations, potential movers remain embedded in community contexts that influence how they perceive and act on the risks and opportunities they experience. This embeddedness occurs because homes are much more than placeless residential units and economic investments; they are also social achievements with place-based status and personal attachments. As we invite these status and attachment considerations back into the conversation, we expand discussion of managed retreat beyond technically rational cost-benefit assessments to engage enduring insights from urban and community sociology. This dialogue, in turn, can

help illuminate what is familiar and what is new about today's climate mobilities. To assist, we begin with classic insights from the Chicago School. We then follow those through subsequent modifications and cultural critiques. We then end with a Du Boisian caution about the scientific pitfalls of applying related insights in colorblind ways. The overarching aim is to begin peeling back the community dimensions of residential relocation to better see the hidden social dynamics of climate mobilities, particularly in zones of active retreat.

The first systematic efforts to theorize community dimensions of residential mobility came from the early Chicago School of urban ecology. While notably blind to the power of racism (more on this topic in the next section), the school advanced the idea that even seemingly static, place-based communities are often quite dynamic demographically. This dynamism occurs as established residents leave and newcomers succeed them, resulting in a steady churn of households through local areas over time (Burgess 1925). Considering how difficult it was (and remains) to observe such residential churning beneath the surface of net population statistics, this insight was quite sophisticated for its time. Yet, Ernst Burgess (1925) and colleagues' use of analogies from plant ecology to motivate and explain this residential "metabolism" struck many scholars as misguided and overly deterministic. In response, subsequent researchers did not abandon the idea so much as substitute economic reasoning for its motivation, introducing the concept of "filtering" along the way (Temkin and Rohe 1996).

Traceable to Homer Hoyt (1933) and later Wallace Smith (1963), filtering assumes the presence of locally stratified housing markets produced by an ongoing interaction of economic forces and institutional actors. The latter include landlords, developers, and realty boards who profit from treating the basic stuff of place, the land, as a commodity, thereby investing variably in its construction, marketing, and upkeep (Besbris et al. 2024). As different local submarkets form and shift over time in relation to one another, households are assumed to strive to move into successively better, or more valued, submarkets over their life course. Here, *better* can mean different things depending on one's life

stage: a better school when raising children; a shorter commute when balancing career and home; a nice, waterfront property when looking for one's forever home. But, beneath these varying tastes is presumed to be a common cultural expectation to pair spatial mobility with social mobility, that is, to move up, not just out, when relocating voluntarily. This expectation is supported materially when one's housing generates wealth that can be subsequently reinvested in new housing in more affluent residential areas over time. As these individual- and community-level dynamics entwine, households filter upward into successively higher-valued communities, opening housing vacancies in their wake. These vacancies, in turn, are filled by others following behind them, reinforcing community attainment as a powerful social dynamic shaping residential mobility.

This filtering perspective, while still influential, met cultural critiques from the beginning, which continue to this day (see Firey 1945; Gans 1962; Small 2004). A common complaint is not so much that aspirations and behaviors of community attainment do not exist. Instead, it is that by emphasizing such forces, researchers miss important social and cultural influences that generate deep and lasting attachments to place-based community, and thus residential immobility. These influences include neighborly bonds, networks, institutions, and sentiments that hold people voluntarily and affectionately in place. Evidence of such attachment has been uncovered time and again across a wide array of cases and places, including prominent communities fighting against urban renewal and gentrification (Korver-Glenn and Mayorga 2024) as well as those recovering from recent wildfires (Morales-Ginder and Mook 2025) and flooding (Lynn 2017). In the latter, the power of community attachment often shows up through interviews with stayers, that is, households that after a recent environmental catastrophe decide to remain in place rather than relocate elsewhere (see Rhodes and Besbris 2022; Kimbro 2022). In telling their stories, field researchers often forefront the difficult emotional, social, and material work that residential immobility now requires in the face of rising climate risks and repetitive impacts.

As debates over community attainment ver-

sus community attachment persist, we contend that pitting the two social forces against one another, as if diametrically opposed, is increasingly misguided in the face of today's rising climate challenges. Instead, we propose synthesizing the two perspectives to foreground how both community attainment and community attachment intersect to structure climate mobilities, both managed and unmanaged. In this vein, we propose that climate movers generally strive to satisfy both social dynamics by seeking not only to move up socioeconomically when they retreat but also stay geographically proximate in ways that help retain their community attachments, even while relocating. We conceptualize this conjunctural force as one of attached attainment. Further, we propose that, if households cannot actualize it, they will be reluctant to relocate, deciding instead to stay in place. In this way, attached attainment influences not only where people move as they retreat but whether they do so at all.

RACIAL PRIVILEGE AND THE REVOLVING DOOR OF RISK

As W. E. B. Du Bois (1899) pointed out more than a century ago, the canonical theories and debates excavated and synthesized earlier came largely from White scholars studying White communities in ways that failed to adequately account for racism in community-mobility dynamics. This failure has since manifested in numerous ways, including a tendency to assume that what happens in White communities generalizes to Black, Asian, Latino, and other socially marginalized communities of color. Research has long since demonstrated that this is not the case. As a result of oppression and opportunity hoarding that favors White communities, non-White communities have long lacked access to the same political and economic resources that have historically facilitated the upward filtering and protected community attachments found in many White residential spaces. Managed retreat offers no exception. Nationwide, analyses show that more than 80 percent of homes purchased through FEMA's buyout program have been in majority-White census tracts, offering homeowners in these areas an extra, publicly funded tool to adapt residentially to rising climate risks that threaten their hous-

ing as both investment and home (Elliott et al. 2020).

For purposes of the present study, these enduring Du Boisian insights have two important implications. First, they warn against assuming the propositions developed thus far hold beyond the majority-White communities from which they originated and managed retreat now concentrates. Thus, we restrict our ensuing empirical analyses to majority-White zones of retreat. In doing so, the intent is not to devalue investigations of climate mobilities in other types of communities. Rather, it is to illuminate how such mobilities are unfolding in areas where racial privilege in housing access, wealth accumulation, and policy implementation are conjoining to steer where and how managed retreat as a federal policy is now largely operating. A second implication of Du Bois's (1903) insights draws more directly from his work on "the veil," which elucidates how White racial privilege can bring with it notable blind spots. In the case of managed retreat, these blind spots can include a relative inability among those filtering up into racially privileged zones of retreat to see the rising flood risks they are taking on as they move into their new homes.

To the extent these dynamics prevail, they begin to conjure an image that looks less like a one-way exit from areas of growing threat—a common conceit in popular accounts of climate migration—and more like a revolving door of risk that continues to spin slowly in place. This occurs as White privilege and risk containment work in concert to maintain steady flows of newcomers, even as nearby housing is being demolished by federally funded local authorities. In this way, displacement via managed retreat and serial resettlement of nearby housing in the same area are not mutually exclusive forms of climate relocation, even on the front lines of retreat. Instead, they co-occur. In *Soaking the Middle Class*, Anna Rhodes and Max Besbris (2022) illuminate this dynamic in their documentation of why residents first moved into the majority-White suburb of Friendswood, despite its high flood risk. As the authors explain, "moving to Friendswood is an act of social reproduction whereby families are leveraging their existing economic and racial advantages to buy into a place that will yield more advantages in the

future" (Rhodes and Besbris 2022, 27). And, when this future brings some of the worst flooding in US history, as Hurricane Harvey did in 2017, newcomer demand continued. When asked why, new arrivals commonly cite quality schools, personal safety, and "the Friendswood feel."

These sentiments are also evident in the recent ethnography *In Too Deep*. Here, sociologist Rachel Tolbert Kimbro (2022) recounts the stories of mothers striving to recover in their White, middle-class community following three major floods over a three-year span. Despite real costs to their mental, marital, and physical health, residents explained to reporters that, "dealing with the risk of hurricanes and flooding is part of life, a tradeoff for a neighborhood with sought-after schools, a strong sense of community, spacious lots and a close-in location" (Luck and Cowen 2022). And, as in Friendswood, market demand in the area continues to reflect this collective sensibility. Even after repeatedly flooding, the desire of newcomers to move into the area has increased housing prices by more than 38 percent, assisted by public investments in the construction of a new \$23 million elementary school, \$50 million cultural center, and \$480 million flood mitigation project—all as federal buyouts occur in the same area. Similar trends are also apparent nationwide (Harris 2025).

SUMMARY AND NEW CLIMATE SIGNALS AT DESTINATION

Drawing from the preceding discussion, we advance three hypotheses for empirical investigation, all scoped to majority-White communities, where racial privilege and managed retreat policy intersect with enduring expectations and resources for both community attainment and attachment. First, consistent with recent conceptualizations of risk containment, we hypothesize that market-based resettlement—or business as usual—dwarfs managed retreat as the dominant mode of climate mobility, even in areas where the latter is federally funded, publicly touted, and visibly conducted. Second, we hypothesize that all households moving from these zones of retreat—regardless of their mode of exit—will exhibit behavior consistent with both community attainment and community

attachment, meaning they will strive to move up socioeconomically but stay close spatially in ways that integrate these two enduring community influences on residential mobility; otherwise, they will tend to stay in place.

To these hypotheses, we add a third. Namely, that climate signals are now inserting themselves into these enduring social forces to pull climate movers into less risky housing as they filter up into nearby neighborhoods of higher value. In this way, materially speaking, retreat is currently unfolding more as an act of privilege than duress, even within the nation's most at-risk places.

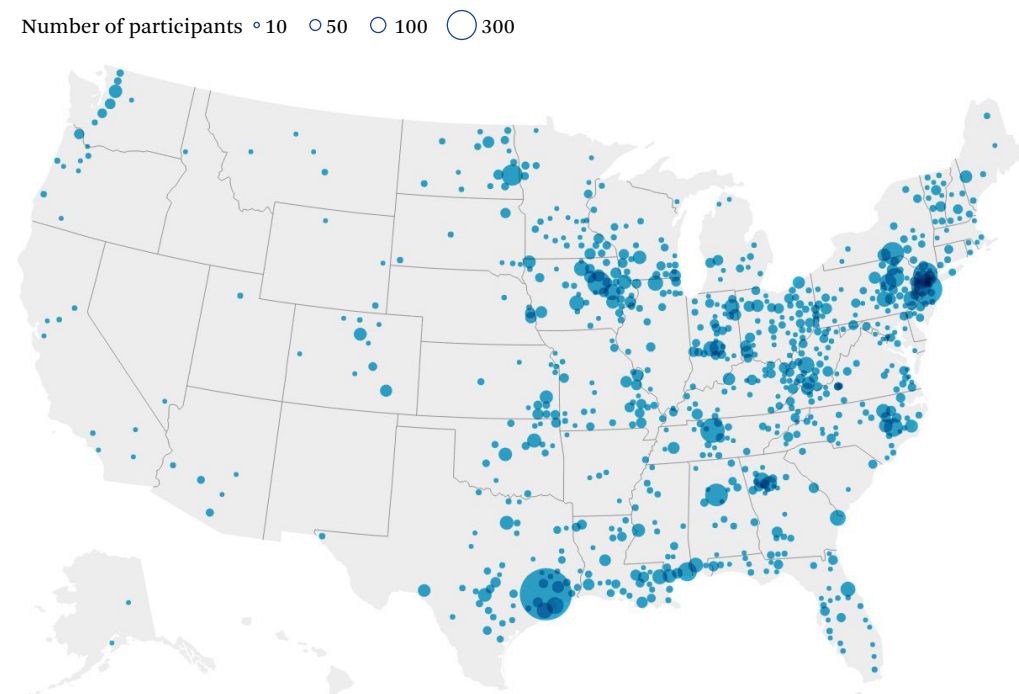
DATA

Our analyses investigate zones of retreat nationwide. We define these zones by identifying owner-occupant participants in FEMA's Home Mitigation Grant Program (FEMA 2024) and then drawing a half-mile buffer around their acquired property. To locate these homes and identify respective homeowners by name, we use a na-

tional database that was publicly released following a suit filed under the Freedom of Information Act (Benincasa 2019). A map showing where these buyouts occurred, scaled to the number of transactions, appears in figure 1.

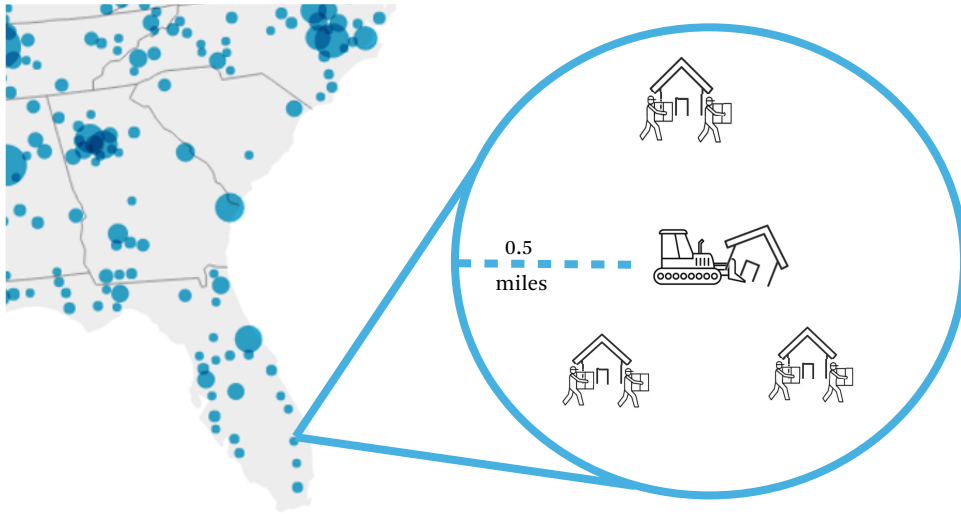
A stylized depiction of a local zone of retreat appears in figure 2. We use a radial buffer rather than administrative units (say, census tracts) to define our zones because boundaries for the latter may include bodies of water that flood into adjacent units unrecognized if no buyout occurred there. We use a half-mile distance because that length is short enough for nearby residents to know about buyouts in their zone. It is also long enough to account for residents who may not have received buyout offers but nonetheless considered moving in response to local flooding and implementation of managed retreat. We focus only on buyout locations where the program participant was an owner-occupant because we want to ensure that those voluntarily taking observed buyouts are also the ones moving.

Figure 1. Areas Where FEMA Has Funded Managed Retreat, by Number of Participants



Source: Elliott and Wang (2023b). Reprinted through Creative Commons license.

Figure 2. Zones of Retreat Defined Using a Half-Mile Buffer Around Each Buyout Address



Source: Authors' rendition.

Identifying and Tracking Movers from Zones of Retreat

Within these zones of retreat, there are no available data indicating who was offered a buyout; there are only data for those who accepted. We refer to households who accepted a buyout offer as policy movers; we refer to all other movers, who can include renters as well as homeowners, as market movers. In all cases, we lack comprehensive, reliable data on individual home prices and rents. Our presumption, however, is that homeowners will take the best financial offer available to them if, and when, they decide to move. In socially desired, majority-White neighborhoods, such offers can exceed appraised, fair market value even after recent flooding.

To identify and track policy and market movers, we had to innovate because no publicly available data are sufficient nationwide. We turned to files produced by Data Axle, a private-sector vendor. Data Axle produces annual residential files that include the names and current addresses of more than 150 million US adults. To update these files each year, the company uses more than a hundred sources, including real estate tax assessments, deed transfers, and other public records (voting registrations and utility connections) as well as change of address noti-

fications, credit card billing statements, loyalty programs, and the like. Because the company sells the data widely to major corporations wishing to identify consumer locations for bill collection, targeted marketing, and other commercial communications, Data Axle is strongly incentivized to ensure that its data are accurate and up to date. Recent studies have assessed the validity of the data using the American Community Survey as a benchmark (Acolin et al. 2022; Ramiller et al. 2024). Their general conclusion is that the Data Axle files are indeed valid, with a tendency to under-represent younger adults (ages eighteen to twenty-four) and the unemployed. These studies also indicate that avoiding the use of Data Axle's imputed sociodemographic characteristics and focusing strictly on tracking residential locations over time offers the greatest validity. This is the approach we take for the present study, consistent with other peer-reviewed research that has used the data to analyze residential mobility (Diamond et al. 2019; Elliott and Wang 2023a; Phillips 2020).

The annual Data Axle files start in 2006. Beginning there, we can use the files to locate owner-occupant, buyout participants (policy movers) and then track where they moved next. We can also use the data to rebuild the residential population living within a half-mile buffer

of that participant during the year buyouts commenced in their community. We can then follow those nearby neighbors over time to see if they moved. If multiple participant-centric buffers overlap in an area, we eliminate redundant observations so that each household in our dataset is observed only once. To identify and track policy movers, we use the name and address provided in FEMA's Hazard Mitigation Grant Program database; to identify and track nearby neighbors, or market movers, we use and follow the first adult listed at a given address in Data Axle's household record.

For all movers in our dataset, and regardless of the year in which buyouts began in their zone of retreat, we extend the window of observation for relocation to the same time point: December 2022, five years after the last observed buyout in the publicly available FEMA data. We take this approach because buyouts can take years to finalize and because we are interested in the total, or cumulative, relocation of residents from respective zones of retreat following buyout implementation. To ensure all households in our study were present when buyouts began in their zone of retreat, we exclude all residents who arrived after buyouts commenced. This restriction has the added benefit of controlling for variation in local residential repairs and redevelopment following a recent disaster, thus maximizing comparative validity across zones of retreat that might otherwise experience very different recovery trajectories nationwide (Pais and Elliott 2008).

To measure distance moved from origin to next address, we use a batch-processing variant of Google Maps to estimate the shortest driving distance (in miles) between origin and next observed address. We use driving distance rather than straight-line distance because our interest lies in residents' continued attachment, or connectivity, to communities of origin, and driving distance offers a better proxy for that attachment than straight-line distance (Roberto 2018).

Address-Level Flood Risks at Origin and Destination

Because flood risk can vary from address to address within zones of retreat, and because that variance can influence property values as well as decisions about whether to move, it is useful

to know the flood risk associated with each mover's origin and destination address. For this information, we rely on address-level risk estimates produced by the First Street Foundation (FSF). The FSF is a scientific consortium that uses a combination of twenty-one global climate models under the middle Intergovernmental Panel on Climate Change RCP 4.5 emissions scenario while considering a range of high (75th percentile) and low (25th percentile) scenarios. It also incorporates a baseline climate period from 1980 to 2010 in addition to data on historical flood events. Using this approach, FSF calculates a Flood Factor (FF) for each addressed parcel in the US (First Street Foundation 2020). The FF is an integer that ranges between 1 and 10, reflecting the likelihood and severity of flooding by 2050. On this scale, 1 represents minimal risk and 10 represents extreme risk. For example, a property at *moderate risk* (FF = 3) has a 6 to 12 percent chance of flooding by 2050 and a good chance of that flooding reaching a depth of 6 to 9 inches.

FSF's flood modeling methodology has been independently reviewed and used by the US EPA in its 2021 report on social vulnerability and climate change (US Environmental Protection Agency 2021). For addresses where the FF is missing, we use the value of the next closest parcel. We assume that even if a mover is unaware of their origin and destination's exact flood risk, the FF associated with each home nonetheless provides a valid and reliable proxy for the risk the mover weighed in deciding if and where to retreat.

Community-Level Racial Composition and Median Housing Values

To measure community-level factors of interest—racial composition and median housing values—we use annualized data at the level of census tracts. For origin tracts, we use the year in which policy moves began; for destination tracts, we use the year respective movers are first observed at their new address. To obtain these annualized values, we applied linear interpolation to decennial population data standardized to 2010 tract boundaries in the Longitudinal Tract Data Base (Logan et al. 2016). We define majority-White communities as those where 50.1 percent or more of the residential

population in the tract reports being non-Hispanic White. For median housing values we use the federal Consumer Price Index to standardize all tract-level values to the same 2017 benchmark to adjust for inflation.

Sample

Using the above data and procedures, we identify and follow $n = 5,039$ policy movers nationwide who accepted a FEMA-funded buyout and subsequently relocated. We also identify and track $n = 68,630$ market movers who were living within a half-mile radius of each of these policy movers at the time buyouts commenced in their shared zone of retreat. When we restrict our sample to majority-White tracts of origin, these counts reduce to $n = 4,445$ and $n = 56,877$, respectively. These movers constitute our analytical sample, spanning 1,200 census tracts of origin, located in 416 counties across 44 states.

RESULTS

We start by assessing the extent to which residential relocation from zones of retreat occurs through the local managed retreat program versus the market once the former commences. We then assess patterns of attached attainment and address-level risk scores at destination.

Policy Versus Market Moves from Zones of Retreat

To begin, figure 3 presents two ways of viewing the counts of each type of mover over time. In both panels, the x-axis refers to the year in which buyouts began in respective zones. For example, values for the year 2007 refer to the counts of movers from zones where buyouts commenced in that year, not the number of residents who moved in 2007. Figure 3, panel A then displays the national counts of both types of movers on a single y-axis. Here, we see that market movers exceed policy movers by a wide margin. Over the full span of our study, the ratio is approxi-

mately 12:1, and that ratio remains relatively constant year to year. At an average count of 9 policy movers per zone of retreat, this ratio equates to approximately 108 additional market movers that typically go unaccounted for in research focused on managed retreat participants. To assess the extent to which zones of retreat with higher shares of renters are driving the larger counts of market movers, we ran supplemental regression analyses. Results (available on request) show no statistically significant association between local proportions of renter-occupied housing and the ratio of policy movers to market movers in the zone of retreat.

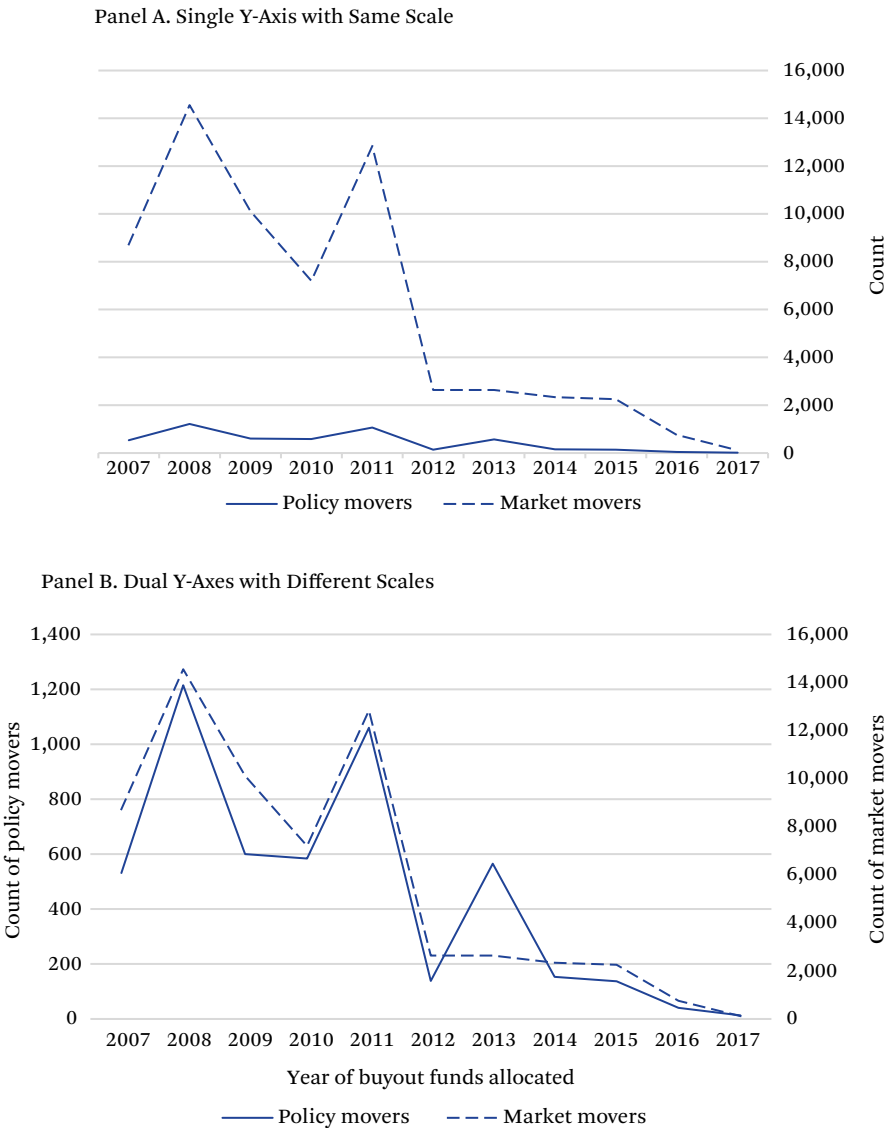
Next, figure 3, panel B uses a dual y-axis to help visualize the ratio of policy movers to market movers over time. Overall, the results show the two types of movers generally track each other over the course of our study, suggesting both types of movers are responding to the same impacts and risks in their zone, just at vastly different scales. This is true even in later years, as both types of mobility decline. In zones where buyouts commenced in 2016, for example, we count 34 policy movers nationally compared with 614 market movers in the same zones of retreat. The notable exception is 2013—the year in which FEMA began funding large numbers of buyouts in coastal New Jersey following Superstorm Sandy. We are uncertain why this anomaly occurs.¹

Patterns of Attached Attainment in Relocation

To assess if movers exhibit patterns of community attachment and community attainment, or attached attainment, we begin with community attachment. The presumption here is that shorter moves reflect stronger attachment to the home and community from which movers are relocating. Using driving distance (in miles) between origin and destination addresses, we find the median distance for all movers is just

1. Results in figure 3, panel B also indicate that the gap between counts of policy movers and market movers is not a function of our decision to observe all relocations through December 2022. If that decision were driving the observed gap, we would expect more divergence between policy movers and market movers during earlier years. This is because the earlier starting point would create a longer period of observation, which could favor market movers over policy movers given possible program deadlines imposed on the latter. Figure 3, panel B, however, shows no such pattern. Instead, counts for each type of mover track relatively closely year to year, even for earlier buyout years.

Figure 3. Counts of Movers from Majority-White Zones of Retreat over Time, by Type of Move



Source: Original analyses by authors based on data described earlier.

7.4 miles. This is considerably shorter than the median distance of 10 to 15 miles for all moves observed by the National Association Realtors (NAR 2024) over the past thirty years. It is also substantially shorter than the average American’s commute from home to work, which studies now estimate to be approximately 13 miles (Bricka et al. 2024). Thus, it seems most movers from zones of retreat are remaining notably attached to their communities of origin rather than moving away to far-off “climate havens”

being promoted by local boosters farther north and inland (Morris et al. 2023). To visualize this pattern, figure 4 restricts our sample to just those who moved within 50 driving miles of their home of origin (77 percent of all movers in our study). Figure 4, panel A presents a box-and-whiskers plot for this subsample, subdivided by mover type. Here, stripped of outliers, the median distance (represented by the box’s midline) drops to 4.8 miles, with a range of 1.9 to 10.9 miles between the

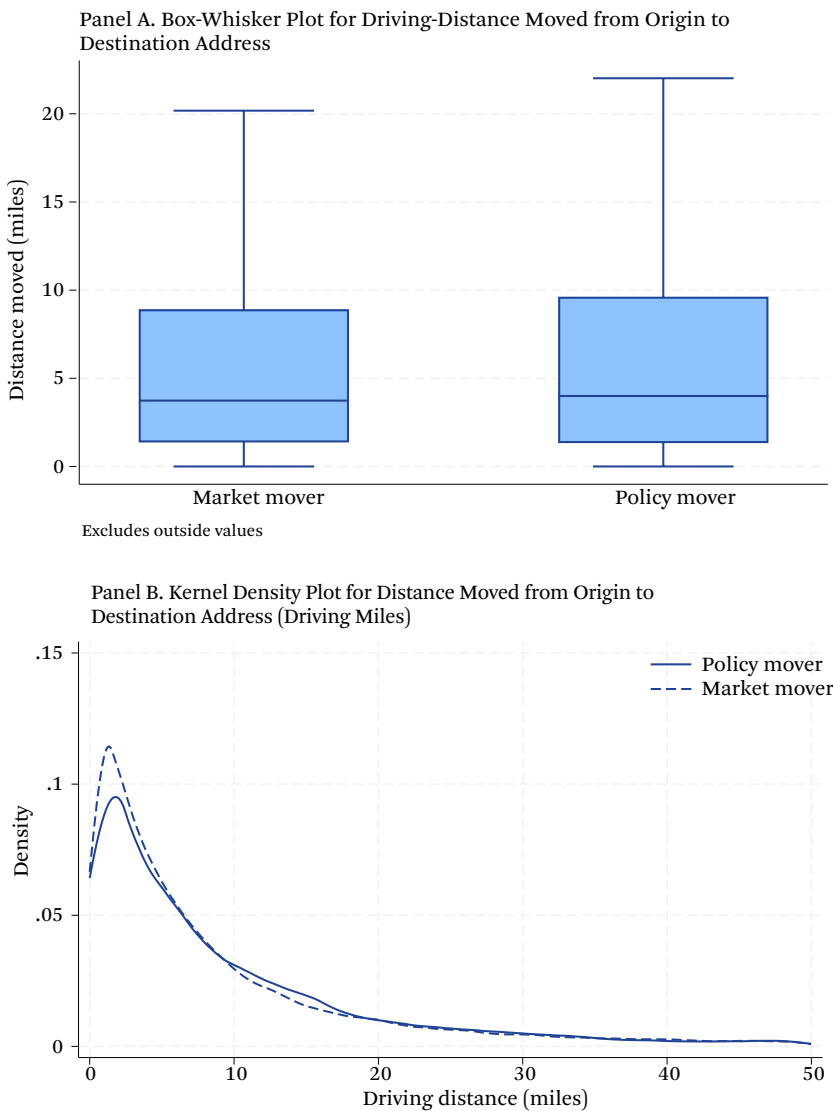
25th and 75th percentiles, respectively (represented by the box's lower and upper bounds). Figure 4, panel B then displays a kernel density plot for distances moved for the same subsample. Again, we see the bulk of moves occurring over relatively short distances, as well as similar distributions for policy and market movers.

Next, we turn to community attainment. Our hypothesis, again, is that movers seek not only to remain close as they retreat but also filter up socioeconomically into higher valued neighbor-

hoods. To test this idea, we begin with the average change in median housing value from origin to destination tract for all movers. The result is a positive increase of approximately \$33,000, or 15 percent of the average housing value at origin. This evidence of upward filtering accounts for nearly 70 percent of all movers in our study.

To probe further, we estimate an Ordinary Least Squares (OLS) regression equation predicting change in median housing value from origin to destination for all movers. We keep

Figure 4. Distance Moved from Origin to Destination Address (Driving Miles)



Source: Original analyses by authors based on data described earlier.

the model simple, consistent with Stanley Lieberman's (1985) call to avoid overly complicated models in pursuit of social explanations of complex phenomena. First, to assess variation between policy movers and market movers, we include a binary indicator distinguishing the two. Second, because the flood risk of one's home may impact the ability to filter up, especially through the market, we include this risk factor at origin as both an independent variable and moderating factor. Finally, to control for changes in the potential to filter up over time, we include a continuous variable measuring the years elapsed since 2007, the first year of relocation observed in our study. Results, estimated with robust errors to account for the clustering of movers from the same buyout tract of origin, appear in table 1 and are then graphed in figure 5.

Broadly, two insights emerge. First, as figure 5 shows, the expected upward mobility of market movers consistently exceeds that of policy movers. This finding conforms to the idea that managed retreat typically serves as a backstop for movers when market prices begin to soften, thus offering less profit to invest in subsequent community upgrading. Second and relatedly, figure 5 shows that as a home's flood risk increases, subsequent attainment—though still

notable—declines for market movers. This, too, makes sense, if one imagines that such risk cuts into market valuation and thus profits that can be reinvested into subsequent community attainment. To affirm the robustness of these findings, we also conducted supplemental analyses that introduced fixed effects for state of origin. Results (available on request) were in the same direction and even stronger than those reported in table 1 and displayed in figure 5.

Climate Signals as One Retreats

Finally, we assess whether people moving from zones of retreat appear to be processing climate signals not just at origin but also at destination. To begin, we compute the average flood factor at each origin and destination address for all movers. For policy movers, we find the mean value at origin is 5.7; at destination it declines to 2.0, or by 65 percent. For market movers, the scores are 2.8 and 2.2, respectively, reflecting similarly low values at destination despite comparatively lower flood risk at origin. These findings are consistent with the idea that the riskiest homes in zones of retreat are the ones most likely to enter the buyout program. They are also consistent with the idea that, regardless of one's initial level of risk and mode of exit, mov-

Table 1. Ordinary Least Squares Regression Results Predicting Difference in Median Housing Value Between Origin and Destination Tracts (Robust Standard Errors)

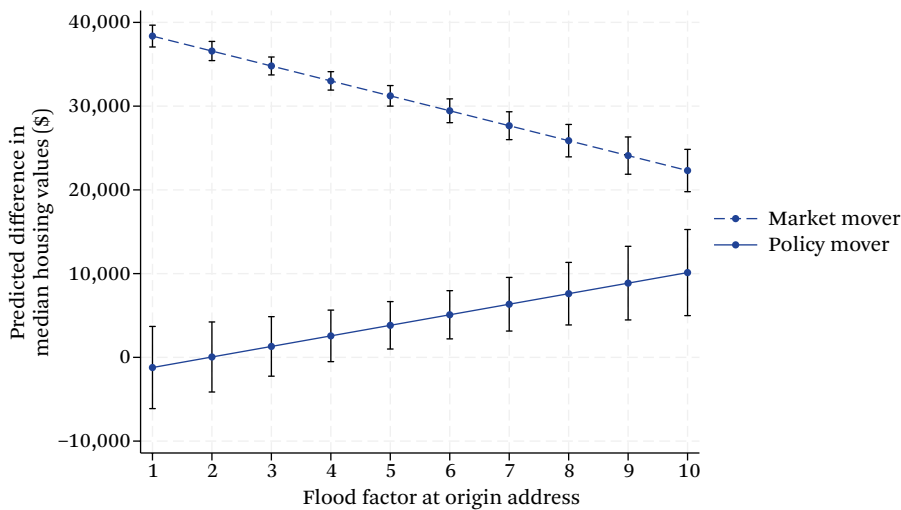
Difference in Median Housing Values from Origin to Destination Tract (\$000)	
Policy mover [ref: market mover]	-42.63* (3.00)
Flood factor at origin address	-1.78*** (.017)
Policy mover × flood factor at origin address	3.04*** (0.52)
Time (in years since 2007)	-2.57* (0.20)
Constant	50.48*** (1.08)
<i>N</i>	61,314
<i>R</i> ²	0.07

Source: Data described earlier.

Note: two-tailed test.

* $p < .05$; ** $p < .01$; *** $p < .001$

Figure 5. Predicted Difference in Median Housing Value Between Origin and Destination Tracts, All Else Equal



Source: Original analyses by authors based on data described earlier and presented in table 1.

Note: All other variables held constant at sample means.

ers from zones of retreat are seeking out safe homes as they relocate.

To probe further, we reran the same OLS regression model above (in table 1) but changed the outcome variable to the mover's flood factor at destination. Results appear in table 2 and are graphed in figure 6. Here, again, we see clear

evidence of risk reduction for both types of movers at nearly all origin risk levels, even after controlling for other factors. In supplemental analyses (not shown), results affirm that this risk reduction is also clear and statistically significant after the introduction of state-level fixed effects. Most movers, it appears, are looking not

Table 2. Ordinary Least Squares Regression Equation Predicting Flood Factor at Destination Address (Robust Standard Errors)

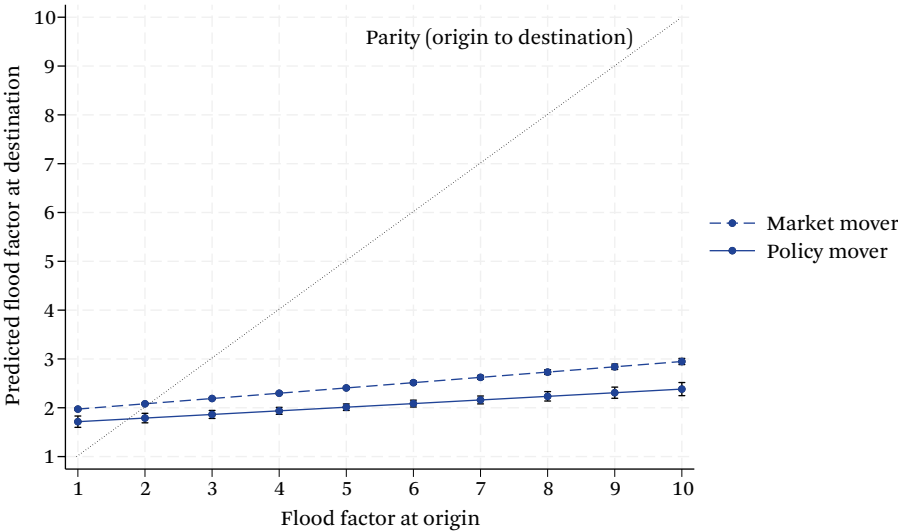
Flood Factor at Destination Address	
Policy mover [ref: market mover]	-.224** (.070)
Flood factor at origin address	.108*** (.004)
Policy mover × flood factor at origin address	-.034** (.007)
Time (in years since 2007)	.040* (.004)
Constant	1.705*** (.020)
N	61,322
R ²	0.02

Source: Data described earlier.

Note: two-tailed test.

* $p < .05$; ** $p < .01$; *** $p < .001$

Figure 6. Predicted Flood Factor at Destination Address, by Flood Factor at Origin, All Else Equal



Source: Authors’ tabulation based on data described earlier and results in table 2.
Note: All other variables held constant at sample means.

only to engage in attached attainment but also to ensure their next location has relatively low risk of future flooding.

DISCUSSION

A growing literature predicts that more and more Americans will begin moving away from housing threatened by rising climate threats, especially flooding. To help guide these developments, local authorities are partnering with federal agencies to implement a policy of managed retreat. In studying the largest of these programs, run by FEMA, we advocated against thinking about the climate mobilities that emerge as entirely new phenomena. Instead, we encouraged viewing them as being forged through the enduring and often hidden social dynamics of community attachment and community attainment as they intersect with persistent racial inequities and new climate signals. Our results support this perspective. They show that in racially privileged White communities, where managed retreat has thus far predominated in the United States, residents are indeed departing in notable numbers. Our findings also reveal that most of these moves are undertaken by residents who can afford to filter up into safer housing located in more affluent neighborhoods

nearby, often through conventional market means rather than through publicly funded property acquisitions. These findings matter for several reasons.

First, they indicate that nationally, our current phase of managed retreat remains a relatively privileged affair. Not only is it disproportionately occurring in majority-White communities, but within these communities, it is also disproportionately occurring among those who can afford to move up socioeconomically while they stay close spatially as they transition into safer housing. Hitting this trifecta is attractive because it offers a way to maintain the social value of one’s community by staying geographically proximate and increasing the economic value of one’s housing investment by moving into a more desired neighborhood while also reducing risk to that investment by ensuring one’s new home has relatively low risk of future flooding. Meanwhile, residents unable or unwilling to make such privileged moves and newcomers entering behind those who leave comprise an increasingly segmented population. One segment is likely to have the financial resources needed to defend in place, say, by paying for additional insurance or elevating their home, which now costs approximately \$75 per

square foot, on average. Another segment is unlikely to afford such investments and will instead face rising insurance costs that provide declining coverage as they await the next flood in their zone of retreat. Joining them is likely to be incoming residents who, as they replace those leaving, are more motivated by the opportunity to move up into their new community than capable of immediately investing in costly flood protections for their new home.

Although we did not study them directly, we suspect the more socially vulnerable segments of these populations will be notably larger in flood-prone communities of color than in the majority-White communities we did study. This supposition rests partly on the ongoing devaluation of housing in racially minoritized communities in general (Howell and Korver-Glenn 2021), which can block opportunities for “upward exit” to safer housing as well as home equity loans that can help finance new defenses in place. As a result, strong place attachments will likely prevail over new attainment opportunities, leaving residents with little choice but to resist buyouts and instead advocate for place-based flood infrastructure that has long been underfunded in their politically marginalized communities. In Houston, for example, local officials initiated a program to buy out more than 600 homes in a historically flood-prone Black community. Fewer than a dozen residents accepted (Lynn 2017). Faced with this resistance, local authorities began experimenting with alternative ways to encourage relocation from flood-prone communities of color. One way they settled on was to shift such efforts away from FEMA funding toward other sources of revenue that allow for the exercise of eminent domain. This strategy is now being pursued in low-lying, predominantly Hispanic communities, where many residents—lacking safe, affordable housing nearby—are reluctant to relocate despite repetitive flood impacts to their homes and neighborhood (Bonnyman 2024).

Another implication of our study involves how retreat is occurring when it does happen. Our findings show that in respective zones, it resembles less of a one-way exodus of property and people than a revolving door of risk, powered by ongoing demand for housing. As this door spins, it does not eliminate local flood risk;

instead, it simply transfers it to the next incumbents. A key question thus becomes, how long can this highly individualistic mode of adaptation persist? While the answer remains unclear, what does seem certain is that the federal government cannot afford to acquire and demolish all homes at growing flood risk. Thus, for financial reasons alone, the federal government is likely to continue operating managed retreat more as a form of risk containment than as a comprehensive means of addressing the full scale and scope of the nation’s rising flood challenge. Another thing that seems certain from our results is that no matter how rational relocation from respective zones may seem, residents’ decisions about if and how it occurs will continue to filter through powerful social forces that condition who leaves and to where.

How managed retreat can be refashioned to better and more equitably intervene in these matters remains an issue of ongoing urgency, as does consideration of other mechanisms highlighted by studies in this special issue. Such mechanisms include rising rents in disaster zones, as highlighted by Brian Y. An and colleagues (2026, this issue), which can increase residential turnover in and around zones of retreat in ways that continue to spin the revolving door of risk highlighted in the present study. Another mechanism, raised by Megan Mullin (2026, this issue) in her piece, is the propensity of local officials to support buyouts more for low-income than high-income residents, which not only raises concerns of equity but can also lead to unexpected and increasingly draconian results if low-income communities are reluctant or unable to comply. More conceptually, efforts to improve managed retreat policy can also benefit from engaging more sociologically informed understandings of real estate, which are now synthesizing insights from Du Bois and Karl Polanyi to better illuminate the structural forces shaping questions of why some environmentally vulnerable people and places seem to gain while others continue to lose in ongoing efforts to adapt to our growing climate crisis (Besbris and Robinson et al. 2024).

CONCLUSION

The present study conducted the first nationwide investigation of residential relocation from

areas of managed retreat. Analyses focus on majority-White communities, where analyses show that most movers are still relocating through the market rather than through publicly funded programs that demolish at-risk housing on exit. This dynamic creates a revolving door of risk, even in areas where government officials are dutifully seeking to remove not only people but property from harm's way. Findings also indicate that those "on the move" from these zones of retreat are mostly residents who can afford to engage in attached attainment as they relocate to wealthier, safer housing nearby.

As future research engages these findings, it is worth noting some limitations of the present study. One limitation is that our analyses remained relatively simple by design. We chose this approach because current theorization of climate mobilities is still developing, and we preferred to generate new insights to assist that effort rather than to test more nuanced assumptions with more complicated models. Another limitation is that we did not study flood-prone communities of color. As Du Bois's methodological work underscored more than a century ago, engaging these communities will take more than simply collecting additional data and making statistical comparisons across different community types. While such efforts can be useful, it is also imperative to think deeply about how race, space, and place intersect with rising climate risks not just to "trap" certain populations in places of increasing risk but also to shape how they understand what is possible and right in response.

Relatedly, our study is limited in what it can say about growing concerns over climate gentrification, defined here as the unintended displacement of less-privileged residents from areas with lower climate risk (Keenan et al. 2018). As the prospect of these more involuntary forms of climate mobility increases, they expand into questions about how different types of climate risk, say from wildfires, may modify and extend managed retreat policy into new areas (McConnell and Koslov 2024). We look forward to continuing to contribute to these important, ongoing efforts alongside others in this special issue.

REFERENCES

- Acolin, Arthur, Ari Decter-Frain, and Matthew Hall. 2022. "Small-Area Estimates from Consumer Trace Data." *Demographic Research* 47(27): 843–82.
- An, Brian Y., Andrew Jakabovics, Anthony W. Orlando, Seva Rodnyansky, and Raphael W. Bostic. 2026. "The Trajectory of Rental Housing in the Wake of Natural Disasters: Evidence from California and Florida." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 54–76. <https://doi.org/10.7758/RSF.2026.12.4.03>.
- Benincasa, Robert. 2019. "Search the Thousands of Disaster Buyouts FEMA Didn't Want You to See." *National Public Radio*, March 5. <https://www.npr.org/2019/03/05/696995788/search-the-thousands-of-disaster-buyouts-fema-didnt-want-you-to-see>.
- Besbris, Max, Rebecca Elliott, Daniel Aldana Cohen, and Ruthy Gourevitch. 2024. "The Housing Regime as a Barrier to Climate Action." *NPJ Climate Action* 3: 66. <https://doi.org/10.1038/s44168-024-00150-0>.
- Besbris, Max, John N. Robinson, and Hillary Angelo. 2024. "A Sociology of Real Estate: Polanyi, Du Bois, and the Relational Study of Commodified Land in a Climate-Changed Future." *Annual Review of Sociology* 50: 365–83. <https://doi.org/10.1146/annurev-soc-033022-035124>.
- Bittle, Jake. 2024. *The Great Displacement: Climate Change and the Next American Migration*. Simon & Schuster.
- Boas, Ingrid, Hanne Wiegel, Carol Farbotko, Jeroen Warner, and Mimi Sheller. 2022. "Climate Mobilities: Migration, Im/mobilities and Mobility Regimes in a Changing Climate." *Journal of Ethnic and Migration Studies* 48(14): 3365–79. <https://doi.org/10.1080/1369183X.2022.2066264>.
- Bonnyman, Helen. 2024. *Mandatory Home Buyouts in Houston, Texas: Program Overview and Lessons Learned*. New America. September 12. <https://www.newamerica.org/future-land-housing/briefs/mandatory-home-buyouts-in-houston/>.
- Bricka, Stacey, Timothy Reuscher, Paul Schroeder, Matthew Fisher, Jeffrey Beard, and Liang Sun. 2024. *Summary of Travel Trends: 2022 National Household Travel Survey*. FHWA-HPL-24-009. Federal Highway Administration, US Department of Transportation. January. <https://rosap.nhtl.bts.gov/view/dot/73764>.

- Burgess, Ernst W. 1925. "The Growth of the City: An Introduction to a Research Project." In *The City*, edited by Robert E. Park, Ernest W. Burgess, and Roderick Duncan McKenzie. University of Chicago Press.
- Diamond, Rebecca, Tim McQuade, and Franklin Qian. 2019. "The Effects of Rent Control Expansion on Tenants, Landlords, and Inequality: Evidence from San Francisco." *American Economic Review* 109(9): 3365–94. <https://doi.org/10.1257/aer.20181289>.
- Du Bois, W. E. B. 1899. *The Philadelphia Negro: A Social Study*. University of Pennsylvania Press.
- Du Bois, W. E. B. 1903. *The Souls of Black Folk: Essays and Sketches*. A. C. McClurg & Co.
- Ehrenfeucht, Renia, and Marla Nelson. 2022. "Towards Transformative Climate Relocation Initiatives." *Journal of Planning Literature* 38(3): 395–407. <https://doi.org/10.1177/08854122221130287>.
- Elliott, James R., Phylicia Lee Brown, and Kevin Loughran. 2020. "Racial Inequities in Federal Buyouts of Flood-Prone Homes: A Nationwide Assessment of Environmental Adaptation." *Socius: Sociological Research for a Dynamic World* 6: 1–15. <https://doi.org/10.1177/2378023120905439>.
- Elliott, James R., Kevin Loughran, and Phylicia Lee Brown. 2023. "Divergent Residential Pathways from Flood-Prone Areas: How Neighborhood Inequalities Are Shaping Urban Climate Adaptation." *Social Problems* 70(4): 869–92. <https://doi.org/10.1093/socpro/spab059>.
- Elliott, James R., and Zheyue Wang. 2023a. "Managed Retreat: A Nationwide Study of the Local, Racially Segmented Resettlement of Homeowners from Rising Flood Risks." *Environmental Research Letters* 18(6): 064050. <https://iopscience.iop.org/article/10.1088/1748-9326/acd654>.
- Elliott, James R., and Zheyue Wang. 2023b. "When Homes Flood, Who Gets FEMA Buyouts and Where Do They Go? We Mapped Thousands of Moves and Found Distance and Race Both Play a Role." *The Conversation*, June 15. <https://theconversation.com/when-homes-flood-who-gets-fema-buyouts-and-where-do-they-go-we-mapped-thousands-of-moves-and-found-distance-and-race-both-play-a-role-206590>.
- Federal Emergency Management Agency (FEMA). 2022. *NFIP Debt*. Federal Emergency Management Agency. November 4. <https://www.fema.gov/case-study/nfip-debt>.
- Federal Emergency Management Agency (FEMA). 2024. "Hazard Mitigation Grant Program." Federal Emergency Management Agency. September 9. <https://www.fema.gov/hazard-mitigation-grant-program>.
- Firey, Walter. 1945. "Sentiment and Symbolism as Ecological Variables." *American Sociological Review* 10: 140–8.
- First Street Foundation. 2020. *First Street Foundation Flood Model: Technical Documentation*. First Street Foundation, June 17. https://assets.firststreet.org/uploads/2020/06/FSF_Flood_Model_Technical_Documentation.pdf.
- First Street Foundation. 2023. "Over 3.2 Million Americans Have Left High Flood Risk Neighborhoods Creating 'Climate Abandonment Areas.'" First Street Foundation. December 18. <https://firststreet.org/press/over-32-million-americans-have-left-high-flood-risk-neighborhoods-creating-climate-abandonment-areas>.
- Frickel, Scott, and James R. Elliott. 2018. *Sites Unseen: Uncovering Hidden Hazards in American Cities*. Russell Sage Foundation.
- Gans, Herbert J. 1962. *The Urban Villagers: Group and Class Life of Italian Americans*. Free Press.
- Harris, Alex. 2025. "Climate Change Is Coming for Florida's Real Estate. Why Don't Prices Reflect It?" *Tampa Bay Times*, May 10. <https://www.tampabay.com/news/environment/2025/05/06/florida-real-estate-prices-climate-change/>.
- Horn, Diane P. 2025. "Floodplain Buyouts: Federal Funding for Property Acquisition." Congressional Research Service. April 22. <https://crsreports.congress.gov/product/pdf/IN/IN11911>.
- Howell, Junia, and Elizabeth Korver-Glenn. 2021. "The Increasing Effect of Neighborhood Racial Composition on Housing Values, 1980–2015." *Social Problems* 68(4): 1051–71.
- Hoyt, Homer. 1933. *One Hundred Years of Land Values in Chicago*. University of Chicago Press.
- Jerolleman, Alessandra, Elizabeth Marino, Nathan Jessee, et al. 2024. *People or Property: Legal Contradictions, Climate Resettlement, and the View from Shifting Ground*. Springer International Publishing.
- Keenan, Jesse M., Thomas Hill, and Anurag Gumber. 2018. "Climate Gentrification: From Theory to Empiricism in Miami-Dade County, Florida." *En-*

- Environmental Research Letters* 13(5): 1–11. <https://doi.org/10.1088/1748-9326/aabb32>.
- Kimbro, Rachel Tolbert. 2022. *In Too Deep: Class and Mothering in a Flooded Community*. University of California Press.
- Korver-Glenn, Elizabeth, and Sarah Mayorga. 2024. *A Good Reputation: How Residents Fight for an American Barrio*. University of Chicago Press.
- Liebersohn, Stanley. 1985. *Making It Count: The Improvement of Social Research and Theory*. University of California Press.
- Logan, John R., Brian J. Stults, and Zengwang Xu. 2016. "Validating Population Estimates for Harmonized Census Tract Data, 2000–2010." *Annals of the American Association of Geographers* 106(5): 1013–29. <https://doi.org/10.1080/24694452.2016.1187060>.
- Luck, Marissa, and Diane Cowen. 2022. "How Harvey Transformed Resilient Meyerland, from Modest 1950s Homes to Raised Mini-Mansions." *Houston Chronicle*, August 24. <https://www.houstonchronicle.com/news/houston-weather/hurricanes/article/Harvey-Meyerland-transformation-raised-mansions-17388045.php>.
- Lustgarten, Abrahm. 2024. *On the Move: The Overheating Earth and the Uprooting of America*. Farrar, Straus and Giroux.
- Lynn, Kevin A. 2017. "Who Defines 'Whole': An Urban Political Ecology of Flood Control and Community Relocation in Houston, Texas." *Journal of Political Ecology* 24(1): 951–67. <https://doi.org/10.2458/v24i1.20977>.
- Mach, Katharine J., Caroline M. Kraan, Miyuki Hino, A. R. Siders, Erica M. Johnston, and Christopher B. Field. 2019. "Managed Retreat Through Voluntary Buyouts of Flood-Prone Properties." *Science Advances* 5(10). <https://doi.org/10.1126/sciadv.aax8995>.
- McConnell, Kathryn, and Liz Koslov. 2024. "Critically Assessing the Idea of Wildfire Managed Retreat." *Environmental Research Letters* 19: 041005. <https://doi.org/10.1088/1748-9326/ad31d9>.
- Morales-Giner, Pilar, and Anne Mook. 2025. "Ash Everywhere: Place Attachment and Meanings in the Aftermath of Wildfires." *Environment and Behavior* 56(9–10): 1–31.
- Morris, Aldon. 2017. *The Scholar Denied: W. E. B. Du Bois and the Birth of Modern Sociology*. University of California Press.
- Morris, Erin, Joshua J. Cousins, and Andrea Feldpausch-Parker. 2023. "Transformation and Recognition: Planning Just Climate Havens in New York State." *Environmental Science & Policy* 146: 57–65.
- Mullen, Megan. 2026. "Social Class Targeting of Property Buyouts." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 254–71. <https://doi.org/10.7758/RSF.2026.12.4.11>.
- National Association of Realtors (NAR). 2024. *2024 NAR Profile of Home Buyers and Sellers*. National Association of Realtors. https://www.nar.realtor/sites/default/files/2024-11/2024-profile-of-home-buyers-and-sellers-highlights-11-04-2024_2.pdf.
- Pais, Jeremy F., and James R. Elliott. 2008. "Places as Recovery Machines: Vulnerability and Neighborhood Change After Major Hurricanes." *Social Forces* 86(4): 1415–53. <https://doi.org/10.1353/sof.0.0047>.
- Phillips, David C. 2020. "Measuring Housing Stability with Consumer Reference Data." *Demography* 57(4): 1323–44. <https://doi.org/10.1007/s13524-020-00893-5>.
- Ramiller, Alex, Taesoo Song, Madeleine Parker, and Karen Chapple. 2024. "Residential Mobility and Big Data: Assessing the Validity of Consumer Reference Datasets." *Cityscape: A Journal of Policy Development and Research* 26(3): 227–240.
- Rhodes, Anna, and Max Besbris. 2022. *Soaking the Middle Class: Suburban Inequality and Recovery from Disaster*. Russell Sage Foundation.
- Roberto, Elizabeth. 2018. "The Spatial Proximity and Connectivity Method for Measuring and Analyzing Residential Segregation." *Sociological Methodology* 48(1): 182–224.
- Shu, Evelyn G., Jeremy R. Porter, Mathew E. Hauer, et al. 2023. "Integrating Climate Change Induced Flood Risk into Future Population Projections." *Nature Communications* 14: 7870. <https://doi.org/10.1038/s41467-023-43493-8>.
- Siders, A. R. 2022. "The Administrator's Dilemma: Closing the Gap Between Climate Adaptation Justice in Theory and Practice." *Environmental Science & Policy* 137: 280–89. <https://doi.org/10.1016/j.envsci.2022.08.022>.
- Siders, A. R., and Logan Gerber-Chavez. 2021. "Floodplain Buyouts: Challenges, Practices, and Lessons Learned." University of Delaware Disaster Research Center. August. <https://udspace.udel.edu/items/3808e0ca-aa19-4939-bcc6-63a1ad4d1edb>.
- Siders, A. R., and Jesse M. Keenan. 2020. "Variables

- Shaping Coastal Adaptation Decisions to Armor, Nourish, and Retreat in North Carolina." *Ocean & Coastal Management* 183: 105023. <https://doi.org/10.1016/j.ocecoaman.2019.105023>.
- Small, Mario Luis. 2024. *Villa Victoria: The Transformation of Social Capital in a Boston Barrio*. University of Chicago Press.
- Smith, Wallace F. 1963. "Forecasting Neighborhood Change." *Land Economics* 39(3): 292–97.
- Temkin, Kenneth, and William Rohe. 1996. "Neighborhood Change and Urban Policy." *Journal of Planning Education and Research* 15(3): 159–70.
- US Environmental Protection Agency. 2021. *Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts*. September. US Environmental Protection Agency. https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf.
- US Government Accountability Office. 2022. *Flood Mitigation: Actions Needed to Improve Use of FEMA Property Acquisitions*. Report to Congressional Requesters, no. #GAO-22-106037. US Government Accountability Office. September. <https://www.gao.gov/assets/gao-22-106037.pdf>.

The Trajectory of Rental Housing in the Wake of Natural Disasters: Evidence from California and Florida



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Natural disasters have been increasing in intensity while rental affordability has been declining in many cities. This article presents a new dataset at this intersection, merging rental outcomes with disaster incidence and government assistance. We construct two new panel models that estimate the effects of the natural disasters from 2000 to 2020 on zip codes across California and Florida. Results indicate that rents per unit increase by 0.2 to 1.3 percent immediately after a disaster and 6.5 to 12.5 percent in the long run. These findings are driven primarily by hurricanes and wildfires—and to a lesser extent, winter storms. The effects accumulate after multiple disasters. They are persistent and not mean-reverting. We further demonstrate that these impacts are moderated somewhat in communities receiving federal Community Development Block Grant–Disaster Recovery (CDBG-DR) funds, whose rental restrictions and rebuilding incentives temper post-disaster rent escalation. By centering this analysis, we highlight how disaster-recovery design influences long-term housing affordability and equity.

Keywords: natural disasters, rental housing, rental markets, CDBG-DR, housing affordability

Natural disasters fundamentally disrupt rental housing markets. They destroy properties, displace residents, and alter the balance of power between tenants and landlords, potentially ex-

acerbating income and wealth inequality. At first, disasters reduce both the demand for and the supply of housing, as population and housing units decline. What this means for housing

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affordability is an open empirical question, especially for long-term affordability as residents return home and property owners rebuild. What is the trajectory of rental housing markets during this multi-year process? And how is it altered by public policies designed to aid vulnerable residents?

In this article, we investigate how rents and vacancy rates evolve in two large states with extensive disaster experience, California and Florida, in the wake of six categories of natural disasters: earthquakes, flooding, hurricanes and tropical storms, tornadoes, wildfires, and winter storms. We situate this question within the growing literature on natural disasters, documenting the forces that push rents up and down and the many persistent, negative real economic outcomes that befall communities exposed to disaster damage despite post-disaster the Federal Emergency Management Agency (FEMA) economic assistance. These findings underscore the importance of understanding how the most vulnerable members of society bear these losses—and the role of public policies that attempt to alleviate this burden.

We begin our analysis by compiling a new database that matches disaster shocks to rental price and vacancy rate outcomes. We obtain zip code-level effective rents per unit and per square foot, asking rents per unit and per square foot, and vacancy rates from CoStar on a quarterly basis for twenty years from 2000 to 2020 in the major metropolitan areas across both California and Florida. We merge these data to zip code-level disaster incidence from the FEMA.

We then construct two types of panel models to analyze these data. First, we estimate a dosage model that counts the number of disasters by quarter and by year in each zip code, allowing us to account for the temporal overlap from multiple treatments in a way that typical difference-in-differences models do not allow. Second, we estimate the new interactive fixed effects model developed by Licheng Liu and colleagues (2024), which matches treated and control units prior to treatment to eliminate the parallel trends concern and allows units to switch in and out of treated status, relevant to our study setting as zip codes recover from one disaster and then are impacted by another.

The results in this article show that rents per unit increase by 0.2 to 0.6 percent immediately after a disaster in Florida and 0.9 to 1.3 percent immediately after a disaster in California. In the long run, the cumulative rental appreciation is 6.5 percent higher in disaster-impacted zip codes in California and 12.5 percent higher in Florida. These findings are driven primarily by wildfires and winter storms. Effects accumulate after multiple disasters. They are persistent and not mean-reverting, and they are often driven by factors other than simply the immediate destruction of housing supply, as the effect on vacancy rates is mixed.

We also investigate trajectories in markets with differential access to federal aid to support renters. In markets that receive funding from the CDBG-DR—funding that comes with certain types of rental requirements designed to protect tenants and improve rebuilding of affordable housing—the long-term increase in rents is slightly lower than the average long-run rent increase in disaster-affected zip codes. While disasters' housing-market effects are important in their own right, one of our primary analytical foci is on how federal recovery policy shapes those trajectories. The CDBG-DR program offers a quasi-experimental setting to compare similar disaster-affected areas that did and did not receive targeted recovery funds. Accordingly, we interpret all preceding estimates as a foundation for understanding the moderating role of CDBG-DR.

The results of this study offer a meaningful, policy-relevant perspective on the impacts of disasters on rental markets. Prior work on rental impacts focused on one disaster, Hurricane Sandy, in one region (New York City) (Harwood 2025); the remainder of the literature looks at property prices. Our finding that disasters in Florida and California induce sustained rental price appreciation, that is moderated by the presence of CDBG-DR, over a twenty-year period, significantly expands the literature and geographic context. This study provides more generalizable estimates than previous work by covering zip codes in major metropolitan areas of these two large states (by population, rental market, and frequency and strength of disasters). Moreover, the study provides a showcase of two valid, repeatable methods that make fu-

ture research on disaster impacts more robust. The remainder of the article reviews the economic literature documenting how housing markets adjust to natural disasters and develops hypotheses that can be tested with our new dataset. It then describes the data and methodology, presents the results, and concludes with implications for policymakers tasked with preparing for and responding to natural disasters in ways that prevent socioeconomic inequalities from expanding.

HOW NATURAL DISASTERS CAN IMPACT RENTAL HOUSING MARKETS

The classic economics model of supply and demand does not offer a clear prediction for rental affordability in the wake of natural disasters. In this section, we outline the forces that can drive rents up versus down—and how these forces might differ across geographies, disaster types, and time. We also review the literature documenting the government’s role in mitigating these impacts.

Downward Pressure: Forces That Can Decrease Rents

Natural disasters often drive residents out of their homes, at least temporarily, leading to loss of population, income, wealth, and rental housing demand. If this effect dominates, vacancies should increase, and rents should fall. Katharine WH Harwood (2025) shows that this dynamic took hold in low-income neighborhoods in New York City in the wake of Hurricane Sandy. Since there was heterogeneity across neighborhoods, this study suggests that we might find negative or muted effects of hurricanes on rents, but it is not clear if this finding will extend to other disaster types. There has been little research on rents aside from this study, but researchers have documented this impact on property prices extensively.

Even before a disaster occurs, property prices discount at least some of the risk to which they are exposed. In the Fargo-Moorhead metropolitan area in Minnesota and North Dakota, straddling the oft-flooding Red River of the North, for example, housing prices within the one-hundred-year floodplain are valued 3.5 to 12.2 percent less than comparable properties outside the floodplain (Zhang and Leonard 2019). This

risk is often moderated by mitigation features. In Miami-Dade County in Florida, hurricane mitigation features increase housing prices by 4 to 10 percent—but importantly, only if those features are verified, suggesting that the effect is due to the insurance premium value rather than the actual structural protection of the house (Gatzlaff et al. 2017). Similarly, in Japan, Tokyo has successfully limited flooding in low-lying areas, and housing prices have responded positively (Sado-Inamura and Fukushima 2019). When a disaster actually occurs, however, it becomes clear that more decreases in real estate prices—both residential and commercial—are in store (Boustan et al. 2020; Cheung et al. 2018; Eichholtz et al. 2019). Even in Fargo-Moorhead, where the discount was apparent before the floods, Lei Zhang and Tammy Leonard (2019) find that the discount grows significantly after floods.

Why do prices respond so negatively? Resident behavior offers some explanation. From 1920 to 2010, natural disasters have driven significant out-migration from US counties despite increasingly active governmental policies of assistance (Boustan et al. 2020). After Hurricane Katrina, over one-third of the displaced residents did not return in the decade that followed, significantly reducing housing demand (Deryugina et al. 2018). These residents who evacuated were more likely to be older, higher-income, and White, leaving the local market with lower wealth and more vulnerability per capita (Bleemer and van der Klaauw 2019). Homeowners who do stay are more likely to get insurance after floods, but they do not appear to distinguish between high-cost and low-cost floods in choosing the optimal policy—and regardless, the effect disappears within a decade (Gallagher 2014). This evidence is consistent with laboratory experiments showing that a large share of the population is “experiential,” meaning they are only willing to sacrifice if they personally experience extreme events. If there is a significant delay between the sacrifice and the payoff—that is, between mitigation and damages—then the group will fail to cooperate in preventing disaster (Ghidoni et al. 2017). Thus, disasters will not be sufficiently anticipated, damages will not be sufficiently mitigated, and costs will not be borne by society equitably.

These failures, in turn, generate real economic outcomes. Comparing observably equivalent blocks in New Orleans, flooded households had higher mortgage delinquency rates, lower credit scores, and lower homeownership rates (Gallagher and Hartley 2017; Bleemer and van der Klaauw 2019). After Hurricane Katrina, labor income fell, and unemployment receipts, non-employment, retirement account withdrawals, and uptake of disability insurance and unemployment all increased. Most of these outcomes returned to their original level after one year, and wages even became higher for hurricane victims, mostly for the evacuees who did not return (Deryugina et al. 2018). Thus, it is not surprising that county-level natural hazard damages from 1999 to 2013 were associated with increases in wealth inequality between Whites and Blacks, between college-educated households and high school dropouts, and between homeowners and renters (Howell and Elliott 2019).

Upward Pressure: Forces That Can Increase Rents

On the other hand, the physical destruction wrought by natural disasters often eliminates capital stock or renders it uninhabitable, driving down rental supply. If this effect dominates, vacancies should decrease, and rents should rise. In the wake of the 2025 wildfires in the Los Angeles area, for instance, news outlets reported significant rate hikes as displaced households flooded the nearby rental markets searching for immediate housing outside the burned areas (Siegel et al. 2025). Three weeks after the Eaton Fire began, the neighboring city of Pasadena had experienced a 60 percent decline in available units and an 85 percent decline specifically in two-bedroom units that could house entire families (Patap 2025). Economic theory suggests that these declines should have the largest impact in markets with low housing supply elasticities, where it is difficult and expensive to build, funneling these demand pressures more into rents than into new construction (Glaeser and Gyourko 2018).

However, this new equilibrium should be temporary. As tenants return and landlords rebuild, the supply curve should retrace its path back to the original equilibrium—unless some-

thing more fundamental has changed about how the market operates. There are at least three ways in which these changes could make rental appreciation more permanent.

First, there could be a permanent increase in rental demand. Tamara L. Sheldon and Crystal Zhan (2019) show that homeownership rates decline after natural disasters, likely because residents update their risk beliefs about the potential losses to property investment. As these residents shift their preferences from owning to renting, the number of renters will increase, putting upward pressure on rents.

Second, insurance companies are likely to raise premiums and deductibles in the wake of natural disasters to cover their losses, protect against future losses, and compensate themselves for the risk associated with new policies. If landlords pass these insurance costs onto tenants, rents will rise. Even in the absence of natural disasters, insurance costs are the fastest growing operating expense that landlords must pay, and nearly half of landlords reported that they were passing some of these insurance hikes on to their tenants (Baar et al. 2024; National Multifamily Housing Council 2023).

Third, it is likely that the disaster destroyed older, more affordable units, allowing developers to build newer, more expensive units in their place. This change in the composition of the housing stock may lead to an increase in rents, and it may attract wealthier residents, changing the composition of the population as well. Ana Varela Varela (2023) finds that, in the aftermath of Hurricane Sandy, flooded coastal properties in areas with higher preflood incomes increased in value, and these areas saw increases in high-income White buyers. This suggests that disaster recovery can lead to increased income segregation via more White high-income enclaves, a pattern documented by Ingrid Gould Ellen and colleagues (2026, this issue). Additionally, disaster recovery aid can exacerbate these inequalities, allocating more capital to wealthier residents, which allows them to remain in the area and rebuild while low-income households are displaced (Rhodes and Besbris 2022). Nicole Lambrou and colleagues (2025) show this pattern after the 2018 Camp Fire in Paradise, California, leading to gentrification.

The Role of Government Intervention

Disaster recovery aid flows in different ways to homeowners and renters, and again in different ways to owners and landlords of rental properties. This possibly creates a disparate effect of disaster recovery effectiveness by housing tenure. Junia Howell and James R. Elliott (2019) find that aid from FEMA is associated with greater wealth inequality in a given county, but Zachary Bleemer and Wilbert van der Klaauw (2019) report that Gulf Opportunity Zone subsidies were larger for young and low-income residents and similar across races, leading to higher homeownership, lower delinquency rates, and greater paydown of outstanding mortgages. What is clear is that these interventions are insufficient to prevent persistently negative outcomes. Even though government transfers exceeded capital damage per capita after the average hurricane from 1979 to 2002, the reduction in employment persisted for five to ten years—with seemingly permanent effects for hurricanes of Category 3 or higher (Deryugina 2017). This negative shock to incomes will tend to reduce rental demand, but it occurs at the same time that landlords may experience greater bargaining power due to the shortage of affordable housing units. On balance, what happens to rents and to the availability of housing, especially when the government intervenes to try to protect renters?

Putting It All Together: Hypotheses Regarding Differential Impacts

This literature review suggests several testable hypotheses that unpack the likely heterogeneity of natural disaster impacts in new ways:

- H1: Because the forces of downward pressure and upward pressure compete in different ways for different disasters, there will be significant differences across disaster types, with some disasters leading to increases in rents and others leading to decreases in rents.
- H2: Because the forces of downward pressure, upward pressure, and government intervention depend on the local rental market and local and state housing policies, there will be significant differences across

states, with California and Florida experiencing different impacts even for the same type of disaster.

- H3: On average across all disaster types, rent increases rather than rent decreases are more common after natural disasters, consistent with the strong evidence of upward pressure and anecdotal lived evidence from tenants (Martín et al. 2023).
- H4: In California, where housing supply elasticities are lower and construction is more expensive and time-consuming, rent increases in the wake of natural disasters will be greater than in Florida, where supply is more responsive to demand.
- H5: In the wake of natural disasters, rental increases will be persistent over the long run, even when vacancy rates do not decrease, reflecting the long-term upward pressure forces identified in the literature that are unrelated to short-term vacancy impacts.
- H6: Government intervention that encourages construction of affordable housing in the wake of natural disasters, such as CDBG-DR funding, will moderate the rental appreciation over the long run.

These six hypotheses follow directly from the literature reviewed earlier. If the empirical evidence confirms these hypotheses, it improves our understanding not only about how rental markets work in the wake of natural disasters but also how policy can be calibrated more precisely to the needs of different markets after different types of disasters.

DATA

To conduct our analysis, we match zip code-level rental data on multifamily housing with locally geocoded variables indicating disaster incidence. First, we obtain rental data from the commercial real estate data provider CoStar. For each building in their database, CoStar collects data on the distribution of unit types, average monthly rent for unit type, vacancy rates, and building characteristics, transactions, and valuations. From these property-level data, CoStar aggregates up to weighted averages within each

zip code, which is useful for matching with other datasets. While CoStar does not collect the entire universe of properties and zip codes, the sample size is sufficiently large for regression modeling in most major markets within California and Florida.

California and Florida are natural choices for study areas due to the frequent incidence of natural disasters and relatively large rental housing sectors. Florida had thirty-six “billion dollar disasters” from 2000 to 2019 (NOAA 2024a), with overall damages estimated at \$150–\$300 billion and California had twenty-seven “billion dollar disasters” from 2000 to 2019, with overall damages estimated at \$60–\$120 billion (NOAA 2024b), across multiple disaster types. Together, these account for 13 to 26 percent of damages from these very large disasters from 2000 to 2019, and likely a high share of smaller disaster damage too. Together, California’s six million-unit rental market and Florida’s three-and-a-half-million-unit rental market make up more than one-fifth of all US rentals. The multifamily rental markets in both states are continuously exposed to disasters, providing a relevant and powerful test case for measuring rental market impacts of natural disasters. Studying outcomes in these states across multiple disasters adds to previous disaster-specific studies of Hurricane Katrina (New Orleans and surrounding regions) and Hurricane Sandy (New York City region). We cannot claim that these two states are representative of the experiences of all Americans in all states, but they provide an important window into many typical experiences and a new window into many cities that have not been studied previously in the literature.

We identify all major natural disasters in California and Florida that generated a FEMA Major Disaster Individual Assistance Declarations and had FEMA funds allocated toward rental properties for rebuilding between 2000 and 2020, the time period for which we have rental data available. These disasters fall into

the following six categories: earthquakes, flooding, hurricanes and tropical storms, tornadoes, wildfires, and winter storms. We match the disasters to zip codes, based on FEMA emergency declarations at the county level.¹

We collect quarterly data on multifamily buildings for every five-digit zip code available in CoStar in Florida and California. CoStar data are available for 1,061 zip codes in California (of 1,768) and 703 in Florida (of 1,476 total). These zip codes include urban, suburban, and even exurban and rural places in both states (see figure 1). We focus here on two dependent variables: effective rent per unit (asking rent per unit and any concessions) and vacancy rate. We find the results to be robust across different versions of these variables, including effective rent per square foot or asking rent that does not account for rental concessions.²

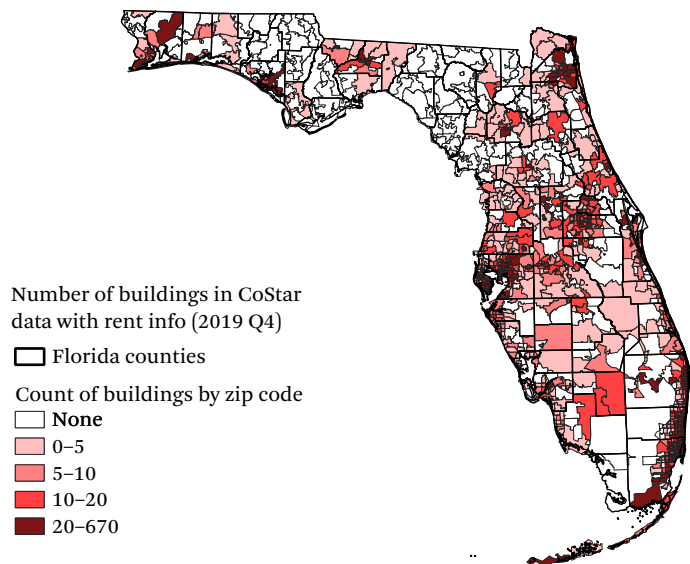
For demographic covariates, we merge these data with the following variables longitudinally from the US Census Bureau’s five-year American Community Survey (ACS) (for 2009 to 2020) and Decennial Census (2000): total population size, poverty rate, share of renters, and share of White residents. ACS and Census data are not available for 2001 to 2008 at the zip code level; we linearly interpolate values for the years when data are not available. Table 1 shows these variables annually for California, averaged across all zip codes and all quarters in the dataset. Following national trends, it shows an increase in rents from 2000 to 2008, followed by a decline during the Great Recession and then a long appreciation period to 2020. Vacancy rates peak in 2009 and then begin a long decline that continues until 2018. The total population grows in most years, and the housing stock achieves steady growth almost every year. The poverty rate is steady in the early years but starts rising after the Great Recession, peaking in 2014 before declining to its lowest point by 2020. The percent of renters rises over time from 41.3 percent to 45.2 percent, as affordability challenges

1. All these disasters have been officially declared at both the state and federal levels, and impacted areas are shown at the county level.

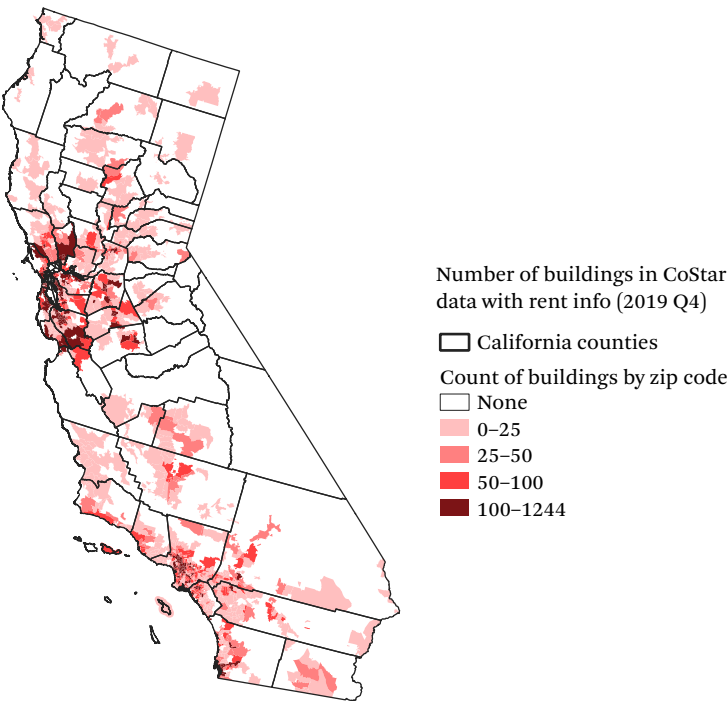
2. The coefficients do not change significantly when we change from effective rent per unit to effective rent per square foot, indicating that the results do not depend on the disasters’ systematic impact on units of smaller or larger sizes.

Figure 1. Zip Code CoStar Building Count

Panel A. Florida



Panel B. California



Source: CoStar.

Table 1. California Descriptive Statistics

	Asking Rent Per Unit	Vacancy Rate (Percent)	Total Population	Housing Units	Poverty Rate (Percent)	Renter Share (Percent)	White Share (Percent)
2000	1,056	3.5	30,130	10,795	13.1	41.3	52.9
2001	1,141	4.5	30,351	10,897	13.1	41.7	52.0
2002	1,141	5.4	30,559	10,995	13.1	41.9	51.3
2003	1,124	5.6	30,780	11,097	13.1	42.1	50.6
2004	1,125	5.9	31,001	11,199	13.1	42.3	49.9
2005	1,159	5.4	31,222	11,301	13.1	42.4	49.3
2006	1,222	4.9	31,443	11,402	13.1	42.6	48.6
2007	1,287	4.9	31,664	11,504	13.1	42.8	48.0
2008	1,319	5.3	31,885	11,606	13.1	43.0	47.4
2009	1,262	6.1	32,106	11,708	13.2	43.1	46.8
2010	1,236	5.8	31,972	11,678	13.2	43.3	46.4
2011	1,249	5.0	31,715	11,636	13.4	42.4	46.9
2012	1,279	5.5	32,024	11,664	14.3	43.2	46.4
2013	1,320	5.1	32,312	11,712	14.9	43.8	45.9
2014	1,364	4.7	32,665	11,756	15.3	44.3	45.4
2015	1,430	4.6	32,969	11,808	15.3	44.7	44.9
2016	1,490	4.4	33,174	11,864	14.9	44.9	44.6
2017	1,540	4.5	33,461	11,936	14.2	44.5	44.1
2018	1,590	4.4	33,609	12,015	13.6	44.4	43.7
2019	1,637	4.5	33,718	12,095	12.7	44.1	43.3
2020	1,789	5.0	35,942	12,791	11.9	45.2	39.8

Source: Authors' calculations.

have reduced homeownership. The non-Hispanic White share of the population declines from 52.9 percent to 39.8 percent. In Florida, table 2 shows similar cyclical patterns in rents and vacancy rates, though monthly rents are generally \$200 to \$400 lower and vacancy rates are generally two to three percentage points higher. The total population is growing faster in Florida, as is the housing stock. The poverty rate is slightly lower, and the percent of renters is much lower, rising from 29.3 percent to 35.8 percent over time. The White share is much higher, declining from 69.3 percent to 53.9 percent.

Scope and External Validity

Our study focuses on California and Florida, which together account for roughly one-quarter of US disaster damages and encompass diverse hazard types and housing markets. Nevertheless, these findings should be interpreted as analytically illustrative rather than nationally

representative. Similarly, the CDBG-DR analysis conditions on areas that received federal recovery allocations, which may reflect higher verified damage or administrative capacity than other jurisdictions.

METHODOLOGY

Our goal is to identify the effect of natural disasters on the rental market. A standard difference-in-differences approach is insufficient to achieve this goal, even given recent advances in the field. We identify four econometric challenges, only one of which the current difference-in-differences tool kit can resolve.

First, natural disasters are staggered treatments. They affect different zip codes at different times. It is not a simple binary switch that gets flipped for all the treated units simultaneously. Fortunately, the recent difference-in-differences literature proposes useful methods to explore this timing heterogeneity (for exam-

Table 2. Florida Descriptive Statistics

	Asking Rent Per Unit	Vacancy Rate (Percent)	Total Population	Housing Units	Poverty Rate (Percent)	Renter Share (Percent)	White Share (Percent)
2000	835	7.0	22,150	10,155	12.1	29.3	69.3
2001	861	7.4	22,392	10,321	12.3	29.9	68.3
2002	868	7.2	22,652	10,494	12.6	30.3	67.4
2003	862	7.4	22,912	10,668	12.8	30.8	66.6
2004	861	7.6	23,172	10,841	13.0	31.2	65.8
2005	884	6.4	23,432	11,015	13.2	31.6	65.1
2006	930	6.6	23,692	11,188	13.5	31.9	64.3
2007	975	8.6	23,952	11,362	13.7	32.3	63.6
2008	959	9.7	24,212	11,535	13.9	32.6	63.0
2009	928	9.6	24,471	11,709	14.1	33.0	62.3
2010	919	8.4	24,292	11,677	14.4	33.0	62.1
2011	929	8.0	24,190	11,628	14.5	31.2	62.7
2012	948	7.4	24,430	11,676	15.4	32.2	62.3
2013	971	6.5	24,702	11,702	16.1	33.1	61.9
2014	995	6.0	25,069	11,763	16.4	34.1	61.4
2015	1,036	5.9	25,441	11,821	16.3	34.9	60.9
2016	1,074	5.9	25,811	11,899	15.9	35.4	60.4
2017	1,107	6.0	26,260	12,032	15.3	35.4	59.7
2018	1,146	6.0	26,688	12,151	14.6	35.1	59.1
2019	1,179	6.3	27,059	12,278	13.8	34.7	58.6
2020	1,303	7.2	29,224	13,132	13.5	35.8	53.9

Source: Authors’ calculations.

ple, Callaway and Sant’Anna 2021; Goodman-Bacon 2021). Unfortunately, these methods do not address the other econometric challenges we describe later.

Second, the effects of natural disasters are likely not permanent. In fact, these effects are of indeterminate length. When the econometrician codes a unit as treated, should it stay treated for the entire posttreatment period? Certainly, as rebuilding occurs, the initial effects can dissipate. Perhaps this can be captured by time-varying effects, but this approach leads to a new problem.

This third problem is the temporal overlap of natural disasters. Sometimes, a zip code is hit by a second disaster in the same quarter. Sometimes, the second disaster occurs a quarter later. Sometimes, it occurs a year or more later. This overlap will be greater in the model if the post period is coded as lasting for longer. Thus, it matters greatly whether the effect is

assumed to be permanent or to have a finite length. However, the existing difference-in-differences approaches do not address this potential temporal overlap, in which a treatment is not binary but rather varies depending on the extent of overlap.

If we grant the possibility of nonpermanent treatment effects, then we introduce a fourth problem: units switching in and out of treatment status. The state-of-the-art difference-in-differences models do not allow for units to be removed from treatment because they are trying to minimize the difficulty in understanding the control groups, which change over time with staggered treatments. The problem of fluid control groups is magnified by units switching between treatment and control status and back again.

To address these four problems, we construct two models. The first is a dosage-type model, as biostatisticians use to understand the effects of

different dosages of a medical treatment such as a pharmaceutical drug. In such a case, there is essentially overlap of treatments—for example, where some patients receive one pill, others receive two, and so on. This is analogous to different zip codes experiencing different numbers of disasters in a given time period. In this approach, our model is similar to Boustan et al. (2020):

$$Y_{ijt} = \sum_{b=0}^4 \beta_b \text{Disasters}_{ijt-b} + \delta_i + \mu_t + \gamma X_{ijt} + \theta_j * (S_j * t) + \varepsilon_{ijt} \quad (1)$$

where Y_{ijt} is our outcome variable rents or vacancy rates, Disasters_{ijt-b} is a series of variables counting the number of different kinds of disasters that occur in zip code i within state j at time t , δ_i is an indicator variable for geographic fixed effects, μ_t is an indicator variable for time fixed effects, X_{ijt} is a vector of demographic control variables, and $(S_j * t)$ is a series of state-specific linear time trends.

This model allows significant flexibility to vary the outcome variable (rents or vacancy rates), the geographic fixed effects (county or zip code), and the time fixed effects (quarter or year). We cluster standard errors at the level above the geographic fixed effects (county or state, respectively) to account for spatial correlation. In equation (1), we employ four quarterly lags to measure the effects of disasters up to one year afterward in a quarterly model; we will also show a specification with one lag when using annual data. Thus, we can address two econometric challenges with this model: the staggered treatments and the temporal overlap of treatments.

The second model takes aim at the problem of units switching in and out of treatment, as well as the unclear finite persistence of the post-treatment effect. We employ the new interactive fixed effects model developed by Liu and colleagues (2024), which allows for these possibilities. Similar to a synthetic control, it matches the pretreatment trends of the treated and control groups, so there is no need to be concerned about the parallel trends problem that so often

plagues difference-in-differences designs.³ Unlike the synthetic control method, however, the interactive fixed effects model allows for multiple treated units.

Briefly, the estimation strategy predicts the counterfactual outcomes in the absence of the treatment—in this case, how rental outcomes would have been different for disaster-impacted zip codes if they had not experienced a disaster—using the observed and unobservable covariates of the untreated observations during our study period (2000–2020), where unobservable attributes are proxied by fixed effects. Specifically, it fits a model of the form:

$$Y_{ijt} = \text{Post}_{ijt} + \delta_i + \mu_t + \gamma X_{ijt} + \lambda_{ij} f_t + \varepsilon_{ijt} \quad (2)$$

where the new term $\lambda_{ij} f_t$ captures the unobservable attributes by assigning a time trend to each zip code and allowing the interactive coefficients to differ heterogeneously across the cross section.

Because this model follows a more familiar difference-in-differences type approach, the treatment variable takes the form of a post-disaster indicator, set to 1 in the periods after the disaster when we expect the zip code to be impacted. We show specifications where the treatment lasts for different time periods, but we also estimate a specification that is agnostic to this problem. Rather than trying to impose structure on the posttreatment period, this latter approach makes each treatment permanent but separates the first treatment to impact a unit from the second, third, and so forth. Thus, we can show the effect of the first disaster to strike a zip code during our time period, controlling for the second and third; the effect of the second disaster, controlling for the first and third; and so on. In all these specifications, the interactive fixed effects strategy uses the counterfactuals and the actual treated outcomes to estimate individualistic treatment effects for each unit-time (zip code-quarter) observation and averages across the units for dynamic post-treatment estimates.

3. Carlos Martin and colleagues (2023) use this more simplistic difference-in-differences model and find very similar results to our findings here. However, the interactive fixed effects model is far more robust and rigorous for the reasons mentioned in this section, and it reveals more persistent long-term impacts.

It is important to note that CDBG-DR allocations are not random. Jurisdictions become eligible only after presidential disaster declarations and state or local applications verified by the US Department of Housing and Urban Development (HUD), typically prioritizing areas with the greatest documented damage and administrative capacity to implement large grants. These factors may correlate with both pre-disaster rental dynamics and post-disaster reconstruction potential. To partially address this concern, our interactive fixed-effects framework matches CDBG-DR zip codes to comparable untreated zip codes within the same state that share similar pre-disaster rent trajectories. The persistence of differences, if they exist, even after this adjustment suggests—but does not conclusively prove—a mitigating effect of CDBG-DR. Future research with detailed project-level grant data could further test for selection bias using propensity-score or synthetic-control designs.

RESULTS

In this section, we operationalize our two models using two outcome variables: rent per unit and vacancy rate. In each case, we run several different specifications, varying the data frequency as well as the geographic unit of analysis, to test the sensitivity of the model and provide a robust range of treatment effects. Throughout these models, we find sufficiently high *F*-statistics, *R*-squared, and degrees of freedom, indicating that the methodology works well in this application for these study areas. First, we present the dosage models. Second, we present the interactive fixed effects models. Finally, we break down the results depending on whether the zip codes received CDBG-DR funding after the disaster.

Dosage Model

Rents per unit change in very different ways depending on the type of disaster, as indicated by the coefficients in table 3. This model focuses on quarterly changes, in which columns (1) and (3) use zip code and quarter fixed effects for California and Florida, respectively, and col-

umns (2) and (4) use zip code and year fixed effects for California and Florida, respectively. Across both specifications, some consistent patterns arise. Generally, natural disasters either have a significant positive effect or a null effect on rents, but there is very little evidence of negative effects. However, confirming hypotheses H1 and H2, there are significant differences across both disaster types and states. Wildfires have the strongest effect, increasing rents significantly in California. Hurricanes also have a significant positive effect in most specifications in Florida. Winter storms have a weakly positive effect in California but not in Florida.⁴ Tornadoes have a very weak positive effect in Florida. Earthquakes and flooding do not have significant positive or negative effects, consistent with the muted average effects suggested by Harwood (2025), where the decline in rental demand balances out the loss of rental supply.

Testing hypotheses H3 and H4, we combine the different disaster types into one general natural disasters variable in table 4. Consistent with H3, we find that disasters significantly increase rents by 0.2 to 0.6 percent per quarter in Florida and by 0.9 to 1.3 percent per quarter in California. This is consistent with a reduced supply, caused by damage and destruction to the properties, as well as homeowners shifting to renting as they update their risk beliefs, as suggested by Sheldon and Zhan (2019). Consistent with H4, these supply effects are more impactful in California than in Florida, consistent with the lower supply elasticities in California cities that generate greater housing shortages and more difficulty in rebuilding (Saiz 2010; Miller et al. 2026).

Vacancy rate effects also depend on disaster type, as shown in table 5. These columns follow the same specification variations as table 3. The strongest effects here come from flooding and hurricanes, which lower vacancy rates, and wildfires and winter storms, which raise vacancy rates. The other disasters have less significant impacts. Table 6 confirms that natural disasters, taken together, have a mixed effect on vacancy rates, with most coefficients very close to zero.

4. It may surprise some readers to see winter storms in Florida, but they do occur. In February 2001, for instance, FEMA declared a major disaster due to a “severe freeze” event that impacted most of the state.

Table 3. Dosage Model: Quarterly Rent per Unit

	(1) California	(2) California	(3) Florida	(4) Florida
Earthquakes _t	0.002 (0.007)	0.002 (0.007)		
Earthquakes _{t-1}	-0.003 (0.008)	0.001 (0.009)		
Flooding _t	0.005 (0.009)	-0.005 (0.007)	-0.006 (0.015)	-0.006 (0.013)
Flooding _{t-1}	0.010 (0.008)	0.011 (0.007)	-0.010 (0.016)	-0.015 (0.014)
Hurricanes _t			0.004** (0.002)	0.001* (0.001)
Hurricanes _{t-1}			0.005** (0.002)	-0.002** (0.001)
Tornadoes _t			0.008 (0.006)	0.010* (0.006)
Tornadoes _{t-1}			0.008 (0.006)	0.008 (0.005)
Wildfires _t	0.016*** (0.004)	0.008 (0.005)		
Wildfires _{t-1}	0.019*** (0.005)	0.022*** (0.005)		
Winter _t	0.010* (0.005)	0.008* (0.004)	0.007 (0.021)	-0.002 (0.007)
Winter _{t-1}	0.008 (0.005)	0.009** (0.003)	0.004 (0.021)	0.001 (0.007)
Demographic controls	Y	Y	Y	Y
Zip code FEs	Y	Y	Y	Y
Quarter FEs	Y	N	Y	N
Year FEs	N	Y	N	Y
State-time trends	Y	Y	Y	Y
Observations	85,537	85,537	54,269	54,269
R ²	0.981	0.980	0.979	0.979

Source: Authors' calculations.

* $p < .05$; ** $p < .01$; *** $p < .001$

Consistent with hypothesis H5, rental increases are possible even when vacancy rates do not decrease significantly.

We test the robustness of these results in table 7 by aggregating all disasters by zip code annually and then running a one-lag model to estimate the effect of the current year and the previous year's disasters on both rent per unit and vacancy rate. These results are very similar to the findings from the quarterly model. The effect on rents per unit is a significant increase

of 0.5 percent per year in Florida and 1.2 to 1.3 percent per year in California, and vacancy rates do not change significantly.

We also explore heterogeneity by historical disaster exposure. Some counties experience disasters frequently since the federal declaration dataset began in 1964, and others do not. Does it matter how much experience a county has with natural disasters when it is hit by the next one? To answer this question, we divide the dataset roughly into thirds based on the ter-

Table 4. Dosage Model: Quarterly Rent per Unit

	(1) California	(2) California	(3) Florida	(4) Florida
Disasters _t	0.011** (0.005)	0.006 (0.005)	0.005*** (0.002)	0.002** (0.001)
Disasters _{t-1}	0.011** (0.005)	0.013*** (0.005)	0.006** (0.002)	0.000 (0.001)
Disasters _{t-2}	0.009** (0.004)	0.013*** (0.004)	0.005** (0.002)	0.002 (0.001)
Disasters _{t-3}	0.011** (0.005)	0.009** (0.004)	0.005** (0.002)	0.004*** (0.001)
Disasters _{t-4}	0.013** (0.005)	0.003 (0.003)	0.004** (0.002)	0.006*** (0.002)
Demographic controls	Y	Y	Y	Y
Zip code FEs	Y	Y	Y	Y
Quarter FEs	Y	N	Y	N
Year FEs	N	Y	N	Y
State-time trends	Y	Y	Y	Y
Observations	82,451	82,451	52,315	52,315
R ²	0.981	0.981	0.979	0.979

Source: Authors' calculations.

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 5. Dosage Model: Quarterly Vacancy Rate

	(1) California	(2) California	(3) Florida	(4) Florida
Earthquakes _t	0.009 (0.007)	0.008 (0.007)		
Earthquakes _{t-1}	0.005 (0.006)	0.005 (0.006)		
Flooding _t	-0.003*** (0.001)	0.000 (0.001)	-0.003 (0.003)	-0.003 (0.003)
Flooding _{t-1}	-0.002** (0.001)	-0.002*** (0.000)	-0.001 (0.005)	0.000 (0.006)
Hurricanes _t			-0.000 (0.001)	-0.001*** (0.000)
Hurricanes _{t-1}			0.000 (0.001)	-0.000 (0.000)
Tornadoes _t			0.001 (0.002)	-0.001 (0.003)
Tornadoes _{t-1}			0.001 (0.002)	-0.000 (0.002)
Wildfires _t	0.001 (0.001)	0.002*** (0.001)		

Table 5. (continued)

	(1) California	(2) California	(3) Florida	(4) Florida
Wildfires _{t-1}	0.002* (0.001)	0.001 (0.001)		
Winter _t	-0.000 (0.002)	0.000 (0.001)	0.003 (0.008)	0.005** (0.002)
Winter _{t-1}	0.000 (0.001)	0.000 (0.001)	0.003 (0.007)	0.002 (0.002)
Demographic controls	Y	Y	Y	Y
Zip code FEs	Y	Y	Y	Y
Quarter FEs	Y	N	Y	N
Year FEs	N	Y	N	Y
State-time trends	Y	Y	Y	Y
Observations	84,995	84,995	53,939	53,939
R ²	0.716	0.714	0.541	0.539

Source: Authors' calculations.

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 6. Dosage Model: Quarterly Vacancy Rate

	(1) California	(2) California	(3) Florida	(4) Florida
Disasters _t	-0.000 (0.001)	0.001 (0.001)	0.000 (0.001)	-0.001 (0.000)
Disasters _{t-1}	0.000 (0.001)	-0.000 (0.001)	0.000 (0.001)	-0.000 (0.001)
Disasters _{t-2}	0.001 (0.001)	0.000 (0.001)	0.001 (0.002)	0.002* (0.001)
Disasters _{t-3}	0.001 (0.001)	0.000 (0.001)	0.000 (0.002)	0.000 (0.001)
Disasters _{t-4}	0.001 (0.001)	0.001** (0.001)	0.000 (0.001)	-0.000 (0.001)
Demographic controls	Y	Y	Y	Y
County FEs	Y	Y	N	N
Zip code FEs	Y	Y	Y	Y
Quarter FEs	Y	N	Y	N
Year FEs	N	Y	N	Y
State-time trends	Y	Y	Y	Y
Observations	81,964	81,964	52,070	52,070
R ²	0.710	0.709	0.539	0.537

Source: Authors' calculations.

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 7. Dosage Model: Annual Rent per Unit and Vacancy Rate

	(1) ln(Rent) California	(2) ln(Rent) Florida	(3) Vacancy Rate California	(4) Vacancy Rate Florida
Disasters _t	0.012** (0.005)	0.005** (0.002)	0.001 (0.001)	0.001 (0.001)
Disasters _{t-1}	0.013** (0.005)	0.005** (0.002)	0.001 (0.001)	0.000 (0.001)
Demographic controls	Y	Y	Y	Y
Zip code FEs	Y	Y	Y	Y
Year FEs	Y	Y	Y	Y
State-time trends	Y	Y	Y	Y
Observations	20,667	13,162	20,555	13,116
R ²	0.983	0.981	0.736	0.577

Source: Authors' calculations.

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 8. Dosage Model: Quarterly Rent per Unit by Disaster Frequency

	(1) California Low	(2) California Medium	(3) California High	(4) Florida Low	(5) Florida Medium	(6) Florida High
Disasters _t	0.007 (0.010)	-0.001 (0.008)	0.005 (0.003)	0.001 (0.003)	0.006** (0.002)	0.008* (0.001)
Disasters _{t-1}	0.007 (0.011)	-0.002 (0.007)	0.009** (0.003)	0.002 (0.003)	0.008*** (0.003)	0.004 (0.001)
Disasters _{t-2}	-0.001 (0.007)	-0.002 (0.005)	0.010** (0.003)	0.002 (0.003)	0.008*** (0.003)	0.003* (0.000)
Disasters _{t-3}	0.003 (0.008)	0.000 (0.007)	0.008** (0.002)	0.003 (0.003)	0.006** (0.003)	0.006* (0.000)
Disasters _{t-4}	0.002 (0.009)	0.002 (0.008)	0.006* (0.003)	0.003 (0.003)	0.005** (0.002)	0.008** (0.001)
Demographic controls	Y	Y	Y	Y	Y	Y
Zip code FEs	Y	Y	Y	Y	Y	Y
Quarter FEs	Y	Y	Y	Y	Y	Y
State-time trends	Y	Y	Y	Y	Y	Y
Observations	17,511	27,917	36,992	17,521	27,579	7,215
R ²	0.983	0.978	0.987	0.969	0.982	0.987

Source: Authors' calculations.

* $p < .05$; ** $p < .01$; *** $p < .001$

ciles of total disasters declared in each county. Table 8 shows the results for these three subsamples, classified as “low” frequency if they experienced fewer than twelve disasters, “medium” frequency if they experienced twelve to sixteen disasters, and “high” frequency if they

experienced more than sixteen disasters. We run a quarterly dosage model with zip code and quarter fixed effects. The coefficients are largest and most significant for the medium and high frequency counties, suggesting that disasters have the greatest impact in counties where

they are experienced most often. Rather than adapting to the repeated disasters, these counties seem to experience magnified effects from the compounded damage.

Finally, we consider whether rent stabilization policies might have an impact on these post-disaster rent increases. In table 9, we run the quarterly dosage model using zip code and quarter fixed effects and include a dummy variable controlling for any time and place where rent stabilization policies were in place in California. The results are very similar to our original findings, suggesting that the impacts are not driven by these policies. Our model is robust to this control variable.

Interactive Fixed Effects Model

How persistent are these effects over the long run? The interactive fixed effects model provides an answer by matching the treated and control groups in the pretreatment period and then estimating quarterly time-varying posttreatment effects for several years. Because this rich temporal variation can only be visualized with a separate graph for each regression, we aggregate across all disasters for this model, rather than showing the variation across every different type of disaster.

As outlined in the methodology section, there are two ways to estimate the treatment effect in this model. First, we identify each treatment as permanent without any units switching out of treated status; however, we have a separate treatment for the first, second, and third disaster to strike a given zip code. Thus, the temporal overlap is handled here by distinguishing between the number of successive disasters, rather than trying to make an assumption about how long the average treatment lasts.

Figure 2 shows each specification of this model in a separate line connecting quarterly average treatment effects for California (panel A) and Florida (panel B). The first disaster line indicates the effect of the initial event on a zip code, controlling for the second and third disaster. It reveals steadily increasing rents as soon as the disaster occurs, peaking around

Table 9. Dosage Model: Quarterly Rent per Unit with Rent Stabilization Control in California

	(1)	(2)
Earthquakes _t	0.002 (0.007)	0.002 (0.007)
Earthquakes _{t-1}	-0.003 (0.008)	0.001 (0.009)
Flooding _t	0.005 (0.009)	-0.005 (0.007)
Flooding _{t-1}	0.010 (0.008)	0.011 (0.007)
Wildfires _t	0.016*** (0.004)	0.008 (0.005)
Wildfires _{t-1}	0.019*** (0.005)	0.022*** (0.005)
Winter _t	0.010* (0.005)	0.008* (0.004)
Winter _{t-1}	0.008 (0.005)	0.009** (0.003)
Rent stabilization	0.010 (0.021)	0.010 (0.021)
Demographic controls	Y	Y
Zip code FEs	Y	Y
Quarter FEs	Y	N
Year FEs	N	Y
State-time trends	Y	Y
Observations	85,537	85,537
R ²	0.981	0.980

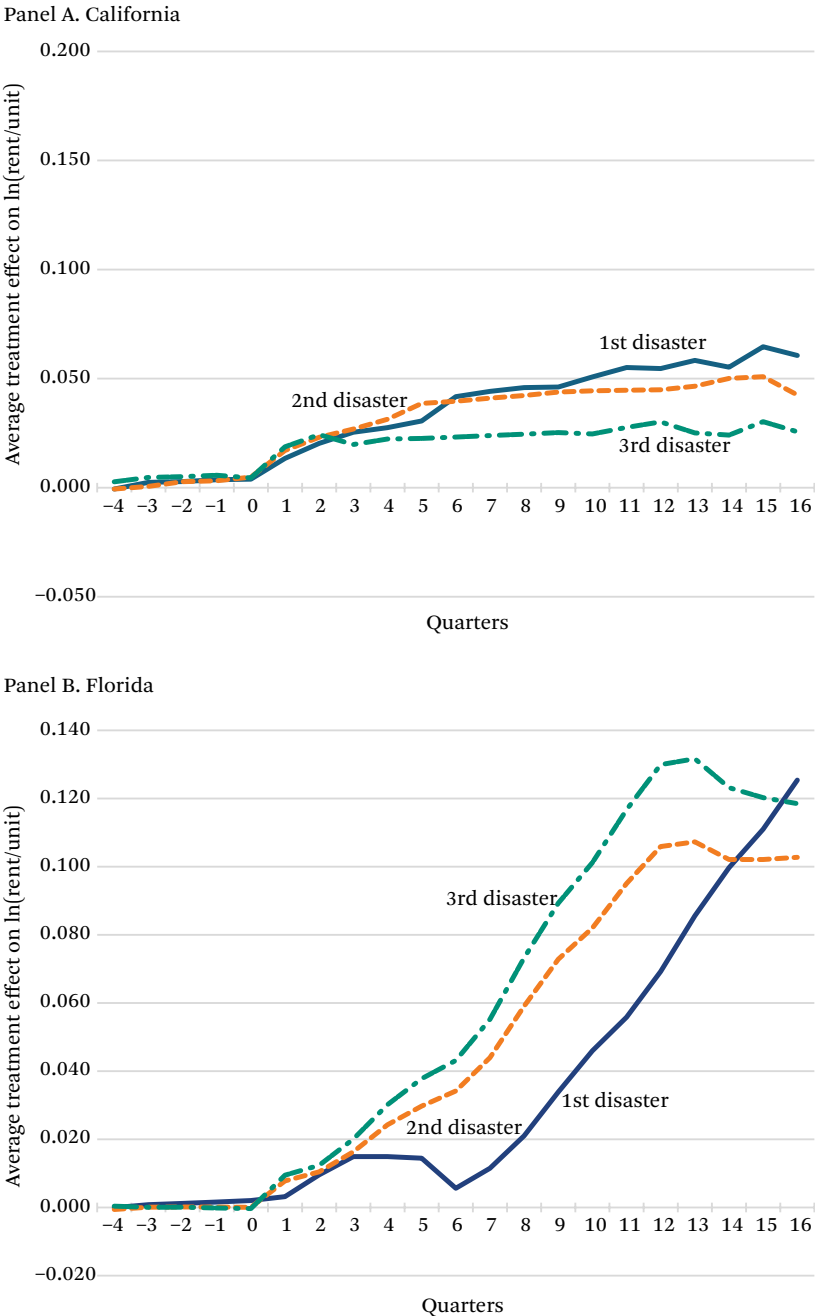
Source: Authors' calculations.

* $p < .05$; ** $p < .01$; *** $p < .001$

four years after the disaster at 6.5 percent higher than the original level in California and 12.5 percent higher in Florida. These patterns are consistent with our earlier dosage model, which suggests approximately a 1 percent increase per quarter immediately after the disaster in California and a 0.2 to 0.6 percent increase per quarter in Florida. Importantly, the rents do not return to their original level. In other words, the treated rents remain permanently higher than the control units' rents, where no disasters occurred. The second disaster and third disaster lines show similar effects for subsequent events affecting a given zip code.⁵ These results are

5. Over this twenty-year period, 98 percent of the zip codes in our California and Florida dataset are impacted by at least one disaster, 98 percent are impacted by at least two disasters, and 94 percent are impacted by three or more disasters.

Figure 2. Interactive Fixed Effects Model: Rent per Unit, Sequential Disasters



Source: Authors' calculations.

additive to the first disaster, as the model controls for its effects. Thus, consistent with H5, the effects of natural disasters on rents accumulate over time as multiple disasters strike the same area.

CDBG-DR Funding

CDBG-DR funding is one of the largest federal programs in disaster recovery. Since the program's inception in 1993, until fiscal year 2023, nearly \$100 billion has been allocated by Con-

gress. As noted earlier, some zip codes receive CDBG-DR funding after a natural disaster while others do not. This funding often includes rental requirements that tie tenant protections and the building of affordable rental housing to program implementation, thus changing how the rental market might operate during the disaster recovery period. Brian An and colleagues (2024), for instance, documents four major rental requirements that are stipulated in the CDBG-DR programs: Action plan consideration; coordination with public housing authorities (PHAs); minimum amount set aside; and set affordability period.

For action plan consideration, states and localities receiving CDBG-DR funds must develop comprehensive action plans outlining how they will allocate resources to address the housing needs of both homeowners and renters. These plans serve as blueprints for disaster recovery efforts and are subject to HUD approval. Coordination with PHAs requires collaboration between CDBG-DR grantees and local PHAs, which is essential for ensuring efficient and equitable distribution of rental assistance and resources. By coordinating efforts, stakeholders can better identify and address the specific needs of low-income renters and vulnerable populations. The minimum amount set aside prioritizes rental housing development by requiring a minimum percentage of CDBG-DR funds to be allocated specifically for rental housing projects. Lastly, the set affordability period requires CDBG-DR grantees to designate a certain period to ensure that rental units developed with the funds remain affordable. This requirement ensures that rental housing remains accessible to low- and moderate-income households beyond the immediate post-disaster period.

Previous research shows that since 2005—when Hurricane Katrina hit New Orleans and its surrounding areas—these four rental requirements were stipulated in CDBG-DR funds, and particularly since 2010, all CDBG-DR grants had at least one of the rental requirements mentioned above (An et al. 2024). Using a case study

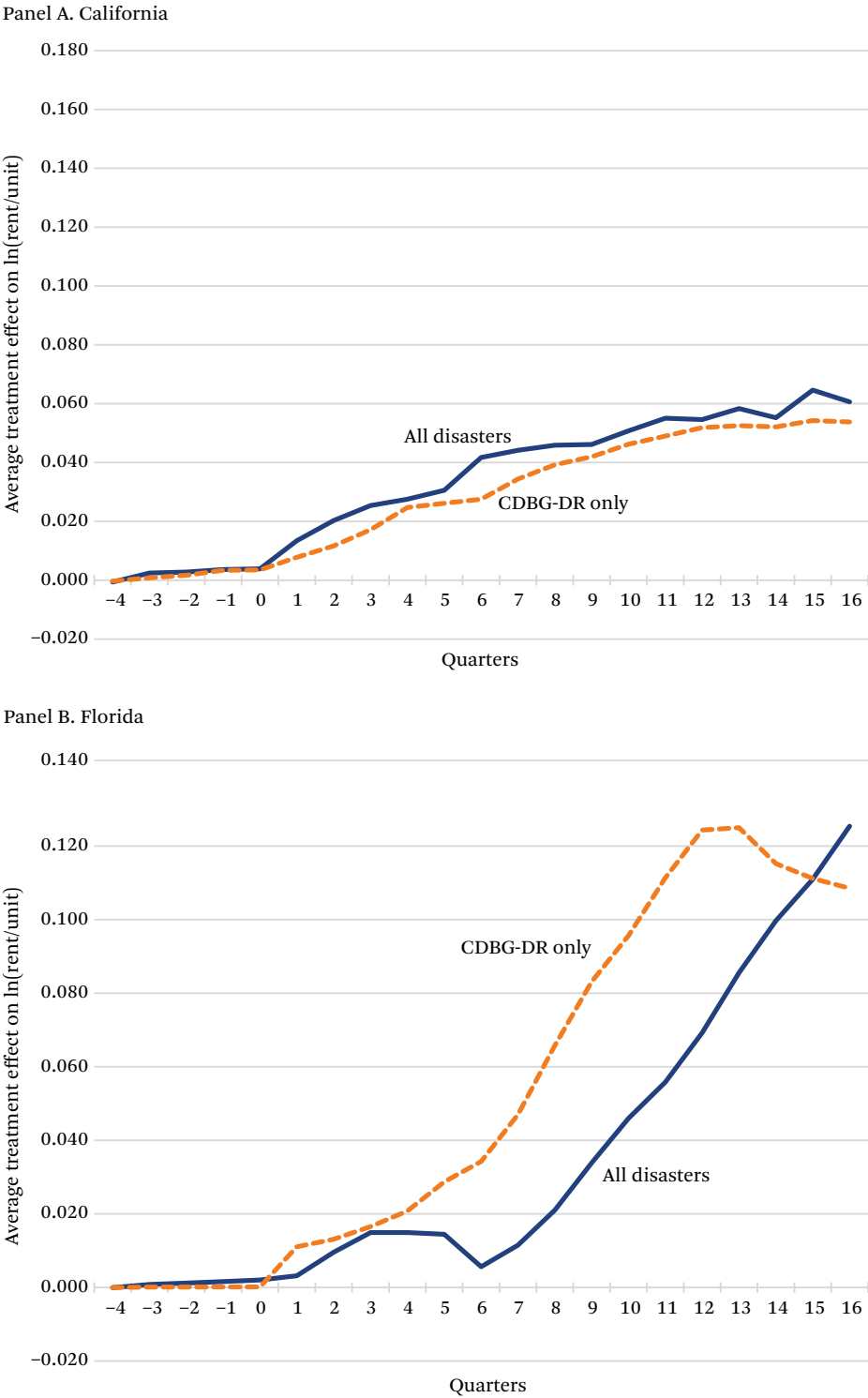
approach, the analysis also finds that the increase in multifamily rents was less steep in zip codes that received CDBG-DR funds than in other nearby zip codes that were impacted by the natural disaster but did not receive the funds later.⁶ An and colleagues (2024) further show that one of the mechanisms driving such results is higher rates of construction of multifamily housing (measured by building permits) during disaster recovery among CDBG-DR zip codes compared with non-CDBG-DR zip codes. However, the referenced study is limited to a single case study, and we do not know how these funds alter the impact of natural disasters. To examine CDBG-DR funding's likely impact on rental markets, we run the interactive fixed effects model in which the treatment group is confined to the zip codes receiving CDBG-DR funds. Following the previous approach, we focus on the first disaster for which zip codes receive these funds, controlling for the second and third such disasters.⁷

As in the previous results, figure 3 shows that these zip codes experience an increase in rents after the disaster in the “CDBG-DR Only” line. However, consistent with hypothesis H6, the long-term impacts are muted. In California, the CDBG-DR zip codes experience less rental appreciation than we see in our main specification throughout all post-disaster quarters. In Florida, rental appreciation is initially higher in the CDBG-DR zip codes; however, this appreciation peaks after three years and begins receding, while the main specification shows continued appreciation. This is consistent with the effects of increased supply of affordable housing coming online three to four years after the disaster. One of the possible reasons is more and faster construction of multifamily housing as the rental requirements in CDBG-DR often stipulate how much should be spent on affordable rental housing or how many years it should be kept affordable. These affordable rental housing developments, in coordination with local housing authorities, have to be part of comprehensive action plans for renters, not just homeowners.

6. FEMA disaster declaration DR-4145-CO (2013 Colorado floods).

7. We do not focus on the effect of the second and third disasters because the sample size is too small for zip codes that receive these funds multiple times.

Figure 3. Interactive Fixed Effects Model with CDBG-DR Funding: Rent per Unit, First Disaster



Source: Authors' calculations.

At the end of the four years, the cumulative rental appreciation is lower in the CDBG-DR zip codes than in the main specification.⁸ Support for the construction hypothesis is provided by Dania V. Francis and Keren M. Horn (2026, this issue), who find small increased upward trends in county-level employment (including short-term gains in construction) starting three quarters after an extreme hazard, with growth slowing by the twelfth quarter.

Given these rental requirements, we may see more and faster construction of affordable multifamily housing complexes in the areas that receive CDBG-DR funds than those that do not. If new multifamily apartments are operating as affordable housing in the disaster-impacted areas where people would have higher demand for affordable and secure housing, we expect that vacancy rates may go down over time. Whereas, if such affordable rental housing developments are not occurring (that is, areas without CDBG-DR funding), while residents should have urgent demand for housing—hence lower vacancy rates in the short run—over time, the rental market may experience higher vacancy rates due to unaffordable and insecure housing combined with rising rents. These expectations are consistent with our findings for all disaster-impacted areas and those split by the receipt of CDBG-DR funding.

Admittedly, our results cannot be interpreted as strict evidence of the effect of CDBG-DR funding, since it is possible that the zip codes receiving CDBG-DR funding are different in unobservable systematic ways that result in different trajectories regardless of the funding itself. While future research can help disentangle the strict causal impacts, our study presents clear evidence that renters experience a more affordable market in the wake of CDBG-DR funding than they do in its absence. This difference is not necessarily due to weaker rental markets, as these CDBG-DR funds come into markets with persistently lower vacancy rates. The greater affordability may be due to other factors, such as the federal aid, the rental require-

ments, or other interventions that prevent landlords from raising rents higher in the face of strong demand.

Potential Selection into CDBG-DR Funding

It is important to acknowledge that the allocation of CDBG-DR resources is not random. Federal and state governments jointly determine which jurisdictions receive disaster-recovery funds based on verified damage assessments, unmet needs analyses, and the administrative capacity of local governments to manage large grants. These selection criteria are designed to target the most heavily impacted areas but may also correlate with underlying housing-market characteristics—such as pre-disaster rent levels, local development intensity, preexisting planned public and private investment, or the socioeconomic composition of residents—that could influence post-disaster trajectories independently of the funding itself. Consequently, a concern arises that the observed moderation of rent increases in CDBG-DR locations may reflect government selection rather than the causal effects of the funding.

To mitigate this concern, our interactive fixed-effects framework compares CDBG-DR recipient zip codes to non-recipient zip codes within the same state that share similar pre-disaster rental trends. This approach reduces bias from unobserved, time-invariant factors and from differing baseline trajectories, although it does not eliminate the possibility of residual endogeneity from time-varying unobservables. As an additional diagnostic, online appendix table A.1 reports pretreatment characteristics—poverty rate, population size, vacancy rate, and average rent—for CDBG-DR and non-recipient zip codes.⁹ The two groups appear broadly comparable along these observable dimensions, providing further reassurance that selection on observables is limited.

We therefore interpret our CDBG-DR findings as strongly suggestive but not definitively causal evidence that federally funded recovery programs with rental requirements can dampen

8. However, we do not track rental requirements of CDBG-DR funds in current research as it is beyond the scope of our study. We encourage future research to examine this issue further.

9. The online appendix for table A.1 can be found at <https://www.rsfjournal.org/content/12/4/54/tab-supplemental>.

post-disaster rent escalation. Future work linking project-level allocations and timing to micro-market data could further disentangle causal effects from selection dynamics.

CONCLUSION

In this article, we have explored the trajectory of rental housing markets in the wake of a wide variety of natural disasters across two of the largest US states: California and Florida. We have merged zip code-level rental data from CoStar with disaster incidence data from FEMA. We have constructed two panel models—a dosage model and an interactive fixed effects model—that estimate the effect of natural disasters for many years after each disaster event. We have varied the lag structure, the time frequency, the unit of analysis, and the treatment definition for robustness, resulting in several different specifications for each outcome. Our results show that rents per unit increase by 0.2 to 1.3 percent immediately after a disaster and 6.5 to 12.5 percent in the long run, while effects on vacancy rates are mixed. This suggests that the decrease in supply, caused by damage and destruction of the housing stock, as well as increases in rental demand from homeowners who update their risk beliefs and exit homeownership, rising in insurance costs, and changes in the composition of housing units, outweigh the decrease in demand from out-migration. These findings are driven primarily by hurricanes and wildfires—and to a lesser extent, winter storms. The effects accumulate after multiple disasters. The rental appreciation is persistent and not mean-reverting. It is milder, however, in the presence of CDBG-DR funding with rental requirements designed to protect tenants, suggesting more routine access to CDBG-DR funds—such as through a formula-based allocation parametrically triggered by a disaster—could be broadly beneficial to impacted communities and their renters.

There are important differences between the disaster impacts in California versus Florida. Some disasters, like hurricanes and wildfires, only occur in one state or the other, but others, like flooding and winter storms, are experienced by both. In these comparable situations, the results sometimes differ. Winter storms, for instance, increase rents significantly in California

but not in Florida. Thus, not all of our findings are generalizable across all types of cities and states. The preexisting rental market conditions, the local and state housing policies, and the demographics all matter, and these factors deserve more careful attention in future work. While California and Florida provide valuable contrasts in hazard type and housing-supply elasticity, extrapolation to other regions should be made with caution, as exposure, governance capacity, and rental market dynamics differ elsewhere. Nonetheless, these heterogeneous effects do not alter the general conclusion that natural disasters have significant effects on rental markets, most often harmful effects for affordability.

The implications of these findings are important for policymakers interested in preventing inequality from widening in the wake of these disasters. While governments have been increasingly proactive with disaster assistance over the past century, it is not clear whether these interventions have been sufficient to overcome the lingering negative impacts of the disasters (Boustan et al. 2012; Boustan et al. 2018). Nor does it appear that governments at the local, state, or federal level have been able to prevent the displacement of residents or encourage optimal take-up of insurance and other mitigation precautions (Berke et al. 2014; Gallagher 2014; Highfield et al. 2014; Kousky et al. 2020). Most residents do not even seem to be aware of the resources that are available for them to improve their situation (Hamel et al. 2018). To the extent that they are aware of government interventions, residents often feel that their actual needs are given less priority than other political concerns (Ford et al. 2019). By exploring the dynamics in rental markets, we hope to bring their needs to the forefront of public debate and help policymakers shape more targeted solutions to the socioeconomic inequities that they face.

REFERENCES

- An, Brian, Jennifer Moody, Rachel Drew, Andrew Jakabovics, Anthony Orlando, and Seva Rodnyansky. 2024. "Community Development Block Grants Disaster Recovery, Rental Requirements, and Rental Market Impacts." *Cityscape* 26(3): 137–156. <https://www.huduser.gov/portal/periodicals/cityscape/vol26num3/ch8.pdf>.

- Baar, Kenneth, Patrick Burns, Daniel Flaming, and Anthony W. Orlando. 2024. *Equitable Rent: Rent Stabilization Standards in the City of Los Angeles*. Economic Roundtable. September. <https://economicrt.org/wp-content/uploads/2024/09/Equitable-Rent-Economic-Roundtable-report-on-the-RSO-9-12-2024-compact.pdf>.
- Berke, Philip R., Ward Lyles, and Gavin Smith. 2014. "Impacts of Federal and State Hazard Mitigation Policies on Local Land Use Policy." *Journal of Planning Education and Research* 34(1): 60–76.
- Bleemer, Zachary, and Wilbert van der Klaauw. 2019. "Long-Run Net Distributionary Effects of Federal Disaster Insurance: The Case of Hurricane Katrina." *Journal of Urban Economics* 110: 70–88.
- Boustan, Leah Platt, Matthew E. Kahn, and Paul W. Rhode. 2012. "Moving to Higher Ground: Migration Response to Natural Disasters in the Early Twentieth Century." *American Economic Review* 102(3): 238–44.
- Boustan, Leah Platt, Matthew E. Kahn, Paul W. Rhode, and Maria Luca Yanguas. 2020. "The Effect of Natural Disasters on Economic Activity in US Counties: A Century of Data." *Journal of Urban Economics* 118: 103257.
- Callaway, Brantly, and Pedro H. C. Sant'Anna. 2021. "Difference-in-Differences with Multiple Time Periods." *Journal of Econometrics* 225(2): 200–30.
- Cheung, Ron, Daniel Wetherell, and Stephan Whitaker. 2018. "Induced Earthquakes and Housing Markets: Evidence from Oklahoma." *Regional Science and Urban Economics* 69: 153–66.
- Deryugina, Tatyana. 2017. "The Fiscal Cost of Hurricanes: Disaster Aid Versus Social Insurance." *American Economic Journal: Economic Policy* 9(3): 168–98.
- Deryugina, Tatyana, Laura Kawano, and Steven Levitt. 2018. "The Economic Impact of Hurricane Katrina on Its Victims: Evidence from Individual Tax Returns." *American Economic Journal: Applied Economics* 10(2): 202–33.
- Eichholtz, Piet, Eva Steiner, and Erkan Yönder. 2019. "Where, When and How Do Sophisticated Investors Respond to Flood Risk?" Unpublished paper. <https://ecommons.cornell.edu/server/api/core/bitstreams/d6dc0bb4-6fc2-4d25-b3ac-88e2a2b8a6a3/content>.
- Ellen, Ingrid Gould, Katharine Harwood, and Rachel Meltzer. 2026. "Tale of Two Storms: Neighborhood Racial Change After Hurricanes Sandy and Harvey." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 77–101. <https://doi.org/10.7758/RSF.2026.12.4.04>.
- Ford, Rebecca M., Andrea Rawluk, and Kathryn J. H. Williams. 2019. "Managing Values in Disaster Planning: Current Strategies, Challenges and Opportunities for Incorporating Values of the Public." *Land Use Policy* 81: 131–42.
- Francis, Dania V., and Keren M. Horn. 2026. "Impacts of Climate Hazards on Employment and Earnings by Hazard Type, Industry, Race, and Ethnicity." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 134–55. <https://doi.org/10.7758/RSF.2026.12.4.06>.
- Gallagher, Justin. 2014. "Learning About an Infrequent Event: Evidence from Flood Insurance Take-Up in the United States." *American Economic Journal: Applied Economics* 6(3): 206–33.
- Gallagher, Justin, and Daniel Hartley. 2017. "Household Finance After a Natural Disaster: The Case of Hurricane Katrina." *American Economic Journal: Economic Policy* 9(3): 199–228.
- Gatzlaff, Dean, Kathleen McCullough, Lorilee Medders, and Charles M. Nyce. 2018. "The Impact of Hurricane Mitigation Features and Inspection Information on House Prices." *Journal of Real Estate Finance and Economics* 57(4): 566–91.
- Ghidoni, Riccardo, Giacomo Calzolari, and Marco Casari. 2017. "Climate Change: Behavioral Responses from Extreme Events and Delayed Damages." *Energy Economics* 68(S1): 103–15.
- Glaeser, Edward, and Joseph Gyourko. 2018. "The Economic Implications of Housing Supply." *Journal of Economic Perspectives* 32(1): 3–30.
- Goodman-Bacon, Andrew. 2021. "Difference-in-Differences with Variation in Treatment Timing." *Journal of Econometrics* 225(2): 254–77.
- Hamel, Liz, Bryan Wu, Mollyann Brodie, Shao-Chee Sim, and Elena Marks. 2018. *One Year After the Storm: Texas Gulf Coast Residents' Views and Experiences with Hurricane Harvey Recovery*. Kaiser Family Foundation; Episcopal Health Foundation. August. <https://files.kff.org/attachment/Report-One-Year-After-the-Storm-Texas-Gulf-Coast-Residents-Views-and-Experiences-with-Hurricane-Harvey-Recovery>.
- Harwood, Katherine WH. 2025. "The Impact of Natural Disasters on Rental Markets: Heterogeneous Effects, Rental Subsidies, and Equity in Disaster Recovery." Unpublished paper. <http://papers.kateharwood.net/The%20Impact%20of%20>

- Natural%20Disasters%20on%20Rents_2_7_25.pdf.
- Highfield, Wesley E., Walter Gillis Peacock, and Shannon Van Zandt. 2014. "Mitigation Planning: Why Hazard Exposure, Structural Vulnerability, and Social Vulnerability Matter." *Journal of Planning Education and Research* 34(3): 287–300.
- Howell, Junia, and James R. Elliott. 2019. "Damages Done: The Longitudinal Impacts of Natural Hazards on Wealth Inequality in the United States." *Social Problems* 66(3): 448–67.
- Kousky, Carolyn, Howard Kunreuther, Michael LaCour-Little, and Susan Wachter. 2020. "Flood Risk and the U.S. Housing Market." *Journal of Housing Research* 29(sup1): S3–S24.
- Lambrou, Nicole, Crystal Kolden, and Anastasia Loukaitou-Sideris. 2025. "Disaster Recovery Gentrification in Post-Wildfire Landscapes: The Case of Paradise, CA." *International Journal of Disaster Risk Reduction* 118: 105235.
- Liu, Licheng, Ye Wang, and Yiqing Xu. 2024. "A Practical Guide to Counterfactual Estimators for Causal Inference with Time-Series Cross-Sectional Data." *American Journal of Political Science* 68(1): 160–76.
- Martín, Carlos, Brian An, Rachel Drew, et al. 2023. *Disasters and the Rental Housing Community: Setting a Research and Policy Agenda*. Brookings Institution. October. https://www.brookings.edu/wp-content/uploads/2023/09/Disasters-and-the-Rental-Housing_final.pdf.
- Miller, Wesley A., Anthony W. Orlando, and Christian L. Redfearn. 2026. "Housing Supply Elasticities: A Structural Vector Autoregression Approach." Unpublished paper.
- National Multifamily Housing Council. 2023. *Skyrocketing Insurance Costs Are Affecting Rents and Housing Affordability*. National Multifamily Housing Council. https://www.nmhc.org/global-assets/research--insight/research-reports/insurance/nmhc_mf_risk_flyer.pdf.
- National Oceanic and Atmospheric Administration (NOAA) 2024a. "Billion-Dollar Weather and Climate Disasters: Florida Summary." National Centers for Environmental Information. <https://www.ncei.noaa.gov/access/billions/state-summary/FL>.
- National Oceanic and Atmospheric Administration (NOAA) 2024b. "Billion-Dollar Weather and Climate Disasters: California Summary." National Centers for Environmental Information. <https://www.ncei.noaa.gov/access/billions/state-summary/CA>.
- Patap, Ryan. 2025. "Pasadena Apartment Availability Nosedives Because of Wildfires." *CoStar*, January 31. <https://www.costar.com/article/160018192/pasadena-apartment-availability-nosedives-because-of-wildfires>.
- Rhodes, Anna, and Max Besbris. 2022. *Soaking the Middle Class: Suburban Inequality and Recovery from Disaster*. Russell Sage Foundation.
- Sado-Inamura, Yukako, and Kensuke Fukushi. 2019. "Empirical Analysis of Flood Risk Perception Using Historical Data in Tokyo." *Land Use Policy* 82: 13–29.
- Saiz, Albert. 2010. "The Geographic Determinants of Housing Supply." *Quarterly Journal of Economics* 125(3): 1253–96.
- Sheldon, Tamara L., and Crystal Zhan. 2019. "The Impact of Natural Disasters on US Home Ownership." *Journal of the Association of Environmental and Resource Economists* 6(6): 1169–203.
- Siegel, Rachel, Andrew Ba Tran, Federica Cocco, and Caroline O'Donovan. 2025. "Rent Rose by 20 Percent Across L.A. County After Fires. That's Illegal." *Washington Post*, January 25. <https://www.washingtonpost.com/business/2025/01/25/la-county-rent-gouging-wildfires/>.
- Varela, Ana Varela. 2023. "Surge of Inequality: How Different Neighborhoods React to Flooding." Working Paper. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4396481.
- Zhang, Lei, and Tammy Leonard. 2019. "Flood Hazards Impact on Neighborhood House Prices." *Journal of Real Estate Finance and Economics* 58(4): 656–74.

Tale of Two Storms: Neighborhood Racial Change After Hurricanes Sandy and Harvey



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We use the case of Hurricane Sandy and Hurricane Harvey to test how extreme climate events drive neighborhood racial change and how impacts vary in settings with different socioeconomic characteristics and exposures to past flooding risk. Using data on neighborhood characteristics, mortgage applications, and inundation after the storms, we show that in both New York City and Harris County, Texas, population and housing units actually increased more in the neighborhoods with more severe flooding. In addition, the share of residents who are White declined more in hard-hit neighborhoods, especially those outside the flood zone where residents would have had less information about flood risk prior to the storm. In New York, we also see a relative decline in income among mortgage applicants in flooded areas outside the flood zone, especially in low-income neighborhoods. Effects are generally more muted in Harris County, perhaps because flooding had been historically more common.

Keywords: neighborhood change, racial change, hurricanes, extreme flooding, climate risk

Extreme weather events are increasing in frequency and severity, threatening cities throughout the world. These events are likely to shape residential decisions in the short- and long-term and, in turn, affect the trajectory of urban neighborhoods. To be clear, neighborhoods change all the time, but damaging storms may affect both the nature and the pace of the change, including shifts in racial composition. Most directly, storms may accelerate change that was already happening by heightening turnover and

thereby opening up more opportunities for racial change. But extreme events can also change the entire course of a neighborhood. The physical damage caused by a storm and the new information about flood risk it provides, may reduce housing prices and rents, making hard-hit neighborhoods more affordable to households of color. Storms may also lead to reductions in homeownership, which could generate racial change given that a disproportionate share of renters are Black or Hispanic. Specifically, in

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the wake of a storm, investors may buy up homes to serve as rentals, as rents may not fall as much as prices. Additionally, in the face of depressed prices, homeowners may choose to rent out their homes rather than sell them when they move.

All of these effects will be larger in areas that were not previously understood to be at risk of flooding and storm damage and where the storm event makes the risk much more salient. Finally, these effects may be especially pronounced in lower-income areas, where there are fewer resources to rebuild or less optimistic expectations about the ability to insure against future risks.

We use the case of two major hurricanes to examine whether and how extreme climate events affect neighborhood racial change in different contexts. Hurricane Sandy made landfall along the eastern seaboard in late October 2012 and inflicted over \$19 billion in damage in New York City alone. Five years later, Hurricane Harvey hit Harris County in Texas and caused nearly \$16 billion in residential damage within the Houston city limits. Research shows that Hurricane Sandy greatly reduced property values and had more modest impacts on rents (Ellen and Meltzer 2024; Harwood 2026; Ortega and Taşpinar 2018). There is less research on the market effects from Hurricane Harvey, but Carolyn Kousky and colleagues (2020) find that the storm was associated with increased mortgage delinquencies among more damaged homes and, in the long run, among homes less likely to have flood insurance prior to the event.

In this article, we build on existing research to explore the implications for racial change in hard-hit neighborhoods after extreme storms. We examine three key questions. First, how does storm-induced inundation affect migration into and out of neighborhoods, and specifically, how does the storm change the racial composition of hard-hit neighborhoods? Second, how do migration patterns differ for renters versus homeowners? Third, how do these patterns vary with the income and resources available in the neighborhoods?

To answer these questions, we rely on census tract data from the American Community Survey (ACS), as well as mortgage application information from the Home Mortgage Disclosure Act (HMDA) datasets. We overlay flood zone

maps with spatially detailed information on storm surge heights. Our models examine the neighborhood population and composition changes in the years after the storm, while controlling for the perceived risk prior to the storms, as reflected in the flood zone boundaries.

We contribute to several strands of literature. First, we contribute to work on climate migration. A number of studies examine the degree to which extreme weather events accelerate migration away from high-risk counties and regions and document the patterns of return for those initially displaced after the disaster (Besbris et al. 2026, this issue; Elliott et al. 2026, this issue; Fussell et al. 2010, 2017, 2023; Boustan et al. 2020; Sastry and Gregory 2019; Schultz and Elliott 2013; Groen and Polivka 2010). But little of this research focuses at the neighborhood level as we do, and little of it distinguishes between homeowners and renters or focuses on migration into the risky areas (Fussell and Harris 2014; Fussell 2018; Ma and Smith 2020). Furthermore, we use microdata on mortgage applicants from HMDA rather than the credit panels that are used in related studies, which are often more limiting in identifying residential tenure (Billings et al. 2022; McConnell et al. 2021).

Second, we contribute to research on the impact of storms on neighborhoods. A growing body of research studies the impact of extreme events on local housing markets, focusing mostly on how localized storm surges affect property values (Ellen and Meltzer 2024; Bin and Landry 2013; Bin and Polasky 2004; Hallstrom and Smith 2005; Ortega and Taşpinar 2018; Harwood 2026). But far fewer studies make the connection between those housing market changes and the demographic trajectories of hard-hit neighborhoods.

Finally, we build most directly on a small, but rich, body of literature that examines how the income and demographics of neighborhoods change after storms (Lee 2017, 2020; Hong et al. 2021; Wyczalkowski et al. 2019; Elliott 2015). Existing articles focus on changes in neighborhood poverty rates in cities and counties where storms hit, or the demographic profiles of those that migrate out of and into those communities. However, most studies have not exploited spatial variation in flooding and destruction

across neighborhoods within those cities and counties. Our models take advantage of this very localized spatial variation. Specifically, we study the impact of storm surges experienced by particular neighborhoods, controlling for preexisting knowledge of risk (as proxied by flood zone designation). We also test whether impacts are greater outside the flood zone, where flooding represented more of an information shock.

THEORY AND BACKGROUND

If damage is severe enough, natural disasters can accelerate out-movement from neighborhoods and trigger sustained decline and disinvestment (Lee 2020; Zhang 2012). Sustained decline can also happen even with residents staying in place, if they lack the resources to rebuild (Hong et al. 2021). John R. Logan and colleagues (2016) use the term “segmented resilience” to describe the tendency for residents with the means and capacities to be the ones that escape disaster-torn communities; those with fewer financial and social networks to leverage are left in place.

Physical damage from storms can also make a neighborhood less attractive to individuals with more resources. Beyond the direct effects of any damage, storms can provide new information to the market that an area is at heightened risk of future disasters (Ellen and Meltzer 2024; Billings et al. 2022; Rhodes and Besbris 2022). Both damage and information can cause sustained declines in property values. In fact, studies consistently show that extreme events, like hurricanes, drive real estate prices down in affected areas (Harwood 2026; Ellen and Meltzer 2024; Bin and Landry 2013; Bin and Polasky 2004; Hallstrom and Smith 2005; Ortega and Taşpınar 2018).

These price declines make neighborhoods more affordable and open up communities and home-ownership to individuals who were previously unable to afford them (Ellen and Meltzer 2024; Ratnadiwakara and Venugopal 2020; Santiago-Bartolomei et al. 2022; Pais and Elliott 2008). In this way, affected neighborhoods could attract lower income and more racially diverse households after the disaster. Alternatively, the price declines and damage can also invite redevelopment (Curtis et al. 2020; Fussell 2015). This is consistent with Jeremy F. Pais and James R.

Elliott’s (2008) “recovery machines,” where pro-growth interests take advantage of the post-disaster moment to redevelop for growth and change (Besbris et al. 2026). If people are myopic, new, higher-income residents may be attracted to recently renovated or constructed homes.

Severe storms may also produce shifts in tenure that, in turn, generate demographic changes. Specifically, the new information about risk provided by storms is likely to have a larger and more sustained impact on property values than on rents (Harwood 2024), as renters will generally care far less than owners about the risk of a 100-year storm. As rent-to-price ratios rise, investors may disproportionately buy up properties in the wake of a storm, leading to reductions in homeownership. Similarly, if prices are depressed, departing owners may rent out their homes rather than immediately selling them. The increased number of rentals may invite more households of color to move into an area, given their disproportionately high rates of renter-ship.

Further, there are reasons to expect heterogeneity in impacts across city and neighborhood contexts. Storms and other extreme weather events may produce less of an impact in cities with histories of such events. In those cities, an individual storm may not provide much additional information about risks. Even before the storm, people may have already known which neighborhoods were most likely to be affected and incorporated this knowledge into their residential choices and willingness to pay for homes.

In our two cities, the perception of risk before the storms likely varied. There is evidence that past flooding as an indicator of future risk was downplayed in the Houston area (Rhodes and Besbris 2022). In addition, the city had seen more storms in the past than New York City had leading up to Sandy, and more than half of the city’s neighborhoods were at least partially in the flood zone, where flooding was presumably more expected. We argue that Hurricane Sandy came as more of a shock, at least to neighborhoods outside the flood zone. In other words, we expect Sandy to have had larger impacts than Harvey, especially in locations outside of the flood maps in place at the time.

Finally, markets may have less confidence in the pace of recovery in lower-income neighborhoods and communities of color, in part because their residents are not as well-positioned to repair damage as those with more financial resources and more resilient structures (Park and Franklin 2023; Rhodes and Besbris 2022; Hong et al. 2021; Wyczalkowski et al. 2019; Lee 2017; Finch et al. 2010; Donner and Rodríguez 2008; Cutter et al. 2003; Chappell et al. 2007). As a result, such neighborhoods may be more likely to see property abandonment, sustained damage, and reduced property values (Ma and Smith 2020). Dalbyul Lee (2020) finds that lower-income neighborhoods see larger increases in poverty rates after disasters. And using cell phone data, Boyeong Hong and colleagues (2021) find socioeconomic and racial disparities in evacuation and mobility responses across neighborhoods, which is consistent with Fussell's work on post-Katrina migration (for example, Fussell 2015). These findings provide support for theories of "differential recovery" (Finch et al. 2010), or the expectation that trajectories of recovery are influenced by pre-disaster vulnerabilities that are uneven across places (Fussell 2015). That said, Christopher K. Wyczalkowski and colleagues (2019) find more recovery and change over the long-run in lower-income census tracts in counties hit by storms in the Houston area, which they argue may result from active speculation as property values fall. But they do not use any data on variations in storm surge across neighborhoods, which may mediate the degree of damage and therefore determine the resources needed for recovery.¹

DATA

We exploit the granularity and fifteen-year time span of our data to tease out the persistence

and nature of neighborhood racial change after Hurricanes Sandy and Harvey. To investigate neighborhood change, we created longitudinal census tracts with consistent boundaries from 2010 to 2022. In most cases, changes in census tract geographies between years, if they happened at all, involved a clear split of a 2010 census tract. However, in a few cases, the changes were more complicated, with, for example, two adjacent 2010 census tracts divided into three 2020 census tracts. In eleven of these more complicated cases in Harris County, we aggregate contiguous census tracts that were affected by the change across the years to form one geographic area that is consistent across 2010 and 2020. For ease of exposition, we will simply refer to our consistent-boundary neighborhoods as census tracts. Note that census tracts are much more consistent across decades in New York City, but we also create neighborhoods in New York City with consistent boundaries between 2010 and 2020.²

We draw on similar data for the New York City and Houston (Harris County) study areas. First, in order to capture flooding risk before the hurricane events, we have flood maps that were in effect leading up to each of the storms. These are the 100-year maps issued by the Federal Emergency Management Agency (FEMA). Since census tracts do not fit neatly within the flood zone boundaries, we calculate the share of the census tract that lies within the 100-year flood zone, and for the preferred analyses, designate a census tract as inside the flood zone if more than 20 percent of its area is within the 100-year boundary.³

Second, we have continuous raster-level information on the surge heights from both storms to understand the variation in flooding across census tracts. FEMA uses high-water

1. Although we cannot test it here, disaster recovery programs may also shape these neighborhood dynamics. Neighborhoods that are able to attract outside capital will be able to repair damage more quickly. The investment in reconstruction will also signal that the neighborhood will recover, or even improve. This may reduce the risk of vacancy and abandonment, preserve neighborhood demand, and accelerate recovery.

2. The analysis of homebuyers uses only the New York City census tracts with consistent boundaries between 2000 and 2010. This constitutes over 95 percent of the census tracts in New York City.

3. We conduct sensitivity analyses, discussed later in the article, to test for changes in the outcome of interest using different thresholds to classify tracts as inside the flood zone.

marks and surge sensor data to interpolate surge levels. FEMA reports surge levels for 1-square-meter cells in Manhattan, Brooklyn, Queens, and Staten Island and for 3-square-meter cells in the Bronx. In Harris County, we accessed data through the Hurricane Harvey Flood Data Collections and HydroShare (Arctur 2023), which provides the gridded depth at a horizontal resolution of 3 meters. We use these data to calculate census tract-level average surge levels. Figure 1, panels A and B show the variation in surge heights across tracts in New York City and Harris County, overlaid with the 100-year flood map boundaries discussed above. Note that we use estimated surge heights rather than FEMA's assessment of property damage. The two measures are highly correlated, but surge heights are more clearly exogenous and not affected by the underlying structural quality of buildings. In New York City, we classify census tracts into three groups: no surge; low-surge (2 feet or less); and high-surge (more than 2 feet).⁴

In Harris County, table 1 shows that all census tracts in the county saw some level of surge during Hurricane Harvey. Thus, the reference group in Harris County is tracts that saw a modest level of flooding rather than no flooding, as in New York City. Specifically, we classify Harris County tracts into three categories, low-surge (1 foot or less), moderate-surge (1 to 2 feet), and high-surge (more than 2 feet).⁵

Third, we have a host of demographic and economic characteristics of the neighborhoods from the ACS five-year data for three windows (2008–2012, 2013–2017, and 2018–2022) and HMDA for the years 2006–2022. These variables capture the racial composition, income, population, number of households and housing units, recent movement into the neighborhood, housing values, rents, and the prevalence of owners and renters.

We use five-year ACS data at the census tract

level to compare initial conditions and changes in economic, housing, and demographic characteristics across census tracts with different degrees of storm surge. Because we can classify tracts as inside or outside the flood zones, and also by average storm surge, we can document change among neighborhoods with similar risk exposures leading up to the storm and isolate any changes due to the storm itself. We can also distinguish between racial changes among homeowners and renters since the ACS data include counts of renters and homeowners by race in each census tract. In New York City, we use the 2008–2012 five-year window to capture baseline characteristics of census tracts prior to the storm, which hit the city at the end of October 2012. We then use the 2013–2017 and 2018–2022 five-year windows to capture short- and longer-term neighborhood change after the storm. For Hurricane Harvey, which hit Harris County at the end of September 2017, we can only observe short-run changes. Specifically, we use 2008–2012 and 2013–2017 five-year ACS data to capture baseline neighborhood conditions and 2018–2022 five-year ACS data to capture post-storm changes. Note that when exploring heterogeneity across different types of neighborhoods, we use baseline ACS data to categorize neighborhoods as low-income or high-income depending on whether their mean income is above or below the citywide (New York City) or countywide (Harris County) median.

We use HMDA data to study changes in the demographics of new entrants and specifically home purchasers in hard-hit areas after the storm. The HMDA data in both counties include the date of the application, the census tract of the property, the loan amount, and the mortgage applicant's race, income, and sex. For our analysis in New York City, we use applications from 2009–2017 and for our analysis in Harris County we use applications from 2012–2022.

4. FEMA documents that at roughly 18 inches of flooding, homeowners are at a higher risk of high cost damage to systems like electrical and HVAC (FEMA 2023).

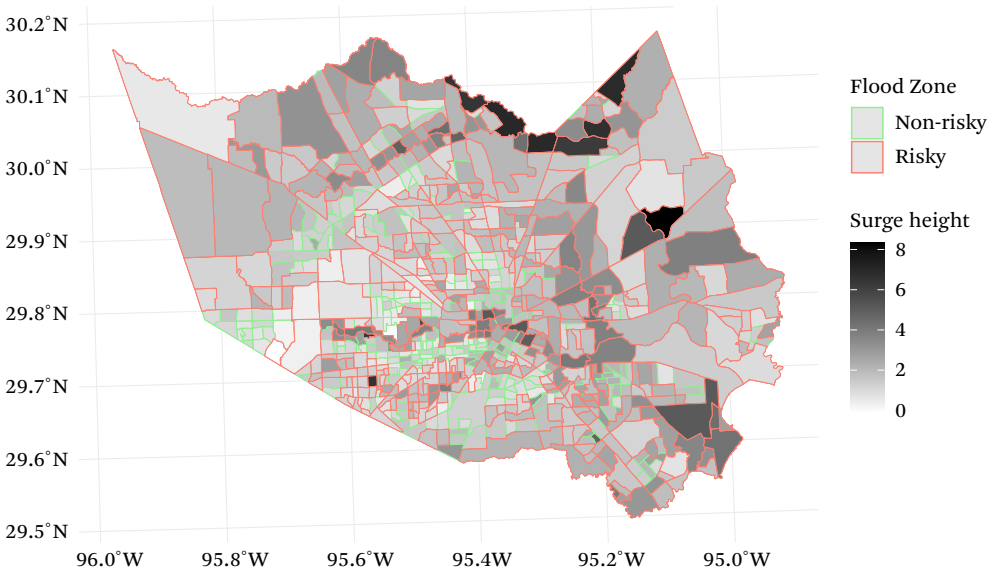
5. While a lower threshold of 6 inches would be closer to the no flooding reference category in New York City, the set of tracts that saw less than 6 inches of flooding is too small to produce precise estimates. We do replicate the baseline analyses using a lower threshold for the low-surge category in Harris County and the results are materially consistent with the 1 foot cutoff we use. These results are available from the authors on request.

Figure 1. Average Surge Height and Flood Zone Designation by Census Tract

Panel A. New York City



Panel B. Harris County



Source: FEMA 100-year flood map boundaries and surge heights; *Hurricane Harvey Flood Data Collections* [dataset] (Arctur 2023).

Note: The optimal way to view this figure is in color. We refer readers of the print edition of this article to <https://www.rsfsjournal.org/content/12/4/77> to view the color version.

Table 1. Share and Number of Census Tracts by Surge Height and Flood Zone

	New York City			Harris County		
	Outside FZ	Inside FZ	Total	Outside FZ	Inside FZ	Total
High surge	0.04 [82]	0.57 [164]	0.11 [246]	0.16 [60]	0.45 [176]	0.31 [236]
Moderate surge	0.03 [65]	0.18 [51]	0.05 [116]	0.59 [222]	0.47 [186]	0.53 [408]
Low surge	0.01 [29]	0.04 [11]	0.02 [40]	0.26 [97]	0.08 [30]	0.16 [127]
No surge	0.91 [1,699]	0.20 [60]	0.81 [1,759]	0.00 [0]	0.00 [0]	0.00 [0]
<i>N</i>	1,875	286	2,161	379	392	771

Source: Authors' calculations based on the larger sample of tracts used in the ACS analyses.

Note: Cell entries report shares; bracketed values report the number of census tracts. FZ = flood zone. High surge tracts have more than 2 feet of inundation; moderate surge tracts have between 1 foot and 2 feet; low surge tracts have less than 1 foot of water.

EMPIRICAL APPROACH

Our identification strategy relies on data on both the severity of storm inundation (which proxies for storm damage) and pre-storm risk (as measured by flood zone designation). We assume that after controlling for the salience of flood risk before the hurricane, any variation in surge heights is conditionally random in the context of fine-grained locational (census tract) and temporal (year) controls. Therefore, we can obtain credible estimates of effects on neighborhood-level demographic change after the storm event.

Figure 1, panels A and B show that flooding was concentrated in certain areas of the study counties, but at a more local level the flooding was somewhat unpredictable and varied substantially, creating exogenous variation in storm exposure across neighboring areas. For example, surge levels varied considerably across neighboring city blocks and within census tracts, as well as across the flood zone boundary. High, low, and no surge blocks and parcels are often contiguous, creating plausibly exogenous “treatment” and “comparison” groups across small geographic areas. This is the kind of variation we leverage to identify the impact of each storm.

We first use the ACS data to assess whether the storm appeared to change the total population, racial composition, tenure, or income in neighborhoods heavily affected by the storm (flooding) compared to nearby neighborhoods that were unaffected (or, in the case of Harris County, less affected) using the following general equation:

$$\begin{aligned} tracttrait_{nt} = & highsurge_{nt} \times post_t + lowsurge_{nt} \\ & \times post_t + floodzone_{nt} \times post_t \\ & + \gamma_g + \delta_t + \varepsilon_{nt} \end{aligned} \quad (1)$$

where the outcome $tracttrait_{nt}$ is one of the following variables for census tract n at time t : population, number of households, number of housing units, homeownership rate, mean income, share of the population by race (non-Hispanic White, non-Hispanic Black or Hispanic), share homeowners, median housing value, and median gross rent. We can also separately observe the White share of homeowners and renters. Here, γ_n is a census tract fixed effect and δ_t controls for the three years of the ACS samples (2008–2012, 2013–2017, 2018–2022). Note that variation across the surge categories is absorbed in the census tract fixed effects.⁶

6. We run all regressions with alternative geographic controls, including county-by-year (for New York City) and Public Use Microdata Area (PUMA)-by-year (for Harris County), both with and without census tracts fixed effects. The results are consistent across all of these specifications.

We then turn to the HMDA data to examine whether exposure to the storm changed the income and racial composition of new mortgage applicants looking to purchase homes in affected neighborhoods. In both locations, we estimate the following general equation:

$$appchar_{int} = highsurge_{nt} \times post_t + lowsurge_{nt} \times post_t + \gamma_n + GEO_p \times \sigma_t + \varepsilon_{int} \quad (2)$$

where $appchar_{int}$ is either the log of the applicant's income, or an indicator for whether the applicant is Black or Hispanic. Our baseline models of applicant race control for the applicant's income since it is heavily correlated with race, but results are very similar without the inclusion of applicant income. We include census tract fixed effects, (γ_n) and either county-by-year or PUMA-by-year fixed effects ($GEO_p \times \sigma_t$), for New York City and Harris County, respectively, to remove variation due to geographic differences or time. New York City applications span 2009–2017, and those from Harris County span 2012–2022.

We stratify the samples and estimate the above regressions by whether the census tract is considered inside or outside the flood zone, and whether its average household income is above or below the median of the sample (designated as high-income or low-income).

RESULTS

As context for our regression results, table 1 highlights some important differences between the two locations in our study. First, New York City and Harris County had different exposures to flooding risk prior to the hurricanes. About half of the census tracts in Harris County were in the FEMA-designated flood zone leading up to Hurricane Harvey, while just over 13 percent of tracts in New York City were in the flood zone.

Second, the storm flooded the two locations in very different ways. Figure 2 shows that an overwhelming number of tracts in New York City saw no flooding, including many tracts that were inside the flood zone. Harris County, on the other hand, experienced some amount of

flooding in every tract. As conveyed in table 1, among the tracts that saw flooding, its intensity was greater in New York City (with the most flooded tracts in the high-surge category). In Harris County, the number of tracts that saw less than 2 feet of water (low- and moderate-surge combined) is more than double the number of tracts with more than 2 feet. Overall, 11 percent of tracts in New York City experienced high surges compared to 31 percent in Harris County.

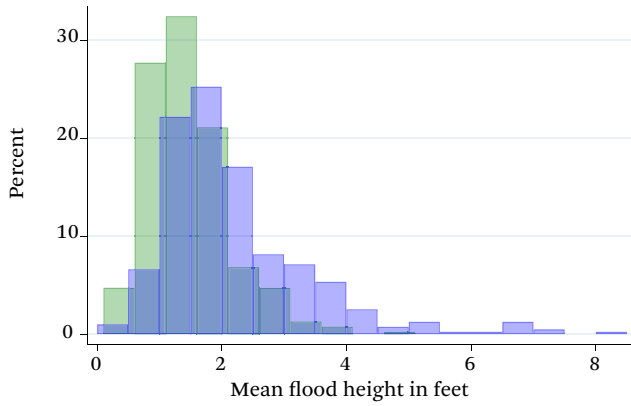
Finally, table 1 illustrates some degree of mismatch in both locations between where the flood maps predicted flooding would take place and where the waters actually surged. To be clear, areas in the flood zone were more likely to see flooding: 45 percent of Harris County tracts classified as inside the flood zone actually experienced severe flooding of more than 2 feet, while this share was 57 percent in New York City. Outside of the flood zone, about 4 percent of tracts in New York City and 16 percent in Harris County experienced high levels of inundation (more than 2 feet). For both places, close to 60 percent of the tracts that saw at least 1 foot of water were inside the designated flood zones.

We also note that there are demographic differences across the two locations that might matter (see online appendix tables A.1 and A.2).⁷ In New York City, the majority of households rent their homes, whereas Harris County has more homeowners. Rents, housing prices, and average incomes tend to be higher in New York City and vacancy rates lower, suggesting a tighter housing market. The racial demographics are also different: Harris County is more evenly comprised of White, Black and Hispanic residents (New York City is slightly whiter and less Hispanic). Within cities, we see few differences in demographics between neighborhoods with different flood risk exposure. In Harris County, the neighborhoods inside the flood zone that experienced the highest inundation tend to be more populated, slightly whiter, and higher-income. In New York City, those neighborhoods tend to have higher rentership rates and slightly higher White and Latino resident shares.

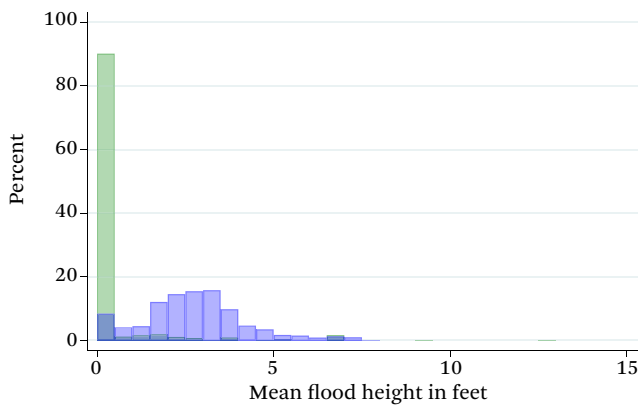
7. The online appendix can be found at <https://www.rsfsjournal.org/content/12/4/77/tab-supplemental>.

Figure 2. Average Surge Distribution by Flood Zone Designation

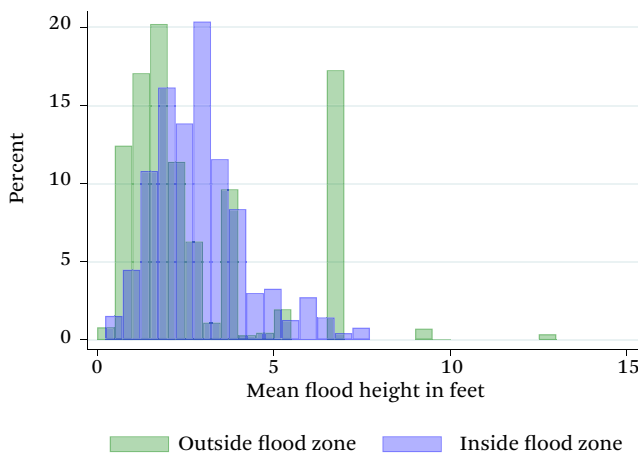
Panel A. Harris County



Panel B. New York City: including 0s



Panel C. New York City: excluding 0s



Outside flood zone Inside flood zone

Source: FEMA 100-year flood map boundaries and surge heights; *Hurricane Harvey Flood Data Collections* [dataset] (Arctur 2023).

Note: The optimal way to view this figure is in color. We refer readers of the print edition of this article to <https://www.rsfjournal.org/content/12/4/77> to view the color version.

Do Hard-Hit Areas See More Population Changes After the Storm?

We consider several dimensions of population change after the storm, including the number of residents, housing units, and racial composition. We explore these outcomes separately for New York City and Harris County.

New York City

One might expect that in the wake of a severe storm, people would migrate away from hard-hit neighborhoods. Table 2 shows that just the opposite happened in New York City in the years following Hurricane Sandy. After the storm, census tracts that experienced both high and low levels of surge saw a growth in the number of households and residents compared to neighborhoods that saw no surge. While there is some evidence of population and household growth in severely flooded areas outside the flood zone, this growth is evident inside the flood zone across low and high inundation levels.

We think much of this relative growth, especially inside the flood zone, was driven by new multifamily development. In the decade between 2010 and 2020, new multifamily housing (including city-subsidized housing) was disproportionately created in the flood zone (Furman Center for Real Estate and Urban Policy 2017). Areas in the flood zone offered large plots of available land that were zoned for multifamily development, some of it planned before the storm. This may have been particularly true in areas that saw high levels of flooding.⁸ An analysis of the change in total housing units over this time period provides support for this hypothesis (see table 3). The housing stock grew more in harder-hit areas. An examination of building permits (see online appendix table A.5) suggests that much of this development was planned before the storm. The coefficients on all the post-storm indicators are insignificant (and the coefficient on *low-surge* $\times$ *post* is negative), so the storm itself does not appear to have caused this new construction.

As hypothesized, we also see significant ra-

cial change in the wake of the storm. In particular, we see a relative reduction in the share of residents who are non-Hispanic White in high- and low-surge neighborhoods (table 4). We note that the largest and most significant decline in the share of non-Hispanic White residents is outside the flood zone among tracts with lower heights of inundation. Perhaps surprisingly, this racial change is not linked to changes in neighborhood income. For New York City, we only see substantial reductions in neighborhood mean income inside the flood zone, and only in neighborhoods that saw low levels of flooding. In neighborhoods outside the flood zone, we see some weak evidence of increases in income.

Harris County

We see similar patterns of population growth in Harris County. Again, neighborhoods with higher surge levels saw an increase in population after the storm (table 2). Analyses of housing units (see table 3) also confirm a relative growth in the housing stock in hard-hit areas, though the effects are only significant inside the flood zone in high-surge areas. In terms of racial change, we see no significant changes in the percentage of residents who are White in hard-hit neighborhoods after the storm in Harris County. Table 4 shows some weak evidence of a decline in income, however, at least in moderate-surge neighborhoods.

In sum, both storms seem to have induced population and housing growth in the most severely flooded neighborhoods. The storms also seem to have led to some compositional changes in hard-hit neighborhoods: a decline in the share of residents who are White in New York City and, more tentatively, a decline in income in Harris County. While we observe a growth in population in hard-hit areas both inside and outside the flood zone in New York City, the racial change appears to be more concentrated outside the flood zone, where information about risk would have been less salient prior to the storm.

8. For example, Hudson Yards, a massive development located near the Hudson River in midtown Manhattan, was planned prior to Sandy. We run analyses (not shown here) without Manhattan and the magnitude of the effects attenuates, suggesting that development planned before the storm contributed at least partially to the post-Sandy growth.

Table 2. Analysis of Neighborhood Population and Total Number of Households

	(1) Total Population Full Sample	(2) Total Population Outside Flood Zone	(3) Total Population Inside Flood Zone	(4) Number of HHs Full Sample	(5) Number of HHs Outside Flood Zone	(6) Number of HHs Inside Flood Zone
New York City						
Flood zone post	16.737 (86.983)			29.587 (31.437)		
High surge post	222.652** (97.317)	245.361* (139.130)	322.111* (170.048)	104.651*** (37.143)	116.938** (54.707)	134.213** (56.605)
Low surge post	160.229*** (60.662)	60.967 (58.271)	409.849** (174.507)	59.490** (24.652)	23.015 (26.076)	146.692** (58.774)
Constant	3,851.389*** (8.550)	3,751.260*** (7.346)	4,461.769*** (41.528)	1,445.568*** (3.496)	1,399.660*** (3.150)	1,725.818*** (15.921)
Tract FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
N	6,647	5,714	933	6,647	5,714	933
Houston						
Flood zone post	262.322** (126.759)			34.707 (45.619)		
High surge post	393.859** (161.636)	20.974 (128.556)	517.954* (283.885)	111.056* (59.248)	-37.047 (62.267)	184.574* (100.603)
Moderate surge post	138.104 (107.626)	240.669** (114.365)	13.554 (247.781)	42.551 (44.280)	68.987 (50.378)	27.239 (91.866)
Constant	5,307.988*** (38.688)	5,219.855*** (38.337)	5,393.199*** (66.267)	1,832.549*** (13.079)	1,833.298*** (14.979)	1,831.824*** (21.176)
Tract FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
N	2,313	1,137	1,176	2,313	1,137	1,176

Source: Authors' calculations based on ACS 2008-2012, 2013-2017, and 2018-2022.

Note: Standard errors in parentheses. HHs = households. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 3. Analysis of Total Number of Housing Units in Neighborhood

	(1) Number of Units Full Sample	(2) Number of Units Outside Flood Zone	(3) Number of Units Inside Flood Zone
New York City			
Flood zone post	13.426 (42.139)		
High surge post	153.366*** (56.378)	186.694** (91.073)	149.168** (61.687)
Low surge post	69.425*** (25.735)	31.492 (23.404)	136.195** (59.707)
Constant	1,591.614*** (4.070)	1,540.658*** (3.667)	1,902.451*** (18.744)
Tract FE	X	X	X
Year FE	X	X	X
N	6,647	5,714	933
Houston			
Flood zone post	42.506 (45.656)		
High surge post	120.885** (59.703)	-30.012 (60.759)	183.037* (101.608)
Moderate surge post	28.720 (45.044)	63.181 (51.734)	-4.858 (92.032)
Constant	2,075.739*** (13.087)	2,077.393*** (14.499)	2,074.140*** (21.488)
Tract FE	X	X	X
Year FE	X	X	X
N	2,313	1,137	1,176

Source: Authors' calculations based on ACS 2008–2012, 2013–2017, and 2018–2022.

Note: Standard errors in parentheses. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Racial and Income Changes Among Mortgage Applicants

A key question is how the composition of people buying homes in hard-hit neighborhoods (and taking on the flood risk) changes after severe storms. Using HMDA data on mortgage applicants, we can identify any changes in the race of the marginal homebuyer that could be masked by the net changes documented in the

ACS data. These results for New York City are shown in table 5, and event study plots are displayed in online appendix figure A.1.⁹

The probability that a mortgage applicant identifies as Black or Hispanic increases after the storm in areas with any degree of flooding, and this increase is concentrated in census tracts outside the flood zone.¹⁰ Further, the average income of applicants in neighborhoods expe-

9. The event-study figures allay any concerns that our study period might be contaminated by the onset of COVID-19; there are no changes in trends post-2020.

10. Note that this pattern holds up when restricting the HMDA sample to households receiving mortgages and buying homes, rather than the larger pool of applicants.

Table 4. Analysis of Average Household Income and White Population Share

	(1) Average HH Income Full Sample	(2) Average HH Income Outside Flood Zone	(3) Average HH Income Inside Flood Zone	(4) Share White Full Sample	(5) Share White Outside Flood Zone	(6) Share White Inside Flood Zone
New York City						
Flood zone post	2,656.233 (2,162.805)			0.004 (0.005)		
High surge post	2,530.933 (2,140.524)	2,297.287 (2,531.437)	-3,038.108 (4,782.800)	-0.014** (0.006)	-0.010 (0.007)	-0.011 (0.010)
Low surge post	-676.673 (1,705.983)	2937.212* (1,736.049)	-12077.847** (4,958.590)	-0.013** (0.006)	-0.020*** (0.006)	0.002 (0.013)
Constant	66,101.341*** (319.152)	65,920.590*** (320.261)	67,222.974*** (1188.612)	0.335*** (0.001)	0.320*** (0.001)	0.425*** (0.002)
Tract FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
N	6,454	5,600	854	6,570	5,669	901
Houston						
Flood zone post	100.453 (1,491.599)			-0.006 (0.005)		
High surge post	-965.311 (2,701.845)	-1,547.563 (3,679.001)	-331.728 (4,284.812)	-0.002 (0.008)	-0.001 (0.010)	0.005 (0.015)
Moderate surge post	-3,960.127* (2,400.081)	-4,063.777 (2,963.738)	-3,532.068 (3,995.563)	0.006 (0.006)	0.002 (0.007)	0.016 (0.014)
Constant	71,117.363*** (465.481)	66,928.190*** (694.923)	75,176.388*** (622.357)	0.328*** (0.001)	0.324*** (0.002)	0.332*** (0.002)
Tract FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
N	2,298	1,131	1,167	2,313	1,137	1,176

Source: Authors' calculations based on ACS 2008–2012, 2013–2017, and 2018–2022.

Note: Standard errors in parentheses. HHs = households. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 5. Analysis of Mortgage Applicant's Race in New York City

Applicant Is Black or Hispanic	(1) Full Sample	(2) Inside Flood Zone	(3) Outside Flood Zone	(4) Outside Flood Zone Low Income	(5) Outside Flood Zone High Income
Income	-0.01*** (0.002)	-0.01* (0.004)	-0.01*** (0.002)	-0.02*** (0.003)	-0.01** (0.002)
High surge × post = 1	0.03*** (0.01)	0.01 (0.01)	0.04*** (0.01)	0.06*** (0.02)	0.01 (0.01)
Low surge × post = 1	0.04*** (0.01)	0.02 (0.01)	0.06*** (0.01)	0.08*** (0.01)	0.01 (0.01)
Constant	-0.002 (0.66)	0.17 (1.19)	-0.07 (0.81)	-2.65 (1.96)	0.82 (0.88)
Tract FE	X	X	X	X	X
Year-by-Borough FE	X	X	X	X	X
N	279,276	56,292	222,984	133,245	89,739

Source: Authors' calculations based on HMDA 2009–2017.

Note: Robust standard errors in parentheses. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

riencing low and high surges declines after the storm, again concentrated among neighborhoods outside the flood zone (table 6).

We confirm that this shift in the racial and ethnic identities of the mortgage applicants is not due to a change in the number of applicants

in the hard-hit areas. As shown in table 7, there is no significant change in the number of applicants outside the flood zone. Notably, the number of applicants declines in the hardest hit areas inside the flood zone, suggesting lower turnover in the owner-occupied stock. This re-

Table 6. Analysis of Mortgage Applicant's Income in New York City

Log Applicant Income	(1) Full Sample	(2) Inside Flood Zone	(3) Outside Flood Zone	(4) Outside Flood Zone Low Income	(5) Outside Flood Zone High Income
High surge × Post = 1	-0.02 (0.01)	0.01 (0.03)	-0.10*** (0.02)	-0.13*** (0.03)	-0.05 (0.04)
Low surge × Post = 1	-0.04** (0.01)	0.00 (0.04)	-0.07*** (0.02)	-0.08*** (0.03)	-0.04 (0.03)
Constant	4.13*** (1.57)	3.18 (2.17)	4.56** (2.05)	1.25 (2.33)	5.93** (2.84)
Tract FE	X	X	X	X	X
Year-by-Borough FE	X	X	X	X	X
N	345,379	70,052	275,327	161,006	114,321

Source: Authors' calculations based on HMDA 2009–2017.

Note: Low-income census tracts have average household income below the median of the sample. Robust standard errors in parentheses. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

duction is also consistent with any population increase being driven by multifamily rental development.

In Harris County, we similarly see an increase in the probability that a mortgage applicant is Black or Hispanic in high-surge neighborhoods outside the flood zone, though we don't see im-

pacts in neighborhoods experiencing more moderate levels of flooding (See Table 8.)

In contrast to New York City, we see no significant impacts on applicant income in hard-hit neighborhoods either inside or outside the flood zone (table 9). Table 10 confirms that the change in applicant composition is not driven

Table 7. Analysis of Number of Mortgage Applicants per Census Tract in New York City

	(1) Full Sample	(2) Inside Flood Zone	(3) Outside Flood Zone
High $\times$ post = 1	-11.450** (5.311)	-17.070*** (5.474)	0.274 (5.379)
Low $\times$ post = 1	3.350 (3.261)	6.141 (6.820)	0.707 (2.390)
Flood zone = 2 $\times$ post = 1	-6.920* (4.046)		
Tract FE	X	X	X
Year-by-Borough FE	X	X	X
N	376,937	75,823	301,114

Source: Authors' calculations based on HMDA 2009–2017.

Note: Standard errors in parentheses. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 8. Analysis of Mortgage Applicant's Race (Black or Hispanic) in Harris County

	(1) Full Sample	(2) Inside Flood Zone	(3) Outside Flood Zone	(4) Outside Flood Zone Low Income	(5) Outside Flood Zone High Income
Applicant is Black or Hispanic					
Income	-0.075*** (0.004)	-0.079*** (0.005)	-0.070*** (0.006)	-0.075*** (0.006)	-0.068*** (0.007)
High surge $\times$ post = 1	-0.003 (0.008)	-0.011 (0.012)	0.034*** (0.009)	0.034 (0.022)	0.022** (0.009)
Moderate surge $\times$ post = 1	0.005 (0.006)	0.010 (0.013)	0.005 (0.006)	-0.008 (0.014)	0.002 (0.006)
Risky $\times$ post = 1	0.000 (0.006)				
Constant	0.785*** (0.017)	0.800*** (0.022)	0.764*** (0.025)	0.949*** (0.026)	0.711*** (0.032)
Tract FE	X	X	X	X	X
Year-by-PUMA FE	X	X	X	X	X
N	877,078	494,619	382,459	87,289	295,169

Source: Authors' calculations based on HMDA 2012–2022.

Note: Low-income census tracts have average household income below the median of the sample. Standard errors in parentheses. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 9. Analysis of Mortgage Applicant's Income in Harris County

Log Applicant Income	(1) Full Sample	(2) Inside Flood Zone	(3) Outside Flood Zone	(4) Outside Flood Zone Low Income	(5) Outside Flood Zone High Income
High surge × post = 1	0.002 (0.010)	0.009 (0.020)	-0.013 (0.014)	-0.058** (0.027)	-0.015 (0.016)
Moderate surge × post = 1	0.008 (0.008)	0.011 (0.019)	0.009 (0.009)	-0.036* (0.018)	0.012 (0.011)
Risky × post = 1	-0.001 (0.006)				
Constant	4.527*** (0.003)	4.549*** (0.009)	4.494*** (0.003)	4.255*** (0.007)	4.569*** (0.004)
Tract FE	X	X	X	X	X
Year-by-PUMA FE	X	X	X	X	X
N	1133,507	642,046	491,461	111,773	379,687

Source: Authors' calculations based on HMDA 2012–2022.

Note: Low-Income census tracts have average household income below the median of the sample. Standard errors in parentheses. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 10. Analysis of Number of Mortgage Applicants per Census Tract in Harris County

	(1) Full Sample	(2) Inside Flood Zone	(3) Outside Flood Zone
High surge × post = 1	-1.990 (49.057)	53.765 (52.891)	16.881 (13.565)
Moderate surge × post = 1	27.912 (29.918)	92.568 (92.377)	21.063*** (7.447)
Risky × post = 1	22.400 (51.344)		
Tract FE	X	X	X
Year-by-PUMA FE	X	X	X
N	1,213,983	688,622	525,361

Source: Authors' calculations based on HMDA 2012–2022.

Note: Standard errors in parentheses. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

by changes in the number of applicants in the hardest hit areas. We do, however, observe increases in mortgage applications in the more moderately flooded areas outside the flood zone.

How Do Patterns Differ in Low-Income and High-Income Neighborhoods?

The patterns of change observed thus far reflect averages for neighborhoods of all income levels.

But we expect that patterns might vary with neighborhood income. For example, property owners in higher-income neighborhoods will generally have more resources to rebuild after the storm. Further, the income of a neighborhood may signal greater resilience and potentially attract more investment. For both these reasons, we expect to see more demographic churn, and more long-lasting change, in lower

income neighborhoods, at least among homebuyers who are investing in the future of a neighborhood.

New York City

As expected, when looking at racial change among homebuyers using the HMDA data, we see greater effects on racial change among homebuyers in low-income neighborhoods as compared to higher income areas. Among areas outside the flood zone, where significant effects were observed, we see that the increased probability that applicants identify as Black or Hispanic is concentrated in low-income neighborhoods (see online appendix figure A.1). Similarly, we find the most significant decrease in income of applicants in low-income neighborhoods outside the flood zone (table 6).

Harris County

For Harris County, we do not see clear differences in impacts on mortgage applicants' race by neighborhood income. While the coefficient on *high-surge* $\times$ *post* is only statistically significant for high-income neighborhoods, the point estimate is actually larger for low-income tracts. However, we only observe declines in applicant income in hard-hit areas in low-income neighborhoods outside the flood zone. We see no change in higher income neighborhoods.

In sum, in New York City, hard-hit neighborhoods see increases in home purchases by households of color, and those increases are driven by low-income neighborhoods outside the flood zone. We do not see these same differences by neighborhood income in Harris County. We think part of the explanation for the differences in income patterns is that the hard-hit high-income neighborhoods in New York City are considerably higher income than those in Harris County. In New York City, the hard-hit neighborhoods include some of the highest income areas in Manhattan. Investors and potential purchasers were likely very confident that any damage in these areas would be quickly repaired and that demand would remain strong. The above median income, hard-hit neighborhoods in Harris County were closer to

the median and may have been viewed as more vulnerable, or, at best, similar in terms of their economic resilience.

ROBUSTNESS CHECKS

We test the robustness of our main results in several ways. First, to confirm that the differences we observe across the flood zones are not just numerically meaningful, but also statistically significant, we run regressions on the pooled sample of neighborhoods and interact the surge height variables that vary by flood zone. The results from fully interacted (rather than stratified) regressions are largely consistent with the stratified ones.¹¹

Second, we test whether results in New York City are driven by Manhattan, since it has distinct demographics and housing markets from the other four boroughs of the city and most cities across the country. To test this, we estimate similar regressions excluding Manhattan. The results are generally unchanged when Manhattan is excluded from the sample.¹²

Third, for a subset of the outcomes, we conduct supplemental regressions to account for the different sizes of census tracts across our two sample cities. On average, census tracts are about ten times larger in Harris County than New York City. For the cases where the census tract intersects the flood zone boundary, we assign the census tract as inside the flood zone if 20 percent or more of its land area is inside the zone. While we have applied this designation consistently across New York City and Harris County, some portion of the homes located in tracts that are partially in the flood zone are likely to be much further from the flood zone boundary in Harris County (compared to those in New York City tracts) and therefore at lower risk. To address this discrepancy in risk exposure, we reestimate some of the baseline regressions for three subsamples of tracts according to the share of overlap with the flood zone: those with less than 20 percent of land area in the flood zone, those with between 20 percent and 50 percent of land area in the flood zone, and those with a majority of land in the flood zone. These re-

11. These results are available from the authors on request.

12. These results are available from the authors on request.

sults are displayed in online appendix tables A.3 and A.4.

In New York, we see population and housing unit growth both in hard-hit tracts that are partially in the flood zone and those that are mostly in the flood zone. In Harris County, the growth is concentrated in hard-hit tracts that are only partially in the flood zone, perhaps suggesting that people are moving to areas that they do not perceive to be at as much of a future risk. It remains surprising, however, that population and housing units are disproportionately growing even in these neighborhoods.

EXPLORING MECHANISMS

Disentangling mechanisms is challenging, but our results provide some suggestive evidence. First, the fact that the racial change and income declines are more pronounced outside the flood zone (at least for incoming homebuyers) suggests that the new information provided by the storms about flood risk may have triggered the population shifts. Prior to these storms, residents in the flood zone (and potential future residents) would have already had salient information about the risk of future flooding, in part because of the requirement that home purchasers buy flood insurance when obtaining a mortgage for a property inside the flood zone. But the storm provided new, potentially shocking, information about flood risks to neighborhoods lying outside the official flood zone, and this helps to explain the larger impacts on homebuying in those neighborhoods.

More generally, the fact that Hurricane Sandy led to more significant racial changes than Hurricane Harvey also suggests that new information about risk is an important channel. In Houston, given the history of repeated storms and flooding and the higher probability of living in or near a flood zone, residents were probably more aware of the risks. So Harvey provided little in the way of new information. Consider that about half of the population in Harris County lives inside the flood zone, compared to about 11 percent in New York City. The more

modest impacts in Harris County, especially for the ACS outcomes, may reflect the fact that we can observe only short-term responses. In Harris County, we only have access to one five-year window of data after the storm, as compared to two in New York City.

In addition to information, another potential channel is changes in homeownership. As noted earlier, storms may also induce changes in housing tenure, which could in turn generate changes in racial composition given racial disparities in homeownership. We examine this possibility in table 11. Counter to theoretical expectations, we see no significant change in the share of households who own their homes in high- or low-surge tracts relative to those that had no flooding. This holds true in both cities. So we see little evidence that shifts in tenure explain the racial change that we observe. That also means that despite our theoretical predictions about rising investor demand as sales prices decrease more than rents after the storms, we see no change in homeownership rates in hard-hit neighborhoods. It does not appear, that is, that the storms invited more investors to purchase small buildings or more generally encouraged the conversion of owner-occupied buildings to rental properties.

We also explore changes in the racial composition of homeowners and renters, to understand if change is being driven more by owners or renters. As shown in table 12, we see no significant change in the share of homeowners who are White in surge areas in New York City. Yet HMDA data show that after the storm, the marginal homebuyer in flooded neighborhoods had a lower income and was more likely to be Black or Hispanic (controlling for income). This suggests that homeowners of color were both more likely to enter the hardest hit neighborhood after a storm and more likely to sell their homes, resulting in no net change in the racial composition of homeowners.¹³ As for renters, we see a significant decline in the White share of renters in high-surge neighborhoods, at least outside the flood

13. When we stratify the sample by neighborhoods that are majority White or majority Black and Hispanic residents (not shown here), the patterns observed for the full sample persist across both strata. Therefore, the increase in the prevalence of Black and Hispanic homeowners is not concentrated in more racially homogeneous neighborhoods.

Table 11. Analysis of the Neighborhood Owner Occupied Rate

	(1) Full Sample	(2) Outside Flood Zone	(3) Inside Flood Zone
New York City			
Flood zone post	-0.013 (0.010)		
High surge post	0.003 (0.009)	-0.004 (0.009)	0.017 (0.026)
Low surge post	-0.008 (0.008)	-0.008 (0.008)	0.003 (0.026)
Constant	0.368*** (0.001)	0.370*** (0.001)	0.353*** (0.005)
Tract FE	X	X	X
Year FE	X	X	X
N	6,496	5,627	869
Houston			
Flood zone post	0.012* (0.007)		
High surge post	-0.006 (0.009)	0.002 (0.013)	-0.007 (0.012)
Moderate surge post	-0.002 (0.008)	-0.004 (0.010)	0.001 (0.014)
Constant	0.560*** (0.002)	0.540*** (0.002)	0.580*** (0.003)
Tract FE	X	X	X
Year FE	X	X	X
N	2,308	1,132	1,176

Source: Authors' calculations based on ACS 2008–2012, 2013–2017, and 2018–2022.

Note: Standard errors in parentheses. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

zone, where information about the storm's risk was less readily available.

As in New York City, we do not observe any significant change in the White share of homeowners in surge areas after Hurricane Harvey, again suggesting that in hard-hit neighborhoods outside the flood zone, homeowners of color were more likely both to enter and to leave neighborhoods. Contrary to New York City, we see an increase in the percentage of renters who are White in moderate surge neighborhoods that are outside of the flood zone.

Another mechanism is reduced prices and enhanced affordability (which may be driven by the new information about risk). In both cities, we see evidence of reductions in home prices in hard-hit neighborhoods outside the flood

zone (table 13), consistent with prior research (Ellen and Meltzer 2024). The magnitude is always larger outside the flood zone, with median reported home values in surge neighborhoods falling by roughly \$60,000 relative to neighborhoods that saw no storm surge in New York City. In Harris County, the estimated impacts are somewhat smaller, as expected given lower house price levels. These lower home prices appear to open up more opportunities for homebuyers of color to purchase homes in the hard-hit neighborhoods. Again, since we see little evidence of net changes in the racial composition of homeowners in either city from the ACS, homeowners of color may have been not only more likely to enter a hard-hit neighborhood in the wake of a storm, but also more likely to

Table 12. Analysis of Percentage White, Homeowners and Renters

	Percent White, Homeowners			Percent White, Renters		
	(1) Full Sample	(2) Outside Flood Zone	(3) Inside Flood Zone	(4) Full Sample	(5) Outside Flood Zone	(6) Inside Flood Zone
New York City						
Flood zone post	0.000 (0.013)			0.010 (0.011)		
High surge post	-0.005 (0.013)	0.001 (0.016)	0.011 (0.025)	-0.020* (0.010)	-0.026** (0.013)	-0.027 (0.024)
Low surge post	-0.002 (0.012)	-0.019 (0.013)	0.043 (0.029)	-0.001 (0.009)	0.010 (0.011)	-0.028 (0.025)
Constant	0.414*** (0.002)	0.397*** (0.002)	0.528*** (0.006)	0.345*** (0.002)	0.331*** (0.002)	0.440*** (0.005)
Tract FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
N	6,330	5,508	822	6,484	5,620	864
Houston						
Flood zone post	-0.001 (0.009)			0.000 (0.010)		
High surge post	-0.013 (0.013)	-0.029 (0.022)	0.001 (0.019)	0.005 (0.015)	0.014 (0.021)	-0.033 (0.024)
Moderate surge post	-0.000 (0.010)	-0.001 (0.012)	0.007 (0.019)	0.014 (0.014)	0.033** (0.017)	-0.034 (0.023)
Constant	0.462*** (0.002)	0.464*** (0.003)	0.459*** (0.003)	0.320*** (0.003)	0.308*** (0.005)	0.331*** (0.004)
Tract FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
N	2,275	1,113	1,162	2,305	1,131	1,174

Source: Authors' calculations based on ACS 2008-2012, 2013-2017, and 2018-2022.

Note: Standard errors in parentheses. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 13. Analysis of Median Neighborhood Housing Values and Median Gross Rent

	(1) House Value Full Sample	(2) House Value Outside Flood Zone	(3) House Value Inside Flood Zone	(4) Gross Rent Full Sample	(5) Gross Rent Outside Flood Zone	(6) Gross Rent Inside Flood Zone
New York City						
Flood zone post	48,269.082** (19839.904)			15.367 (28.516)		
High surge post	-37,879.918** (19009.534)	-58,179.039*** (20091.000)	7,163.449 (44950.969)	42.519 (30.612)	53.063 (40.798)	48.479 (55.213)
Low surge post	-53,412.797*** (15051.977)	-56,069.152*** (15179.031)	-15,590.229 (46253.615)	14.508 (27.922)	11.336 (32.035)	26.595 (62.597)
Constant	655,753.825*** (3071.219)	657,442.379*** (3059.695)	644,510.632*** (11954.510)	1,523.534*** (4.171)	1,527.046*** (4.209)	1,495.708*** (16.285)
Tract FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
N	5,981	5,223	758	6,366	5,564	850
Houston						
Flood zone post	-10,352.181* (5709.120)			15.840 (17.645)		
High surge post	-25,028.004** (11,908.125)	-37,253.267** (17,544.704)	-2,743.716 (15,013.692)	-16.838 (27.601)	-10.501 (41.612)	-22.871 (50.996)
Moderate surge post	-39,058.127*** (10,949.094)	-45,944.467*** (13,871.966)	-17,823.434 (14,279.585)	-1.906 (22.482)	-1.151 (24.178)	-5.400 (51.138)
Constant	198,263.589*** (2,221.803)	196,843.974*** (3,107.992)	199,632.661*** (3,166.508)	1,169.270*** (5.742)	1,159.975*** (8.458)	1,178.301*** (7.791)
Tract FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
N	2,239	1,097	1,142	2,273	1,118	1,155

Source: Authors' calculations based on ACS 2008–2012, 2013–2017, and 2018–2022.

Note: Standard errors in parentheses. FE = fixed effects.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

leave. This might be due to a lack of resources to repair the storm damage.

Table 13 also shows that in contrast to home prices, we see no evidence in either city of reductions in median rents, again consistent with past research (Harwood 2026). So increased rental affordability cannot explain the racial change we see among renters in the two cities.

In sum, our analyses rule out some mechanisms (like changes in tenure and rental affordability), but provide suggestive evidence that other mechanisms might drive the observed compositional changes. New information about risk and declining home prices appear to play an important role. Notably, our results suggest that the storms both increased the entry of homeowners of color and also increased exits, leading to little net change in racial composition.

DISCUSSION AND CONCLUSION

Extreme climate events can cause severe flooding and structural damage, but they can also shape the economic and demographic trajectories of the affected areas. We use the cases of two of the most severe storms in recent US history, Hurricanes Sandy and Harvey, to understand the nature of racial change in hard-hit neighborhoods. We use flood zone designation to capture information about flood risk leading up to the storms and then fine-grained variation in how the storm waters actually surged to measure the impacts, while controlling for pre-existing knowledge of risk.

We find some similarities across New York City and Harris County. First, in both places, population and housing units increase in the neighborhoods that saw more severe inundation. So while we might expect large storm surges to reduce construction and to drive people away from these areas given the new information about their risk, we see precisely the opposite. In the years after the storm, the total number of housing units grows more in neighborhoods that saw high storm surge than in those that saw little or no surge. Therefore, not only are people moving into those areas, but investment and development may be supporting that trend as well. That said, it appears that much of the new development started

prior to the storms (most certainly in New York City).

In addition, there are signs of racial change in both locations: the share of residents who are White goes down (although more notably in New York City) in hard-hit neighborhoods. In both places, the racial change and income declines among incoming homebuyers are more pronounced outside the flood zone, suggesting that the new information provided by the storms about flood risk may have triggered the population shifts.

There are also important differences across the two locations and storms. The racial change is more pronounced in New York City, manifesting for both owners and renters, and is concentrated outside of the flood zone in New York City, where residents would have had less information about the flooding risk before the storm. The more muted impacts in Harris County may also be explained by information. While Sandy and Harvey were both severe and devastating, Sandy came earlier and was a more novel event. Residents of New York City were truly unprepared for the storm surge induced by Sandy, and therefore the new information about risk was very salient. Furthermore, most of the neighborhoods in New York City were not in a designated flood zone, suggesting that people were even more unaware of the potential risks from the storm. Harvey, on the other hand, came in the wake of other major storms and hit a county in which half of the neighborhoods were in a FEMA-designated flood zone. Therefore, the new information about risk from the storm may not have been as meaningful.

In sum, we find that extreme weather events, like Hurricanes Sandy and Harvey, can indeed induce neighborhood change. We show that the damage (and perhaps newly learned risk) decreases the value of homes. While this economic shock harms the owners of those homes, it may also open up buying opportunities for households who could not previously afford homes in those neighborhoods. But while lower prices may increase access to homeownership, they come with heightened risks of future flooding and damage. This pattern is consistent with James R. Elliott and colleagues' (2026) revolving

door of risk, in which the burden of climate risk gets passed along as homeowners in risky areas sell their homes to new residents. Our results suggest that homebuyers of color are being disproportionately exposed to that risk.

REFERENCES

- Arctur, David. 2023. *Hurricane Harvey Flood Data Collections* [dataset]. CUAHSI HydroShare. November 6. <https://www.hydroshare.org/resource/c037167e497546a1bc1508dfb32a9cff/>.
- Besbris, Max, Pastor Manuel, Anna Rhodes, Wolfram Schlenker, and Pamela Winston. 2026. "The Social, Political, and Economic Consequences of Climate Hazards." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 1–32. <https://doi.org/10.7758/RSF.2026.12.4.01>.
- Billings, Stephen B, Emily A. Gallagher, and Lowell Ricketts. 2022. "Let the Rich Be Flooded: The Distribution of Financial Aid and Distress After Hurricane Harvey." *Journal of Financial Economics* 146(2): 797–819.
- Bin, Okmyung, and Craig E. Landry. 2013. "Changes in Implicit Flood Risk Premiums: Empirical Evidence from the Housing Market." *Journal of Environmental Economics and Management* 65(3): 361–76.
- Bin, Okmyung, and Stephen Polasky. 2004. "Effects of Flood Hazards on Property Values: Evidence Before and After Hurricane Floyd." *Land Economics* 80(4): 490–500.
- Boustan, Leah Platt, Matthew E. Kahn, Paul W. Rhode, and Maria Lucia Yanguas. 2020. "The Effect of Natural Disasters on Economic Activity in US Counties: A Century of Data." *Journal of Urban Economics* 118: 103257.
- Chappell, William F., Richard G. Forgette, David A. Swanson, and Mark V. Van Boening. 2007. "Determinants of Government Aid to Katrina Survivors: Evidence from Survey Data." *Southern Economic Journal* 74(2): 344–62.
- Curtis, Katherine J., Jack DeWaard, Elizabeth Fussell, and Rachel A. Rosenfeld. 2020. "Differential Recovery Migration Across the Rural–Urban Gradient: Minimal and Short-Term Population Gains for Rural Disaster-Affected Gulf Coast Counties." *Rural Sociology* 85(4): 856–98.
- Cutter, Susan L., Bryan J. Boruff, and W. Lynn Shirley. 2003. "Social Vulnerability to Environmental Hazards." *Social Science Quarterly* 84(2): 242–61.
- Donner, William, and Havidán Rodríguez. 2008. "Population Composition, Migration and Inequality: The Influence of Demographic Changes on Disaster Risk and Vulnerability." *Social Forces* 87(2): 1089–1114.
- Ellen, Ingrid Gould, and Rachel Meltzer. 2024. "Heterogeneity in the Recovery of Local Real Estate Markets After Extreme Events: The Case of Hurricane Sandy." *Real Estate Economics* 52(3): 714–52.
- Elliott, James R. 2015. "Natural Hazards and Residential Mobility: General Patterns and Racially Unequal Outcomes in the United States." *Social Forces* 93(4): 1723–47.
- Elliott, James R., Kevin Loughran, A. Alexander Priest, and Phylicia Lee Brown. 2026. "The Revolving Door of Risk: Climate Hazards, Risk Containment, and the Hidden Social Dynamics of Managed Retreat." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 34–53. <https://doi.org/10.7758/RSF.2026.12.4.02>.
- Federal Emergency Management Agency (FEMA). 2023. *Why Should I Buy Flood Insurance?* Federal Emergency Management Agency. May 2.
- Finch, Christina, Christopher T. Emrich, and Susan L. Cutter. 2010. "Disaster Disparities and Differential Recovery in New Orleans." *Population and Environment* 31(4): 179–202.
- Furman Center for Real Estate and Urban Policy. 2017. *Housing in the U.S. Floodplains*. New York University. May.
- Fussell, Elizabeth. 2015. "The Long-Term Recovery of New Orleans' Population After Hurricane Katrina." *American Behavioral Scientist* 59(10): 1231–45.
- Fussell, Elizabeth. 2018. "Population Displacements and Migration Patterns in Response to Hurricane Katrina." In *Routledge Handbook of Environmental Displacement and Migration*, edited by Robert McLeman and François Gemenne. Routledge.
- Fussell, Elizabeth, Sara R. Curran, Matthew D. Dunbar, Michael A. Babb, Luanne Thompson, and Jacqueline Meijer-Irons. 2017. "Weather-Related Hazards and Population Change: A Study of Hurricanes and Tropical Storms in the United States, 1980–2012." *Annals of the American Academy of Political and Social Science* 669(1): 146–67.
- Fussell, Elizabeth, Jack DeWaard, and Katherine J.

- Curtis. 2023. "Environmental Migration as Short- or Long-Term Differences from a Trend: A Case Study of Hurricanes Katrina and Rita Effects on Out-Migration in the Gulf of Mexico." *International Migration* 61(5): 60–74.
- Fussell, Elizabeth, and Elizabeth Harris. 2014. "Homeownership and Housing Displacement After Hurricane Katrina Among Low-Income African-American Mothers in New Orleans." *Social Science Quarterly* 95(4): 1086–1100.
- Fussell, Elizabeth, Narayan Sastry, and Mark VanLandingham. 2010. "Race, Socioeconomic Status, and Return Migration to New Orleans After Hurricane Katrina." *Population and Environment* 31: 20–42.
- Groen, Jeffrey A., and Anne E. Polivka. 2010. "Going Home After Hurricane Katrina: Determinants of Return Migration and Changes in Affected Areas." *Demography* 47(4): 821–44.
- Hallstrom, Daniel G., and V. Kerry Smith. 2005. "Market Responses to Hurricanes." *Journal of Environmental Economics and Management* 50(3): 541–61.
- Harwood, Katharine W.H. 2026. "The Impact of Natural Disasters on Rental Markets: Heterogeneous Effects, Rental Subsidies, and Equity in Disaster Recovery." *Journal of Urban Economics* 153: 103862.
- Hong, Boyeong, Bartosz J. Bonczak, Arpit Gupta, and Constantine E. Kontokosta. 2021. "Measuring Inequality in Community Resilience to Natural Disasters Using Large-Scale Mobility Data." *Nature Communications* 12(1): 1870.
- Kousky, Carolyn, Mark Palim, and Ying Pan. 2020. "Flood Damage and Mortgage Credit Risk: A Case Study of Hurricane Harvey." *Journal of Housing Research* 29(sup1): S86–S120. <https://doi.org/10.1080/10527001.2020.1840131>.
- Lee, Dalbyul. 2017. "Neighborhood Change Induced by Natural Hazards." *Journal of Planning Literature* 32(3): 240–52.
- Lee, Dalbyul. 2020. "The Impact of Natural Disasters on Neighborhood Poverty Rate: A Neighborhood Change Perspective." *Journal of Planning Education and Research* 40(4): 447–59.
- Logan, John R., Sukriti Issar, and Zengwang Xu. 2016. "Trapped in Place? Segmented Resilience to Hurricanes in the Gulf Coast, 1970–2005." *Demography* 53(5): 1511–34.
- Ma, Chenyi, and Tony Smith. 2020. "Vulnerability of Renters and Low-Income Households to Storm Damage: Evidence from Hurricane Maria in Puerto Rico." *American Journal of Public Health* 110(2): 196–202.
- McConnell, Kathryn, Stephan Whitaker, Elizabeth Fussell, Jack DeWaard, Kobie Price, and Katherine Curtis. 2021. "Effects of Wildfire Destruction on Migration, Consumer Credit, and Financial Distress." Federal Reserve Bank of Cleveland Working Paper. December 27. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3995455.
- Ortega, Francesc, and Süleyman Taşpınar. 2018. "Rising Sea Levels and Sinking Property Values: Hurricane Sandy and New York's Housing Market." *Journal of Urban Economics* 106: 81–100.
- Pais, Jeremy F., and James R. Elliott. 2008. "Places as Recovery Machines: Vulnerability and Neighborhood Change After Major Hurricanes." *Social Forces* 86(4): 1415–53.
- Park, Gainbi, and Rachel Franklin. 2023. "The Changing Demography of Hurricane At-Risk Areas in the United States (1970–2018)." *Population, Space and Place* 29(6): e2685.
- Ratnadiwakara, Dimuthu, and Buvaneshwaran Vengopal. 2020. "Do Areas Affected by Flood Disasters Attract Lower-Income and Less Creditworthy Homeowners?" *Journal of Housing Research* 29(sup1): S121–S143.
- Rhodes, Anna, and Max Besbris. 2022. *Soaking the Middle Class: Suburban Inequality and Recovery from Disaster*. Russell Sage Foundation.
- Santiago-Bartolomei, Raúl, Deepak Lamba-Nieves, and Enrique A. Figueroa. 2022. "Tracking Neighborhood Change in Geographies of Opportunity for Post-Disaster Legacy Cities: A Case Study of San Juan, Puerto Rico." Working Paper WP22RS1. Lincoln Institute of Land Policy. January. <https://www.lincolnst.edu/publications/working-papers/tracking-neighborhood-change-in-geographies-opportunity-post-disaster/>.
- Sastry, Narayan, and Jesse Gregory. 2020. "Returning to New Orleans in the Year After Hurricane Katrina: Disparities by Race and the Effects of Flooding." PSC Research Report, no. 20-896. Population Studies Center, University of Michigan. September.
- Schultz, Jessica, and James R. Elliott. 2013. "Natural Disasters and Local Demographic Change in the

- United States. *Population and Environment* 34(3): 293–312.
- Wyczalkowski, Christopher K., Eric J. van Holm, Ann-Margaret Esnard, and Betty S. Lai. 2019. "Uneven Neighborhood Recovery: Hurricane Damage and Neighborhood Change in the Houston–Galveston Region Since 1970." *City & Community* 18(2): 689–709.
- Zhang, Yang. 2012. "Will Natural Disasters Accelerate Neighborhood Decline? A Discrete-Time Hazard Analysis of Residential Property Vacancy and Abandonment Before and After Hurricane Andrew in Miami-Dade County (1991–2000)." *Environment and Planning B: Planning and Design* 39(6): 1084–1104.

Weather Extremes in Indigenous Communities in Mexico and Undocumented US Migration and Its Duration



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In Mexico, the context of indigeneity—the share of the local population with precolonial origins—patterns multiple forms of inequality, including disproportionate exposure to weather extremes. We examine whether it also shapes undocumented migration to and return from the United States following weather extremes. Analyzing data on over 90,000 individuals from 147 Mexican communities in the Mexican Migration Project, linked to municipal measures of indigeneity from the Mexican Census and high-resolution daily precipitation and temperature data from Daymet, we estimate linear probability models. Results show that very dry years are associated with a higher probability of undocumented migration from low-indigenous municipalities, while extreme weather is associated with a lower probability of return to Mexico across all contexts of indigeneity. These findings suggest that weather deviations reinforce inequalities in international migration while broadly constraining return. We conclude that migration is a process shaped by overlapping social and environmental inequalities.

Keywords: international migration, undocumented, return migration, weather extremes, indigeneity, Mexico, United States

Indigeneity—having origins in precolonial populations—is a central axis of inequality in Mexico. Relative to nonindigenous (that is, *ladino* or *mestizo*) populations, indigenous populations report lower levels of income and wealth, among other indicators of well-being (Villarreal 2014a). These inequalities also extend to municipalities in Mexico with high concentrations of indigenous residents (Bada and Fox 2022; Barbary 2015; Clement and Piaser 2021; Fierros-González and

Mora-Rivera 2022). Even for individuals who are not themselves indigenous, living in indigenous municipalities is associated with higher rates of poverty (Barbary 2015), limited access to public infrastructure and services (González Rivas 2012), and greater dependence on subsistence farming compared to nonindigenous municipalities (Fierros-González and Mora-Rivera 2022). These inequalities also extend to environmental exposure: weather deviations or ex-

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tremes—periods of unusually high or low rainfall and temperature—disproportionately threaten indigenous municipalities in Mexico (INECC 2021). These overlapping social and environmental inequalities may, therefore, pose unique challenges to individuals in indigenous contexts as they strive to adapt to weather deviations.

International migration is one potential adaptation to weather extremes. Although most weather-related migration occurs within national borders (Hoffmann et al. 2020), international migration—especially that which is undocumented or unauthorized by the receiving country—is possible where extensive migrant networks connect sending and receiving countries and where return migration is feasible (Hunter et al. 2015). This is the case for Mexico-US migration, which is the world's largest sustained binational flow and constitutes roughly half of the United States' eleven million undocumented immigrants (Stoney and Batalova 2013; Batalova 2024). A growing share of this population hails from Mexico's indigenous municipalities; whereas 5 percent did so in 1980, 20 percent did by 2010 (Asad and Hwang 2019a, 1039). Scholars attribute this growth in part to a range of economic and social developments in Mexico throughout the 1980s and 1990s that disproportionately disadvantaged indigenous municipalities relative to nonindigenous municipalities (Asad and Hwang 2019a, 2019b). Yet, despite their greater frequency being linked to Mexico-US migration and return (Murray-Tortarolo 2021; Zhu et al. 2024), weather deviations' role in the migration journey across contexts of indigeneity is less clear.

Although demographers acknowledge that the context of indigeneity likely matters for the migration journey following weather deviations (for example, Riosmena et al. 2018), most evidence about this relationship comes from ethnographies of a handful of indigenous communities in a single period and from retrospective reports of weather extremes. The expected relationships are mixed. On the one hand, migration following weather extremes may be more likely in indigenous communities, where livelihoods depend on rain-fed agriculture (de Frece and Poole 2008; Ebel et al. 2018). On the other hand, it may be less likely due to resource con-

straints that “trap” these individuals in place (Asad and Hwang 2019a, 2019b; Black and Collyer 2014), local adaptations that mitigate agricultural vulnerability to weather extremes (Ebel and Castillo Cocom 2012), or deep symbolic attachments to land (Liffman 2014). Weather extremes may also have similar relationships with migration across contexts of indigeneity, reflecting weather extremes' all-encompassing consequences. As we explain later, parallel ambiguities apply to the relationship between sustained weather extremes in sending communities and return migration. A social demographic perspective that examines these dynamics using granular weather data across contexts of indigeneity and over time can help adjudicate how overlapping social and environmental inequalities relate to the migration journey—from departure to return.

We adjudicate among these different possibilities using data from the Mexican Migration Project (MMP). The MMP is a repeated cross-sectional household survey of communities in migrant-sending areas of Mexico. It contains information on both migrants—including whether they migrated without authorization and whether they returned to Mexico by the time of the survey—and nonmigrants. We focus our analysis on 91,903 people in 147 Mexican communities observed from 1991 to 2018. We merge the MMP data with gridded daily precipitation and temperature data for each community from Daymet, as well as information on the share of indigenous-language speakers in each community's municipality from the Mexican Census compiled by IPUMS International (Ruggles et al. 2024). Results from linear probability models show that the context of indigeneity is associated with opportunities for weather-related migration but not return. Regarding migration, we find a higher probability of undocumented migration in communities in low-indigenous municipalities in very dry years but no such association for communities in high-indigenous municipalities. Regarding return, we find that extreme weather in origin communities is associated with a lower probability of returning to Mexico across communities in all municipal contexts of indigeneity.

This article makes three contributions. First, we establish that one additional hardship cor-

related with the context of indigeneity is disproportionate exposure to weather extremes. Second, adopting a social demographic perspective, we clarify insights from an accumulating qualitative literature on how the context of indigeneity relates to the migration journey—not just migration to but also return from the United States—following weather extremes. Third, we reveal an asymmetry in how the context of indigeneity moderates the relationship between weather extremes and the migration journey: although migrants from communities in low-indigenous municipalities are more likely to migrate following weather extremes, those from communities in both low- and high-indigenous municipalities are likely to remain in the United States as weather extremes persist in their origin communities. Even as we identify weather extremes in origin communities as one mechanism that reproduces existing inequalities in opportunities for migration by the context of indigeneity, then, we also find that weather extremes in part explain undocumented migrants' growing tendency to settle in the United States across contexts of indigeneity. We conclude by discussing the implications of this asymmetry for climate-related migration vulnerabilities, immigration enforcement risks, and policy responses to extreme weather.

INDIGENEITY AS A FEATURE OF PLACE

Indigeneity—having origins in precolonial populations—is both an individual characteristic and a feature of place. Across Latin America, who “counts” as indigenous has long represented a political project, defined and redefined through state practices of enumeration (Loveman 2014). Mexico has an extensive history of the state pursuing the assimilation of its indigenous populations into *mestizaje*, an idealized blend of indigenous and European origins characterized by Spanish-language use and urban residence (Ruiz Medrano 2010). For their part, indigenous communities have organized to resist these efforts (Martínez Casas 2014; Postero et al. 2004). By the late 1980s and throughout the 1990s, Mexico's gradual turn toward democratization coincided with an ostensible embrace of its indigenous population (Hale 2005; Loveman 2014), reflecting a larger turn in Latin America (Telles and PERLA 2014).

Mexico committed to introducing self-identification for enumerating indigenous populations following the International Labour Organization's 1989 Indigenous and Tribal Peoples Convention (No. 169) (Del Popolo 2017). A 1992 reform of Mexico's constitution further signaled Mexico's turn toward a “pluricultural” nation (Loveman 2014; Telles and PERLA 2014; Flores et al. 2023).

There are multiple ways to measure indigeneity. Mexico's national census (INEGI, by its Spanish initials) has shifted its official criteria to combine language use, self- and external identification, and cultural traits in different ways over time (for a helpful summary, see Figueroa-Rodríguez 2020, table 9.1). Early censuses classified individuals by “habitual language” (Spanish or an indigenous language) and race (“pure indigenous,” “mixed,” or “white”), while later censuses experimented with markers such as clothing or diet. Self-identification was formally introduced in the Mexican Census in 2000.

Despite these myriad changes, stratification scholars generally treat indigenous-language proficiency as the most conservative—and consistent—indicator of the relationship between indigeneity and inequality (Loveman 2014; Telles and Torche 2019; Flores et al. 2023; Martínez et al. 2025). About 6 percent of Mexicans report speaking an indigenous language, while about twice that share self-identifies as indigenous (Martínez et al. 2025). While indigenous identity subsequently became a basis for political inclusion and cultural rights, this inclusion was most accessible to Spanish-speaking, upwardly mobile individuals in urban areas who self-identified as indigenous (Barbary and Martínez Casas 2015; Flores et al. 2023; Martínez Casas 2007). In contrast, indigenous-language speakers—those most connected to indigenous communities—remain disproportionately poor and fare worse along nearly every dimension of socioeconomic well-being (Villarreal 2014a; Telles and Torche 2019).

In addition to being an individual characteristic, indigeneity is spatially organized. Indigeneity, in other words, is a feature of place (Batalla 1996; de la Peña 2006; Martínez Novo 2006). The largest indigenous populations are concentrated in the central and southeastern regions of Mex-

Table 1. Average Municipal Socioeconomic Characteristics by Community Indigeneity Level

Variables	Low Indigenous (Percent)	Medium Indigenous (Percent)	High Indigenous (Percent)
Population (number)	58,018	57,697	14,833
Literate (population age 15+)	89.84	87.24	79.26
At least 6 years education (population age 15+)	49.50	48.36	37.51
Labor force employed	94.96	95.96	96.63
Labor force self-employed	31.46	36.96	43.61
Labor force in agricultural industry	33.56	36.62	50.76
Labor force in manufacturing industry	12.44	11.77	10.46
Labor force in service occupations	17.18	16.29	11.32
Median monthly income (Mexican pesos)	520.91	628.17	62.25
Households with electricity	96.31	95.90	93.28
Households with piped water	88.32	84.05	81.40
Households with sewage disposal	80.51	74.61	56.74
Households with toilets	92.36	92.50	89.53
Households with finished floors	92.18	87.33	80.68
N (percent)	990 (43.8)	523 (23.2)	745 (33.0)

Source: Authors' calculations from the IPUMS International-Mexico 2010 data.

Note: Community indigeneity is based on 1 percent and 10 percent cutoffs in the share of population speaking an indigenous language. Counts use IPUMS person and household weights. Labor force excludes populations below age fifteen.

ico, particularly Chiapas, Oaxaca, Veracruz, Puebla, Yucatán, and Guerrero. At the municipal level, nearly 44 percent of Mexico's 2,258 municipalities in 2010 had only a minimal indigenous presence (fewer than 1 percent of residents speak an indigenous language); about 23 percent had a moderate presence (between 1 and 10 percent); and about 33 percent were considered "indigenous" or "predominantly indigenous" (10 percent or more).¹ We follow this typology employed by Mexico's National Office of Social Development (CONEVAL 2012) throughout this article to evaluate whether and how the context of indigeneity relates to multiple forms of inequality.

This spatial organization of indigeneity across municipalities matters for inequality, regardless of whether an individual speaks an indigenous language or identifies as indigenous (Batalla 1996; Friedlander 2006; Martínez Novo 2006). Table 1 shows the average municipal so-

cioeconomic characteristics in the 2010 Mexican Census microdata accessed via IPUMS International (Ruggles et al. 2024) by context of indigeneity following this typology. Compared to low- and medium-indigenous municipalities, high-indigenous municipalities in 2010 had substantially lower literacy and education levels, higher shares of self-employment and labor force participation in the agricultural industry, and low wages. These municipalities also had less infrastructure on average, with lower shares of households with electricity, piped water, sewage disposal, and finished flooring.

The unequal distribution of socioeconomic resources by context of indigeneity reflects indigenous municipalities' long history of subordination in Mexico (Ruiz Medrano 2010). Even as the country embraced pluriculturalism in 1992, another constitutional amendment that year permitted the privatization of communal farmlands (*ejidos*), undermining agricultural

1. Authors' calculations of 2010 Mexican Census data using CONEVAL (2012) categorization of contexts of indigeneity.

livelihoods in many indigenous municipalities (Jung 2003). The North American Free Trade Agreement (NAFTA) took effect two years later over strong opposition from indigenous communities—most notably, the Zapatistas in Chiapas (Harvey 1998; Kelly 2001; Stephen 2002). NAFTA had uneven effects that deepened existing inequalities by contexts of indigeneity: poverty rates increased in indigenous municipalities, while nonindigenous ones gained in income and wealth (Hamilton 2011; González Meza 2006; Fernández-Kelly and Massey 2007).

WEATHER EXTREMES IN INDIGENOUS CONTEXTS

The context of indigeneity thus patterns multiple forms of inequality in Mexico. We propose that one additional form of inequality that this context patterns is indigenous municipalities' exposure to weather deviations or extremes. We define weather deviations as periods of unusually high or low rainfall and temperature. Although climate change has not substantially altered Mexico's annual mean precipitation, its average temperature has increased by roughly 0.71°C between 1951 and 2017 (Murray-Tortarolo 2021). It is expected to experience an additional 1.1°C to 3°C average increase by 2060 (McSweeney et al. 2010). The seasonal distribution of rainfall has also shifted over this same period. Wet seasons (June–November) have become wetter, and dry seasons (December–May) drier (Murray-Tortarolo 2021).

These climatic changes exhibit an uneven regional patterning across Mexico. However, explicit attention to the context of indigeneity is rare in existing quantitative studies, in part because analyses typically occur at spatial (that is, regional or state) scales that obscure important municipal-level variation in indigeneity. Still, the available evidence suggests that regions and states with the largest shares of indigenous residents disproportionately experience these changes. Central and southern states, home to most of the country's indigenous populations, show the largest fluctuations in both temperature and rainfall over time (Murray-Tortarolo 2021). Mexico's recent multi-hazard climate risk assessment confirms a similar pattern (INECC 2021), identifying Oaxaca as the state with the highest number of highly climate-vulnerable

municipalities, followed by Veracruz. Other states with many climate-vulnerable municipalities—namely, Yucatán, Chiapas, and Guerrero—also have high concentrations of indigenous-language speakers. Oaxaca has experienced a pronounced decline in precipitation over the last two decades (Cuervo-Robayo et al. 2020), while Yucatán has undergone a steady drying trend over the past half century (World Bank 2022). Simulations suggest that summer precipitation in southern Mexico could decline by 13 percent by century's end (Colorado-Ruiz and Cavazos 2021).

Differential exposure to weather extremes is consequential for several reasons (see Klinenberg et al. 2020 for a review). Here we focus on its potential impact on agricultural production, the predominant industry in indigenous municipalities. Indigenous municipalities rely heavily on rain-fed subsistence farming, particularly through the traditional *milpa* system, which is a polycropping method combining maize, squash, and legumes (de Frece and Poole 2008). Maize, which occupies the largest cultivated area nationally (Bellon et al. 2011), is highly sensitive to deviations in temperature and rainfall (Ureta et al. 2020). This sensitivity is most acute for subsistence farmers (Bellon et al. 2011), who disproportionately reside in indigenous municipalities (Bada and Fox 2022). One study suggests that “states in which high levels of poverty and subsistence farming prevail, such as Chiapas (6.5 percent), Oaxaca (6.4 percent), and Guerrero (3.1 percent), account for a considerable fraction (16.0 percent) of the costs of climate change impacts on agricultural yields” (Estrada et al. 2022, 126). Although Francisco Estrada and colleagues (2022) do not explicitly consider indigeneity in their analysis, these states make up 25 percent of Mexico's rural municipalities (Bada and Fox 2022) and have large indigenous populations relative to the national average, with at least 21 percent of residents classified as indigenous (CONEVAL 2012).

Taken together, indigenous municipalities are disproportionately rural, agricultural, poor, and vulnerable to weather extremes. These overlapping inequalities pose unique challenges for residents adapting to changing weather conditions. Rurality limits access to public infrastructure and essential services following extreme

weather events (Eakin 2006). Dependence on subsistence agriculture heightens risks of crop failure and income volatility (Bellon et al. 2011). Meanwhile, high poverty rates among residents further constrain municipalities' capacity to recover from extreme weather events (Estrada et al. 2022). This convergence of social and environmental inequalities underscores the plausibility that the context of indigeneity likely patterns responses to weather extremes.

CONTEXTS OF INDIGENEITY AND INTERNATIONAL MIGRATION AND RETURN AFTER WEATHER EXTREMES

We examine whether international migration to and return from the United States is one potential response to weather extremes that varies by the context of indigeneity. We do so for several reasons. First, research links weather deviations to human mobility within and across national borders (for example, Boustan et al. 2012; Thiede and Gray 2017; see Hunter et al. 2015; Garip and Reed 2025 for reviews). Second, while most weather-related migration occurs within countries (de Haas 2023), international migration—especially that which is undocumented or otherwise unauthorized by the receiving country—is more likely where transnational networks connect sending and receiving contexts and where return migration is feasible (Hunter et al. 2015). This is the case for Mexico-US migration, the world's largest sustained binational flow. Finally, demographers emphasize that “the social vulnerability of households and places” mediates how communities respond to weather deviations (Riosmena et al. 2018, 471). Yet despite the rising frequency of both weather extremes and migration from indigenous municipalities since the 1980s (Asad and Hwang 2019a, 2019b; Murray-Tortarolo 2021), the context of indigeneity is largely absent from demographic analyses of weather-related migration and return (for example, Zhu et al. 2024).

We summarize key theories used to explain Mexico-US migration and return to situate our analysis (Massey et al. 1993; Garip and Reed 2025). Neoclassical and new economics approaches frame migration as a strategy to maximize individual income or minimize household risk, respectively (Harris and Todaro 1970; Stark and Bloom 1985). Once income or wealth goals

are achieved, return to the origin community is likely (Garip 2016). Cumulative causation theory explains how migration flows, once initiated, become self-sustaining through social networks that reduce the costs and increase the benefits of migration (Massey 1990). As with neoclassical and new economics approaches, return to the origin community is likely once income or wealth goals are achieved, or when the benefits of migration no longer outweigh the costs. Finally, the aspirations-ability framework emphasizes that migration reflects both desires and constraints: some people who wish to migrate lack the means to do so, while others who can migrate may not (Carling 2002; de Haas 2021; Schewel 2020). Return to the origin community is likely if migrants aspire to do so and have the material and social resources necessary.

These theories each point to varied expectations about the relationship between undocumented migration to and return from the United States across contexts of indigeneity following weather extremes. First, migration entails substantial start-up costs that those with the greatest access to economic resources can afford (Massey et al. 1994). Such resources are unequally distributed across Mexico's municipalities: individuals in nonindigenous municipalities generally have greater access to wage labor, savings, and credit than those in high-indigenous ones (Fierros-González and Mora-Rivera 2022). Economic restructuring during the 1980s and 1990s—including ejido privatization and NAFTA's implementation—further marginalized indigenous municipalities (Jung 2003; Fernández-Kelly and Massey 2007; Hernández-León 2008). Weather extremes can compound these constraints, especially by eroding household income via reduced agricultural yields in municipalities dependent on rain-fed farming. This erosion is likely to be most acute in indigenous municipalities, where access to economic resources is scarcer on average. On the one hand, then, individuals in indigenous rather than non-indigenous municipalities may be less likely to migrate following weather deviations if they lack the resources needed to finance international movement; they may be “trapped” in place despite wanting to migrate (Black and Collyer 2014). On the other hand, individuals in indigenous municipalities may be more likely to mi-

grate following weather deviations if declining agricultural incomes increase the need to maximize earnings through migration, especially when local livelihood options are limited.

Second, the costs of international migration are lower in places with longer migration histories and stronger networks linking origin and destination. Connections with prior migrants offer knowledge, financial assistance, and normative pressures that facilitate migration (Massey 1990; Garip and Asad 2016). While Mexico-US migration has persisted for more than a century, the earliest sending regions were disproportionately nonindigenous (Fox 2006; Asad and Hwang 2019a, 2019b). During the Bracero Program (1942–1964), over 4.6 million Mexican farmworkers—mostly from central-western states in Mexico—migrated to the United States (Cornelius 2001). After the program’s abrupt termination, US agricultural demand for Mexican farmworkers continued, and millions more entered without authorization at their encouragement (Massey et al. 2016). Indigenous municipalities were only modestly represented in these early flows; whereas migrants from indigenous municipalities comprised about 5 percent of all Mexican migrants in 1980, they accounted for roughly 20 percent by 2010 (Asad and Hwang 2019a, 1039). On the one hand, then, weaker and more recently established networks in indigenous municipalities may make undocumented migration less likely following weather deviations if individuals lack the information, financial support, or normative facilitation needed to undertake high-cost migration (Black and Collyer 2014). On the other hand, even less-established networks may provide sufficient footholds—through kin, friends, or co-ethnic ties—to render undocumented migration a viable or necessary response if weather deviations erode local livelihoods, especially when alternative adaptive strategies are limited.

Third, even among those with the economic and social resources to migrate, migration aspirations are not inevitable. Subsistence farming and communal land tenure often bind livelihoods and identities to place (de Frece and Poole 2008; Liffman 2014). Since individuals in indigenous municipalities are disproportionately reliant on these systems, stronger symbolic attachments to land may inhibit migration as-

pirations. In such contexts, weather deviations may produce “acquiescent immobility” (Schewel 2020)—remaining in place despite risk—because migration threatens not material well-being but rather a collective sense of belonging tethered to land (Eakin 2005). On the one hand, then, migration may be less likely after weather deviations for individuals in indigenous than non-indigenous municipalities if symbolic attachments outweigh material pressures. On the other hand, prolonged or severe weather deviations may erode the very livelihoods and identities tied to land, potentially heightening migration aspirations if individuals perceive remaining in place as no longer viable.

While we have thus far focused on undocumented migration, return is another aspect of the migration journey from Mexico to the United States. Between 2005 and 2014, about two million Mexican immigrants left the United States, some of whom were undocumented; during this period, the undocumented Mexican population declined from 6.3 to 5.6 million (Gonzalez-Barrera 2015). Scholars attribute this trend to economic growth in Mexico, as well as economic downturns and intensified immigration enforcement in the United States (Masferrer and Roberts 2012; Villarreal 2014b; Masferrer et al. 2024). Still, weather deviations may also relate to return migration, particularly when they persist in migrants’ origin communities (Zhu et al. 2024). Consistent with this theory and evidence, return may be less likely for migrants from high-indigenous municipalities relative to low-indigenous municipalities if sustained weather deviations continue to undermine agricultural livelihoods in origin communities, reducing the viability and desirability of returning home. Conversely, return may be more likely if undocumented migration enables migrants to offset weather-related losses—through accumulated earnings, savings, or investments—and to transition back into valued land-based livelihoods or symbolic obligations. Finally, because weather deviations are increasingly widespread and unpredictable across Mexico, they may suppress return similarly across contexts of indigeneity, producing no meaningful differences in the likelihood of return between migrants from high- and low-indigenous municipalities.

Despite varied expectations about how

weather deviations relate to undocumented migration and return across contexts of indigeneity, direct empirical evidence remains limited. Most research relies on ethnographies of a few indigenous communities in a single period, drawing on retrospective accounts of weather. Some studies document rising migration pressures linked to declining agricultural yields (Ebel et al. 2018). In X-Pichil, Yucatán, for example, residents attribute increased emigration to the unreliability of milpa production amid prolonged droughts (Ebel and Castillo Cocom 2012). Other studies highlight adaptation rather than migration: farmers in Oaxaca's Mixteca Alta region have delayed planting cycles to align with later rainy seasons (Rogé et al. 2014), and communities in Quintana Roo have adopted fertilizers and pesticides to sustain yields under drought (Ebel et al. 2018). While these studies offer valuable insights, a social demographic approach that examines multiple contexts of indigeneity over time—using high-resolution, daily weather data—can more systematically evaluate how overlapping social and environmental inequalities relate to the migration journey.

SUMMARY OF EXPECTATIONS

Indigenous municipalities in Mexico face overlapping forms of disadvantage that shape opportunities for international migration and return. These disadvantages—higher rates of poverty, rural residence, and dependence on subsistence agriculture—also correspond to greater exposure and sensitivity to weather extremes. Yet, given our theoretical framework and the mixed empirical evidence reviewed above, the expected direction of the relationship between origin-weather deviations and international migration and return remains uncertain. All else equal (including destination weather conditions), these deviations could either intensify, dampen, or be unassociated with migration pressures across contexts of indigeneity.

For undocumented migration, weather extremes in sending communities may be associated with changes in the probability of undocumented migration, but the direction of this relationship may vary by the context of indigeneity. On the one hand, undocumented migra-

tion may be more likely in indigenous municipalities, where livelihoods depend on rain-fed agriculture and climate shocks threaten subsistence. On the other hand, it may be less likely due to limited financial resources, shorter migration histories, and strong land attachments. Alternatively, origin-weather deviations may influence undocumented migration similarly across indigenous and nonindigenous contexts if their effects are sufficiently widespread.

Regarding return migration, origin-area weather extremes may also relate to the probability of return, but again, the direction of this relationship is theoretically ambiguous. Return may be more likely among migrants from indigenous municipalities if strong symbolic or economic ties to land draw them back despite weather-related uncertainty. Conversely, return may be less likely if sustained agricultural disruptions or local economic scarcities make re-establishment difficult. As with migration, origin-weather deviations may also constrain return similarly across contexts of indigeneity.

DATA AND METHODS

We assemble multiple data sources to examine the relationship between weather extremes and undocumented migration to and return from the US by origin contexts of indigeneity in Mexico.

Migration Data

Our migration data come from the MMP, a repeated cross-sectional survey of 170 migrant-sending communities in Mexico between 1991 and 2018. In each community, the MMP team randomly selected about two hundred households and collected retrospective information on migration and return behaviors of all individuals. The team also followed up with migrants from the sample communities in the US through their families in Mexico or referrals from other migrants. These US-based follow-ups account for only 2 percent of the interviews; the remaining 98 percent occur in Mexico via random household sampling. Surveyors collect complete retrospective life histories for all individuals, including absent migrants through proxy respondents.

The MMP data are not representative of the Mexican population but provide an accurate

profile of Mexicans headed to the US that is consistent with benchmark national surveys (Massey and Zenteno 2000). These data capture undocumented migrants (who are undercounted in US-based data collection efforts) and returning migrants (who are not tracked at all with administrative records); they boast low survey-refusal rates (less than 5 percent), which is unusual for migration-related data collection efforts. They also measure migration and return behaviors annually rather than in five-year windows as in the Mexican Census; high-frequency measurement is especially useful for analyzing weather-related moves (Hoffmann et al. 2021).

These data are publicly available from the MMP data archive (Mesoamerican Migration Project n.d.). We merged individual, household, community, and national components to construct a person-year dataset. Our code for data cleaning and analysis is available upon request from the corresponding author.

The MMP questionnaire records dated retrospective information on migration (years of the first and last US trips), household assets, and community context. We reconstruct annual observations using these dates and, where necessary, assume linear progression (for example, education), starting at age fifteen because younger minors' migration is typically tied to parental decisions (Galli and Garip 2024). Most individuals (about 88 percent) have a middle school or lower degree, which is completed prior to age fifteen. For the remaining individuals, we assume they complete one additional year of schooling at each subsequent age until they reach their final reported degree—that is, schooling progresses linearly and without gaps.

We defined undocumented US migration and return using the questions on the timing and duration of the first trip and documentation status of the individual on entry. Our analysis is restricted to 1991–2018 (when we have information on weather extremes). Documented migrants are excluded from our sample because they face different migration constraints. Results are similar when estimating models of any mi-

gration (documented and undocumented) and return (online appendix tables A.3 and A.4).² Our final sample contains 944,416 person-years with 91,903 unique individuals nested within 21,698 households and 147 communities.

Weather Data

We use daily gridded Daymet weather data from Oak Ridge National Laboratory Distributed Active Archive Center, a data center for the NASA Earth Observing System Data, which interpolate observations from ground weather stations to generate “gridded” (1km × 1km) precipitation and temperature surfaces for North America (Oak Ridge National Laboratory Distributed Active Archive Center n.d.). We overlay these grids onto the spatial polygons of MMP communities using a standard geographic information system spatial join, averaging all grid cells whose centroids fall within each community boundary. We then use the daily values to compute the average values during the agricultural seasons. Since MMP communities are geographically small, the assignment of 1km grid cells provides fine-resolution exposure estimates, though—like all interpolation-based products—Daymet inherits uncertainty from the underlying station network.

Corn is the most common crop in Mexico; it accounts for an average of 49 percent of the harvested land in our sample communities. Agriculture is one of the main activities in migrant-sending regions of Mexico. An average of 50 percent of men are agricultural workers in our sample. Similar to earlier work (Feng et al. 2010), we expect weather extremes to lead to migration by reducing agricultural yields. To capture this mechanism, we measure origin weather extremes between May and August, the sensitive months for corn growth. Rainfall deficits in this period reduce nutrient uptake and increase susceptibility to pests, and rainfall excess limits oxygen and nitrogen supply and delays root development. Cool temperatures retard germination, and hot temperatures (especially above 30°C) hurt pollination (Schlenker and Roberts 2006).³

2. The online appendix can be found at <https://www.rsfjournal.org/content/12/4/102/tab-supplemental>.

3. Including absolute weather measures (mean temperature and rainfall during the corn season) in models does not change any of the other coefficient estimates, and these indicators are never statistically significant. Results are available from the authors.

We consider potential adaptation to weather conditions (Dell et al. 2012). A given weather condition (say, average temperature above 35°C) may be considered extreme in one place (for example, Tlaxcala, the coolest state in Mexico), but normal in another (for example, Tabasco, the hottest state). We expect high temperatures or rainfall to have less of an impact on migration in places that are accustomed to those conditions. To capture this idea, we focus on weather anomalies. That is, we compare each locality to its own average in the past. We take 1980–1990 as our baseline period. For each community, we compute changes in seasonal average daily precipitation from May to August relative to its baseline mean and changes in seasonal average daily temperature (average of minimum and maximum temperature) relative to its baseline mean. We divide each measure by the baseline standard deviation. We convert the continuous weather deviations measures to categories. A community-year is considered very wet or very dry if precipitation is two standard deviations or more, higher or lower, respectively, than its baseline mean; wet or dry if precipitation is one to two standard deviations higher or lower, respectively, than its baseline mean; and normal otherwise. Temperature deviation categories are computed similarly.

We also compute weather anomalies at migrant destinations (included as controls). In the return models, we measure annual precipitation and temperature deviations for the specific US location where each migrant resides—at the metropolitan statistical area level for the roughly 75 percent of migrants for whom this information is available, and at the state level for the remainder. In the migration models, because destinations are unknown *ex ante*, we assign each origin community the annual weather deviations of its most common US destination over the prior five years.

Indigenous-Population Data

To measure the context of indigeneity, we draw on municipal-level data—the lowest spatial ag-

gregation available—from the Mexican Census, compiled by IPUMS International (Ruggles et al. 2024). The Mexican Census has been conducted every five years since 1990 and every ten years prior. We categorize municipalities by the share of the population who report speaking an indigenous language. As outlined earlier, language proficiency remains the most consistent—and stringent—indicator of indigeneity (Loveman 2014); about 94 percent of people who speak an indigenous language also identify as indigenous, and fewer than 50 percent of people who self-identify as indigenous report speaking an indigenous language (Villarreal 2014a). The share of people in a municipality speaking an indigenous language has a correlation of .80 with the share of people in a municipality who self-identify as indigenous. Following Mexico's CONEVAL (2012), we categorize communities in municipalities with over 10 percent of the population reporting speaking an indigenous language as “high.” We categorize communities in municipalities with shares less than 1 percent as “low,” and all other municipalities are categorized as “medium.” The Mexican Census asked this question in 1990, 2000, 2005, 2010, and 2015. For intercensal years, we linearly interpolated measures of indigeneity using each person's migration year. The MMP sample contains residents from communities in municipalities with residents speaking indigenous languages ranging from 0 to 85 percent. In the migration year, 68 percent of MMP respondents reside in low-indigenous municipalities, 17 percent in medium-indigenous municipalities, and 15 percent in high-indigenous municipalities.⁴ For brevity, below, we refer to low-, medium-, or high-indigenous communities (rather than communities in low-, medium-, or high-indigenous municipalities).

Descriptive Statistics

Table 2 shows average sample characteristics across the context of indigeneity. Most of the person-year observations ($N = 944,416$) come

4. Nearly one-third of Mexico's municipalities reported more than 10 percent of residents speaking an indigenous language in 2010, but only 19 municipalities, or 13 percent, in the MMP sample surpass this threshold. Because the MMP is conducted in Spanish, residents who only speak an indigenous language—approximately 7 percent of the population according to the 2010 census—are excluded from the sample.

from low-indigenous communities ($N = 641,108$). A community can move across indigeneity categories over time. As a result, the sum of communities across indigeneity categories (171) exceeds the total number of communities in our sample ($N = 147$). Undocumented migrants make up less than 1 percent of person-year observations, but about 5 to 8 percent of persons in our sample. Their share is higher among low- (7 percent) and high- (8 percent) indigenous communities. Return migration is common among undocumented migrants. About 18 percent in low-indigenous communities return after their first year in the US; 14 percent return after the second year, 10 percent after the third year, and 7 percent after the fourth year.⁵ Return rates are somewhat higher in medium-indigenous communities and, in high-indigenous communities, they are lower after the first year but higher in the following years. In terms of exposure to droughts, high-indigenous communities are at the top, with 23 percent of person-years experiencing very dry or dry weather (as opposed to 20 percent in low-indigenous communities and just 13 percent in medium-indigenous places). In terms of heat exposure, high- and medium-indigenous communities also rank highest, with 17 percent of person-years having hot or very hot conditions relative to 14 percent in low-indigenous communities. In terms of US destination weather exposure, migrants from low-indigenous communities are more likely to encounter very wet, very cool, or cool conditions and less likely to experience hot conditions than migrants from medium- or high-indigenous communities. The differences in means (determined with a Chi-square test for categorical indicators and with analysis of variance for continuous indicators) across community

indigeneity groups are statistically significant ($p < 0.05$) for most indicators.

Figure 1 shows two maps: the share of indigenous-language speakers in Mexican municipalities according to the 1990 census (left) and rainfall deviation in Mexican municipalities according to 2000 Daymet data (right). The deviation equals the average rainfall in the same year minus the average rainfall in the baseline period (1980–1990) in a municipality, divided by the standard deviation of rainfall in the baseline period. Indigenous population shares are high in southeastern states, like Oaxaca, Yucatán, Chiapas, and Veracruz (see figure 1 for state names) and in central-western states, like Hidalgo, Puebla, and San Luis Potosí. Rainfall deficits (as indicated by the lighter shades) are also common in the same regions in 2000 (as they are in most other years in our data). This pattern aligns with national reports that indicate regions of indigenous concentration to be especially vulnerable to climate-related hazards (INECC 2021). The pattern is also consistent with descriptive statistics from our own data (table 2) that suggest higher exposure to rainfall and temperature extremes in high-indigenous communities.

Model Description

We use a linear probability model to link weather anomalies to our outcome of taking a first undocumented trip to the US.⁶ We limit our analysis to the first trip and drop individuals who take subsequent trips from our sample. Those with prior migration experience might have access to resources (information about migration or ties to other migrants) or be subject to family expectations (for remittances, for example) that make them more likely to migrate regard-

5. The vast majority of migrants return to their original communities. Only 5 percent of migrants in our data move to a different location in Mexico in the year of their return.

6. We prefer the linear probability model (LPM) over logistic regression for three reasons: First, LPM allows us to include state and year fixed effects, which absorb regional and temporal variation in migration (for example, due to trade shocks, border enforcement trends, crop prices). Logistic regression, a nonlinear model, suffers from incidental parameter bias when many fixed effects are included (Greene 2004). Second, logistic regression with fixed effects requires within-group variation (for example, a drought affecting some but not all communities in a state) to estimate coefficients. In contrast, LPM (using `reghdfe` in Stata) absorbs fixed effects, allowing estimation with between-group variation alone. This means more of the data is usable, which is crucial since weather deviations are rare. Third, our goal is to estimate average effects of weather deviations, not precisely model migration probabilities. For this, LPM is both sufficient and ideal.

Table 2. Average Sample Characteristics by Community Indigeneity Level

Variables	Low Indigenous	Medium Indigenous	High Indigenous	Differences in Group Means
Undocumented trip to US				
Among person-years	0.01	0.01	0.01	*
Among persons	0.07	0.05	0.08	*
Origin precipitation deviation				
Very dry	0.02	0.01	0.02	*
Dry	0.18	0.12	0.21	*
Normal	0.66	0.68	0.64	*
Wet	0.10	0.14	0.11	*
Very wet	0.04	0.05	0.02	*
Origin temperature deviation				
Very cool	0.03	0.05	0.05	*
Cool	0.11	0.12	0.12	*
Normal	0.60	0.63	0.57	*
Hot	0.19	0.14	0.18	*
Very hot	0.08	0.06	0.09	*
Top destination precipitation deviation				
Very dry	0.01	0.03	0.01	*
Dry	0.09	0.09	0.07	*
Normal	0.67	0.68	0.71	*
Wet	0.14	0.13	0.15	*
Very wet	0.09	0.07	0.05	*
Top destination temperature deviation				
Very cool	0.15	0.11	0.04	*
Cool	0.17	0.16	0.07	*
Normal	0.37	0.42	0.52	*
Hot	0.20	0.19	0.21	*
Very hot	0.11	0.13	0.17	*
Individual				
Age	33.97	33.86	32.91	*
Sex (0: female, 1: male)	0.44	0.45	0.46	*
Years of education	7.66	8.25	7.68	*
Household				
Owns any land	0.17	0.21	0.30	*
Owns a business	0.20	0.22	0.24	*
Owns any property	0.69	0.70	0.76	*
Has prior migrants	0.32	0.21	0.21	*
Community				
Share of men in agriculture	0.42	0.39	0.57	*
Share earning less than min wage	0.32	0.36	0.51	
Share earning >2 × minimum wage	0.31	0.28	0.18	
Share with 6+ years of education	0.59	0.63	0.52	

(continued)

Table 2. (continued)

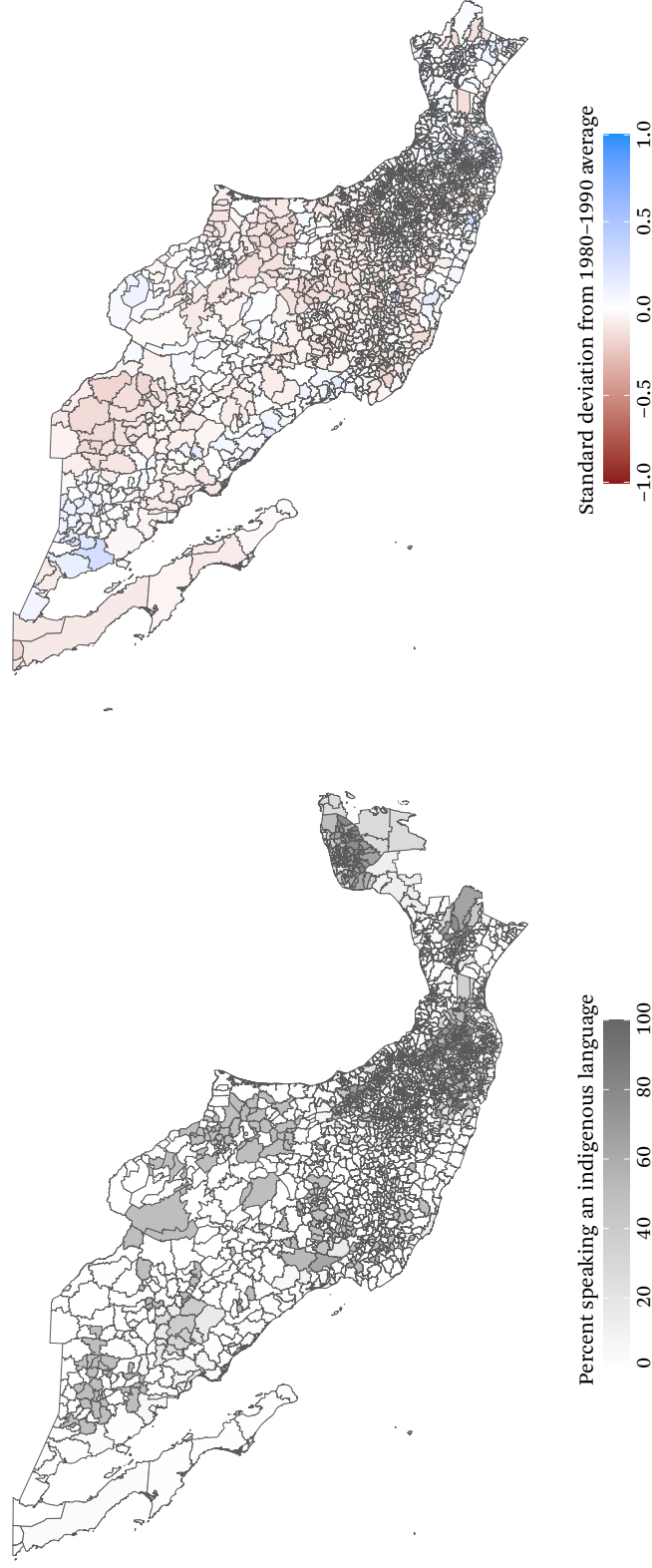
Variables	Low Indigenous	Medium Indigenous	High Indigenous	Differences in Group Means
Share ever migrated	0.14	0.09	0.09	*
Has irrigation, dam or reservoir	0.65	0.83	0.93	*
Homicide rates (per 1 million)	1.23	1.30	0.74	*
Log (distance to border)	13.32	13.55	13.88	*
Return trip to Mexico among migrants				
After year 1	0.18	0.20	0.15	*
After year 2	0.14	0.17	0.17	*
After year 3	0.10	0.12	0.12	
After year 4	0.07	0.07	0.09	*
Destination precipitation deviation				
Very dry	0.01	0.01	0.01	
Dry	0.06	0.06	0.07	
Normal	0.70	0.71	0.72	
Wet	0.16	0.17	0.14	
Very wet	0.07	0.05	0.06	*
Destination temperature deviation				
Very cool	0.09	0.08	0.07	*
Cool	0.12	0.10	0.09	*
Normal	0.48	0.50	0.51	
Hot	0.20	0.25	0.22	*
Very hot	0.10	0.08	0.10	*
Migrant occupation and destination				
Works in agriculture	0.14	0.11	0.07	*
In California	0.45	0.30	0.40	*
In Illinois	0.10	0.19	0.03	*
In Texas	0.10	0.03	0.16	*
Total				
N (person-years)	641,108	164,437	138,871	944,416
N (persons)	69,368	21,698	11,807	91,903
N (households)	16,625	5,607	2,766	21,698
N (communities)	113	39	19	147
N (states)	19	12	8	23
N (years)	27	26	27	27

Source: Authors' calculations from the MMP data.

Note: Community indigeneity is based on 1 percent and 10 percent cut-offs in the share of population speaking an indigenous language. Precipitation (temperature) deviation equals May–August rainfall (average temperature) in a community last year minus the mean value in community in 1980–1990, divided by standard deviation in that period. A community-year is very wet (very dry) if rainfall is two standard deviations or more higher (lower) than its baseline mean, wet (dry) if rainfall is one-to-two standard deviations higher (lower) than its baseline mean, and normal otherwise. Temperature deviation categories are computed similarly. Difference in group means is based on one-way ANOVA for continuous indicators and a Chi-square test for categorical indicators.

* $p < .05$; ** $p < .01$

Figure 1. Distribution of Indigenous Populations in 1990 and Precipitation Deviations in 2000 in Mexican Municipalities



Source: Authors' calculations from the Mexican Census and Daymet data.

Note: Indigenous population is measured by the percent speaking an indigenous language in the 1990 Mexican Census. Precipitation deviation is computed with respect to the municipality baseline in 1980–1990; it equals the difference between the average precipitation in 2000 and the average in the baseline period, divided by the standard deviation in the baseline period. The optimal way to view this figure is in color. We refer readers of the print edition of this article to <https://www.rsfsjournal.org/content/12/4/102> to view the color version.

less of weather (or other) conditions. We test this idea in robustness checks. We include fixed effects for the twenty-three Mexican states and twenty-seven years. The fixed effects absorb any region-specific (such as trade shocks to a state after NAFTA) or time-specific (such as increasing enforcement on the Mexico-US border) conditions that might be related to migration rates. We correct our standard errors for clustering at the community level.

We use a similar strategy to estimate the impact of origin-community weather shocks on returning to Mexico. The longer migrants stay in the US, the less likely they are to return. To consider this pattern, we create migrant cohorts by duration of stay in the US. We then estimate separate models of return migration among migrants who have been in the US for one, two, three, and four years, respectively. Our goal is to evaluate whether the relationship between origin weather shocks and return migration varies across migrants' tenure in their destination.

RESULTS

We first estimate a linear probability of first undocumented migration to the US. Our main indicators measure the presence of anomalies in rainfall (very dry, dry, wet, and very wet) and temperature (very cool, cool, hot, very hot) in the prior year relative to the community norm. Prior work establishes migration as a selective and network-driven process in the Mexico-US setting (Massey and Espinosa 1997; Massey et al. 1994). To capture these patterns, our models include individual characteristics such as age, sex, education, as well as household characteristics such as land, business, and property ownership and the presence of prior US migrants. They also include community characteristics, such as share in agriculture, share earning below the minimum wage, share earning more than twice the minimum wage, share with six or more years of schooling, share of ever migrants, homicide rate per million residents, and distance to the US border, along with state and year dummy variables. Table 3 shows results from models estimated on communities in municipalities with low (less than 1 percent), medium (greater than or equal to 1 and less than 10 percent), and high (10 percent or more) shares of indigenous-speaking populations. Recall that,

for brevity, we refer to these communities as low-, medium-, or high-indigenous. Very dry weather is positively related to subsequent undocumented migration only in low-indigenous communities. Despite their higher exposure to weather extremes, people in high-indigenous communities migrate at a lower rate, possibly due to resource constraints (financial or network-based) that limit their ability to undertake a costly move (Adger 2006). Figure 2 offers a visual summary of origin and top US destination effects. Panel A shows coefficients for precipitation and temperature extremes in low-indigenous communities, with hollow circles for origin measures and gray circles for destination measures; horizontal lines show 95 percent confidence intervals, and coefficients whose intervals exclude zero are statistically significant. Panels B and C repeat the same results for medium- and high-indigenous communities. Rainfall in a community's primary US destination is not associated with out-migration, while very hot destination conditions are negatively related to migration from medium-indigenous communities.

Social and economic factors also play a role in migration behaviors. Across all levels of indigeneity, the results show a higher likelihood of clandestine crossing among younger individuals, men relative to women, those with lower levels of education, and those living in households with prior migrants or in communities with higher prevalences of US migration. Households owning a business, and thus being tied to the origin community, are less likely to send migrants in all communities, but the p -value for the coefficient in low-indigenous communities ($p = 0.09$) is slightly below our threshold for statistical significance. Interestingly, in high-indigenous communities, undocumented migration is more likely from communities that are farther away from the US border, and homicide rates—a proxy for cartel presence—are negatively associated with migration, perhaps reflecting alternative income opportunities tied to trafficking or the deterrent effects of extortion and violence on would-be migrants. Availability of a water source (irrigation, dam, or reservoir) is also negatively associated with migration, but only in high-indigenous settings. This pattern suggests that factors mitigating

Table 3. Coefficient Estimates from Linear Probability Models of First Undocumented Trip to the United States by Community Indigeneity Level

Variables	Low Indigenous	Medium Indigenous	High Indigenous
Origin precipitation deviation			
Very dry	.0023* (.0009)	.0008 (.0037)	-.0004 (.0010)
Dry	.0002 (.0004)	.0010 (.0014)	.0005 (.0008)
Wet	.0001 (.0006)	-.0013 (.0010)	-.0010 (.0010)
Very wet	.0008 (.0009)	-.0014 (.0015)	.0002 (.0025)
Origin temperature deviation			
Very cool	.0000 (.0010)	-.0006 (.0013)	-.0017 (.0009)
Cool	.0001 (.0005)	.0003 (.0013)	.0007 (.0013)
Hot	-.0008 (.0005)	.0000 (.0010)	.0007 (.0010)
Very hot	.0006 (.0008)	-.0019 (.0010)	-.0008 (.0011)
Top destination precipitation deviation			
Very dry	-.0014 (.0010)	.0007 (.0012)	.0037 (.0033)
Dry	-.0003 (.0006)	.0015 (.0015)	.0004 (.0013)
Wet	-.0005 (.0004)	.0001 (.0009)	.0011 (.0012)
Very wet	.0003 (.0007)	-.0011 (.0009)	.0005 (.0013)
Top destination temperature deviation			
Very cool	.0004 (.0009)	-.0015 (.0015)	.0027 (.0036)
Cool	.0004 (.0007)	-.0007 (.0011)	.0017 (.0012)
Hot	-.0002 (.0005)	.0000 (.0010)	.0007 (.0005)
Very hot	.0000 (.0005)	-.0027* (.0011)	.0014 (.0009)
Individual			
Age	-.0003** (.0000)	-.0002** (.0000)	-.0003** (.0001)
Sex (0: female, 1: male)	.0095** (.0009)	.0080** (.0014)	.0089** (.0016)
Years of education	-.0003** (.0000)	-.0001* (.0001)	-.0002* (.0001)

(continued)

Table 3. (continued)

Variables	Low Indigenous	Medium Indigenous	High Indigenous
Household			
Owens any land	.0003 (.0005)	.0003 (.0007)	-.0009 (.0008)
Owens a business	-.0006 (.0003)	-.0012** (.0004)	-.0016** (.0005)
Owens a property	-.0006 (.0003)	-.0002 (.0006)	-.0015 (.0008)
Has prior migrants	.0055** (.0005)	.0070** (.0012)	.0067** (.0010)
Community			
Share of men in agriculture	.0029 (.0030)	-.0090 (.0046)	-.0068 (.0047)
Share earning less than min wage	.0034 (.0036)	-.0046 (.0049)	-.0041 (.0065)
Share earning >2 × minimum wage	-.0024 (.0022)	-.0129 (.0068)	-.0145 (.0086)
Share with 6+ years of education	.0048 (.0058)	-.0190 (.0114)	.0050 (.0085)
Share ever migrated	.0302** (.0046)	.0144 (.0108)	.0392** (.0063)
Has irrigation, dam or reservoir	-.0005 (.0006)	-.0037 (.0022)	-.0043** (.0013)
Homicide rates (per 1 million)	-.0001 (.0001)	-.0007 (.0006)	-.0013** (.0004)
Log (distance to border)	.0003 (.0007)	-.0039 (.0051)	.0137* (.0059)
<i>N</i> (person-years)	641,108	164,437	138,871
<i>R</i> ²	.0115	.0110	.0115

Source: Authors' calculations from the MMP data.

Note: Community indigeneity is based on 1 percent and 10 percent cutoffs in the share of population speaking an indigenous language. A community-year is very wet (very dry) if rainfall is two standard deviations or more higher (lower) than its baseline mean, wet (dry) if rainfall is one-to-two standard deviations higher (lower) than its baseline mean, and normal otherwise. Temperature deviation categories are computed similarly. Standard errors (corrected for clustering at the community level) are in parentheses. All models include state and year dummies.

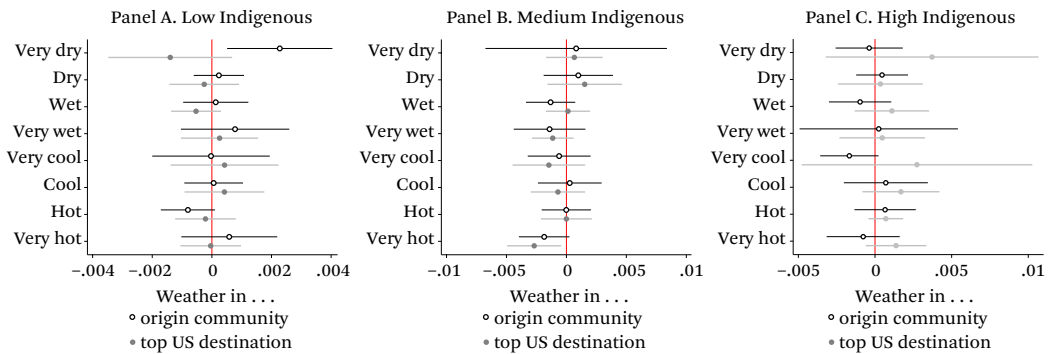
p* < .05; *p* < .01

potential agricultural loss (such as access to water during a drought) are especially important in less-resourced communities.

We next estimate a linear probability of return migration separately for low-, medium-, and high-indigenous communities. Our sample includes all undocumented migrants who have

been in the US for at least a year. The outcome is whether a migrant returns sometime within their second year. We include all the control variables in the undocumented-migration model (except the top US destination weather measures), along with indicators for rainfall and temperature extremes in migrants' actual US

Figure 2. Coefficient Plots for Weather Indicators from Linear Probability Models of First Undocumented Migration



Source: Authors' calculations from the MMP data.

Note: The three panels present the estimates from communities with (A) low, (B) medium, and (C) high levels of indigeneity, respectively. Each panel displays results for weather indicators in the origin community (hollow circle) and the top US destination for that community (full gray circle); the outcome is taking a first undocumented trip to the United States.

destination, migrants' occupation (whether it is in agriculture or not), and destination state (California, Illinois, or Texas).⁷

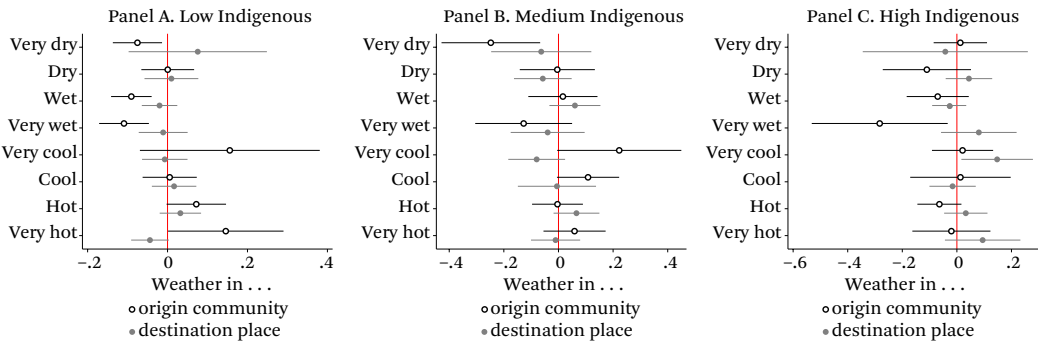
In low-indigenous communities, extreme origin rainfall (very dry, wet, and very wet) is strongly associated with lower rates of return migration among the undocumented in the US. In medium-indigenous places, very dry conditions seem to repel return moves, and, in high-indigenous places, very wet conditions are linked to lower return rates. Two patterns stand out. First, return migration is more sensitive to weather extremes relative to undocumented migration. A range of extreme conditions (both wet and dry) are related to return to Mexico, while a single condition (very dry) is associated with undocumented migration to the US. Second, the link between weather extremes and return holds across all three levels of indigeneity, whereas that between weather and undocu-

mented migration is present only in low-indigenous communities. Figure 3 presents a visual summary of these origin-weather effects alongside the corresponding conditions in migrants' US destinations. Rainfall at the destination shows no association with return, whereas very cool destination conditions are positively related to return among migrants from high-indigenous communities.

The models so far considered return migration among migrants who have stayed a year in the US. We extend this analysis to consider the return among migrants who have been away from their home for two, three, and four years, respectively. In each case, we relate weather extremes in the origin community to return behavior in the following year. Figure 4 displays origin-weather coefficients for low-, medium-, and high-indigenous communities, and figure 5 shows the parallel coefficients for destination

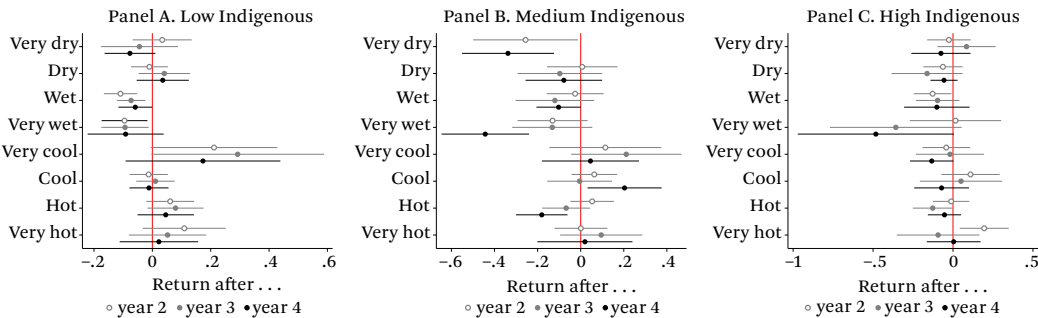
7. The R^2 (share of explained variation) values are higher in return models (table 4) than migration models (table 3). There are two reasons. First, return is less selective compared with undocumented migration. About 41 percent of migrants return to Mexico in our data, while only 8 percent of individuals migrate in the first place. Second, fixed effects for state and year (along with weather shocks) account for a larger share of the variation in return behaviors. Specifically, they explain 11 percent in low-indigenous communities and 27 percent in both medium- and high-indigenous communities. By contrast, the corresponding shares for migration outcomes are 0.3 percent in low-indigenous communities and 0.4 percent in both medium- and high-indigenous communities. This pattern suggests that return is more sensitive to weather, regional, and temporal shocks relative to migration.

Figure 3. Coefficient Plots for Weather Indicators from Linear Probability Models of Return Migration After One Year in the United States



Source: Authors' calculations from the MMP data.
Note: The three panels present the estimates from communities with (A) low, (B) medium, and (C) high levels of indigeneity, respectively. Each panel displays results for weather indicators in the origin community (hollow circle) and the top US destination for that community (full gray circle); the outcome is returning to Mexico after remaining in the United States for one year.

Figure 4. Coefficient Plots for Origin Weather Indicators from Linear Probability Models of Return Migration After Two, Three, and Four Years in the United States



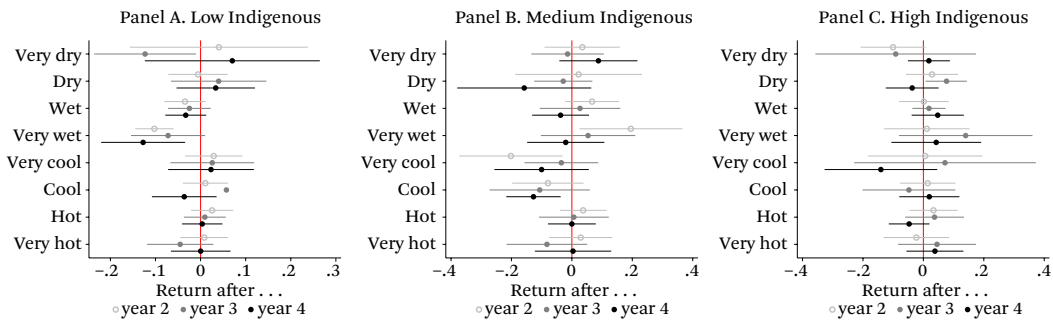
Source: Authors' calculations from the MMP data.
Note: The three panels present the estimates from communities with (A) low, (B) medium, and (C) high levels of indigeneity, respectively. Each panel displays results for origin weather indicators from three different models, where the outcome is returning to Mexico after remaining in the United States for two (hollow circle), three (full gray circle), and four (black circle) years.

weather. Hollow circles show estimates for migrants in the US for two years, gray circles for three years, and black circles for four years.

In low-indigenous communities, wet origin conditions are associated with a lower likelihood of return migration among all migrants, regardless of whether they have spent two, three, or four years in the United States. In medium-indigenous communities, very dry weather is linked to a higher chance of return among all

cohorts. Among migrants who have been in the US for four years, very wet and hot origin conditions correspond to lower return rates, whereas cool conditions show the opposite pattern. In high-indigenous communities, the very dry and very wet weather origin conditions are negatively associated with return patterns among migrants who have remained in the United States for four years. Figure 5 shows corresponding destination-weather patterns: very dry and very wet destina-

Figure 5. Coefficient Plots for US Destination Weather Indicators from Linear Probability Models of Return Migration After Two, Three, and Four Years in the United States



Source: Authors' calculations from the MMP data.

Note: The three panels present the estimates from communities with (A) low, (B) medium, and (C) high levels of indigeneity, respectively. Each panel displays results for US destination weather indicators from three different models, where the outcome is returning to Mexico after remaining in the United States for two (hollow circle), three (full gray circle), and four (black circle) years.

tion conditions are negatively associated with return among those from low-indigenous communities. For medium-indigenous communities, very cool and cool destination conditions are negatively related to return, while very wet conditions are positively associated with return.

Although the sample size drops across migrant cohorts, our models in figure 4 still detect signals that align with those from the larger sample of migrants observed after their first year at the destination (table 4). In medium- and high-indigenous communities, we have only 338 and 428 migrants, respectively, who have remained in the US for four years. Despite the small sample size, return behavior is linked to weather extremes in origin communities even among migrants who have left their communities several years ago; this link is strongest among low- and medium-indigenous communities.

Robustness Analysis

We conducted additional analyses to assess the robustness of our results. First, while we use linear probability models to link weather to migration and return decisions, as discussed in note 6, we also considered a logistic regression model. These results are available on request.⁸

Next, our main analysis presumes weather effects on migration and return decisions work through the agricultural mechanism: extreme rainfall and temperature hurt yields; lower yields trigger migration. We do not have data to test this mechanism directly, but additional robustness checks, along with evidence from prior work (Feng et al. 2010; Jessoe et al. 2018), establish its plausibility. The main models include all the communities in the data to retain statistical power. In supplementary analysis (see online appendix), we restrict our sample to agricultural communities where at least 30 percent

8. To summarize, most findings were consistent. For instance, in low-indigenous communities, very dry weather is linked to higher migration likelihood in both models. Similarly, wet or very wet conditions are negatively associated with returning after a year in the US, while very hot weather is positively associated. However, some results differed. In high-indigenous communities, for example, very wet weather is negatively related to return, but can only be estimated in the linear probability model. The logistic model with fixed effects removes cases with no within-group variation and reduces the sample size (from $N = 773$ to $N = 601$ for return migration models in high-indigenous communities). By contrast, LPM absorbs fixed effects, allowing estimation with between-group variation alone. Similarly, very cool weather is positively related to return but is statistically significant only in the logistic model. This difference could reflect incidental parameter bias (which is common in nonlinear models with many fixed effects) or different sample sizes used in estimation.

Table 4. Coefficient Estimates from Linear Probability Models of Return Trip After First Year in the United States by Community Indigeneity Level

Variables	Low Indigenous	Medium Indigenous	High Indigenous
Origin precipitation deviation			
Very dry	-.0753* (.0310)	-.2477** (.0893)	.0126 (.0463)
Dry	.0005 (.0333)	-.0042 (.0680)	-.1100 (.0766)
Wet	-.0905** (.0256)	.0163 (.0626)	-.0702 (.0539)
Very wet	-.1089** (.0314)	-.1274 (.0877)	-.2827* (.1181)
Origin temperature deviation			
Very cool	.1558 (.1135)	.2226 (.1124)	.0208 (.0531)
Cool	.0054 (.0342)	.1083 (.0563)	.0131 (.0872)
Hot	.0720 (.0375)	-.0036 (.0460)	-.0640 (.0383)
Very hot	.1458* (.0728)	.0589 (.0563)	-.0201 (.0678)
Destination precipitation deviation			
Very dry	.0756 (.0872)	-.0631 (.0907)	-.0425 (.1434)
Dry	.0096 (.0340)	-.0573 (.0522)	.0442 (.0404)
Wet	-.0200 (.0224)	.0603 (.0462)	-.0282 (.0296)
Very wet	-.0109 (.0309)	-.0395 (.0670)	.0804 (.0656)
Destination temperature deviation			
Very cool	-.0069 (.0287)	-.0798 (.0514)	.1475* (.0622)
Cool	.0164 (.0280)	-.0055 (.0708)	-.0157 (.0402)
Hot	.0321 (.0261)	.0659 (.0415)	.0327 (.0376)
Very hot	-.0440 (.0237)	-.0105 (.0445)	.0944 (.0656)
Individual			
Age	.0018* (.0007)	.0011 (.0015)	.0003 (.0019)
Sex (0: female, 1: male)	.0227 (.0144)	.0226 (.0286)	-.0151 (.0204)
Years of education	-.0009 (.0022)	.0066 (.0039)	-.0013 (.0035)

Table 4. (continued)

Variables	Low Indigenous	Medium Indigenous	High Indigenous
Household			
Owens any land	.0002 (.0190)	-.0188 (.0248)	-.0018 (.0145)
Owens a business	-.0176 (.0169)	.0159 (.0342)	-.0162 (.0234)
Owens a property	.0065 (.0143)	.0062 (.0215)	-.0311 (.0217)
Has prior migrants	.0124 (.0166)	.0144 (.0280)	.0146 (.0165)
Community			
Share of men in agriculture	-.0016 (.1084)	-.0727 (.1959)	.2215 (.3436)
Share earning less than min wage	-.1340 (.1537)	-.7409 (.5518)	.0993 (.4934)
Share earning > 2 x min wage	.1135 (.1639)	.0622 (.6082)	.9327 (.6719)
Share with 6+ years of education	.1653 (.2212)	-1.1418* (.5015)	-.4121 (.3603)
Share ever migrated	.2073 (.1277)	-1.1385** (.3061)	.3023 (.3092)
Has irrigation, dam or reservoir	.0230 (.0296)	-.1088* (.0488)	.0864 (.0529)
Homicide rates (per 1 million)	.0031 (.0065)	-.0067 (.0094)	-.0347* (.0138)
Log (distance to border)	.0442 (.0916)	-.0340 (.2315)	-.0039 (.2855)
Migrant occupation and destination			
Works in agriculture in the US	.0088 (.0174)	.0415 (.0365)	.0383 (.0370)
In California	-.0116 (.0202)	.0452 (.0325)	-.0143 (.0188)
In Illinois	.0175 (.0279)	-.0776* (.0378)	.1219* (.0499)
In Texas	-.0505* (.0219)	-.0945 (.0823)	-.0393 (.0336)
<i>N</i> (person-years)	3,103	665	773
<i>R</i> ²	.1321	.3690	.3028

Source: Authors' calculations from the MMP data.

Note: Community indigeneity is based on 1 percent and 10 percent cutoffs in the share of population speaking an indigenous language. A community-year is very wet (very dry) if rainfall is two standard deviations or more higher (lower) than its baseline mean, wet (dry) if rainfall is one-to-two standard deviations higher (lower) than its baseline mean, and normal otherwise. Temperature deviation categories are computed similarly. Standard errors (corrected for clustering at the community level) are in parentheses. All models include state and year dummies.

* $p < .05$; ** $p < .01$

(table A.1, panel A) or 40 percent (table A.1, panel B) of the men work in agriculture. In both cases, our main result for undocumented migration, where very dry weather attains a coefficient estimate of 0.0023 ($p < 0.05$) in low-indigenous communities, replicates and becomes larger (0.0030, $p < 0.05$ and 0.0036, $p < 0.05$, respectively), although the differences in coefficient size across samples (full sample versus agricultural samples) are not statistically significant.⁹ Our main results for return after the first year in the US also replicate in agricultural communities (table A.2, panels A and B).

Third, our main analysis focused on undocumented migrants who entered the US without authorization (as reported by respondents). We also considered an alternative definition of undocumented status that includes individuals who entered with a tourist visa but work for wages, thus going against the provisions of the visa. We also estimated our models of any migration (on samples including both documented and undocumented migrants). In both cases, our results on the weather effects on taking a first migration trip (table A.3, panels A and B) and on returning to Mexico after a year in the US (table A.4, panels A and B) remained similar.

Fourth, we considered several alternative specifications for measuring the context of indigeneity. Because a municipality's history of migration may affect the degree to which people report speaking an indigenous language, we classify MMP respondents' municipal levels of indigeneity using 1990 data for the entire sample (rather than using a time-varying measure). The results for undocumented migration and return models are presented in online appendix table A.5 (panel A) and table A.6 (panel A), respectively. In both cases, the coefficient estimates for the weather indicators remain similar to those in tables 3 and 4. We also considered alternative cut-offs for indigeneity categories using quartiles (less than 25th percentile, 25th–

75th percentile, greater than 75th percentile) to divide our sample into three categories. Whereas low-indigenous communities make up 68 percent of our sample in the original analysis, now they account for 22 percent of the sample. Given this shift in the sample size, we now observe a positive relationship between very dry weather ($p < 0.05$) and taking an undocumented trip in medium (rather than low) indigenous communities (table A.5, panel B). When we run our models of return migration with the alternative community indigeneity cutoffs (table A.6, panel B), our main results remain similar. The negative relationship between extreme weather and return behavior holds across all levels of community indigeneity.¹⁰ Next, we used a continuous measure of the municipal-level shares of indigenous-speaking residents instead of categories and introduced interaction terms between this measure and weather conditions. The results for undocumented migration, presented in table A.7, align with earlier findings. Very dry weather is positively associated with undocumented migration in both the baseline model (0.0017, $p < 0.05$) and the specification including community indigeneity (0.0016, $p < 0.05$). The interaction between very dry weather and indigeneity attains a negative coefficient (−0.0053, $p < 0.05$). This pattern suggests that the drought effect on migration is lower in high-indigenous communities. The results for return migration in table A.8 confirm earlier findings on precipitation effects and reveal new ones for temperature. Very dry, wet, and very wet weather are negatively associated with return migration in the baseline model and the specification including community indigeneity. The interaction terms between precipitation indicators and community indigeneity are not statistically significant. As in table 4, these results confirm that precipitation effects on return seem impervious to the community level of indigeneity. Temperature extremes show no association with return

9. These comparisons are derived from a model run on the full sample where weather conditions are interacted with an indicator for the size of the agricultural labor force. A statistically significant interaction term is taken as evidence for a difference in the size of weather effects between the full and the restricted sample. These results are available from the authors.

10. The results (available from the authors) are similar when we use tertiles and divide the data into three equal-sized groups.

migration in the baseline model, but their interactions with community indigeneity yield negative coefficients. This pattern, not evident in models estimated separately by indigeneity, suggests that temperature shocks may discourage return migration in more indigenous communities.

We tried an alternative measure—the share self-identifying as indigenous—included in the 2000 census. Recent work shows that the self-identified indigenous population has tripled since 2000, partly because of changes to the phrasing of the question in 2010 (Flores et al. 2023). For consistency, we use the values from 2000, and classify the communities into low-, medium-, and high-indigenous categories using the same (1 and 10 percent) cutoffs as in the main analysis. Low-indigenous communities account for 56 percent of our observations, medium-indigenous communities for 16 percent, and high-indigenous communities for 28 percent. Our main results (available from authors) remain largely similar.¹¹

Factors related to the first trip (including weather conditions) may become less important across subsequent trips (Massey et al. 1994). We considered this possibility by estimating models of undocumented migration and return estimated on samples containing migrants on the first and last trips. Our analysis so far considered the first undocumented migration and return, but the MMP data record these first and last trips for all individuals; about 90 percent of our sample makes two trips or fewer. In the model for undocumented migration, we include an indicator for whether an individual is at risk of making a second trip (that is, if a person is a prior migrant who is back in their origin community). This indicator attains a positive coefficient ($p < 0.05$) in the model of undocumented migration (table A.9, panel A). The coefficient for very dry weather falls below the 95-percent

threshold for statistical significance ($0.0016, p = 0.08$). Consistent with earlier research, this pattern suggests that migration behaviors, once started, can become increasingly decoupled from the conditions that initiated them in the first place (Massey 1990; Asad and Garip 2019). In the model for return migration (table A.9, panel B), we introduce an indicator for migrants on their last trip. This indicator is negatively related ($p < 0.05$) to return across all levels of community indigeneity. Weather indicators retain their negative association with return behaviors despite the inclusion of repeat migrants. This finding reaffirms the strong relationship between origin weather extremes and return that holds across all types of migrants (on first or repeat trips) and communities (low-, medium-, or high-indigenous).

Finally, we considered an alternative measure of weather extremes in origin communities that captures conditions over the entire year rather than only during the corn season. In the undocumented migration model (table A.10, panel A), very dry weather shows a positive association in low-indigenous communities ($0.0023, p < 0.05$), replicating earlier results. In the return model (table A.10, panel B), weather extremes are largely insignificant, except for a negative association with very cool conditions in high-indigenous communities. These findings underscore that return responses are driven primarily by seasonal rather than annual weather shocks, highlighting the central role of agricultural cycles.

DISCUSSION AND CONCLUSION

In Mexico, indigeneity—having origins in pre-colonial populations—is a central dimension of inequality. Although indigeneity is an individual characteristic, it is also a feature of place that patterns residents' access to material and social resources, regardless of their own ethnic-

11. Across both categorizations (by language and self-identification), we find that in low-indigenous communities, very dry weather is positively associated with migration. In high-indigenous communities, very dry weather is negatively associated with migration, but this relationship is statistically significant only under the self-identification categorization, which includes a larger sample. Very wet weather is negatively associated with return migration in both categorizations. This relationship is significant across all three self-identification-based categories but only significant for low- and high-indigenous communities when categorized by language. These findings suggest that while the overall patterns are consistent, significance levels vary depending on the categorization method, primarily due to differences in sample size.

ity. Exposure to weather extremes represents one additional disadvantage that we have examined in this article. Indigenous communities are not only more exposed to weather extremes but also face overlapping hardships associated with this exposure, given their rurality, dependence on rain-fed agriculture, and limited access to economic and social resources that might allow them to absorb the impacts of weather extremes. We considered whether weather deviations also shape opportunities for undocumented migration to and return from the United States by the context of indigeneity.

Drawing on large-scale survey data from the MMP, linked with contextual measures of indigeneity from the Mexican Census compiled by IPUMS International and high-resolution daily precipitation and temperature data from Daymet, we find asymmetries in how the context of indigeneity relates to undocumented migration and return following weather deviations. Results from linear probability models show that weather extremes are associated with an increased probability of undocumented migration from low-indigenous communities. By contrast, sustained weather extremes in origin communities are associated with a lower probability of return throughout migrants' tenure in the United States, regardless of their origin communities' context of indigeneity. We nonetheless find evidence that different weather deviations matter for return in different contexts of indigeneity: very dry weather is associated with delayed return to low- and medium-indigenous communities among more recent migrants, while very wet and cool conditions are associated with reduced return to high-indigenous communities among more established migrants. Thus, opportunities for undocumented migration as a response to weather deviations vary by the context of indigeneity; a range of weather extremes may work together to constrain return across contexts of indigeneity.

We propose that these associations operate through weather deviations' impacts on agriculture. Our analysis focuses on 147 MMP communities that rely on maize production. By measuring weather extremes during the corn growing season, we assume—but cannot show directly—that weather-related migration oper-

ates through declining crop yields (see also Zhu et al. 2024). Ethnographic evidence supports this interpretation, illustrating how weather deviations threaten agricultural livelihoods (de Frece and Poole 2008; Ebel et al. 2018). Yet the relationship between weather and migration is more complex when filtered through the context of indigeneity. Our results indicate that undocumented migration increases primarily among low-indigenous communities. One potential explanation is that international migration is a preferred adaptation strategy in agricultural communities with longer migration histories and denser transnational networks (Hunter et al. 2015). Another is that low-indigenous communities possess greater access to financial and social resources—such as wage labor, savings, credit, and coyote networks—that lower the costs of migration independent of historical migration ties (Asad and Hwang 2019a, 2019b). In the latter case, individuals in high-indigenous communities may be “trapped” in place, wanting to move but lacking the resources to do so (Black and Collyer 2014); if so, high-indigenous communities could experience even greater deprivation in the future as the network effects of migration increase inequality over time (see, for example, Garip 2008). We emphasize, though, that a lack of statistical association does not imply that weather extremes are inconsequential in high-indigenous communities. Rather, their relationship with our proposed agricultural mechanism may operate differently. High-indigenous communities may have already adapted to weather variability in ways that reduce the need for international migration (Ebel and Castillo Cocom 2012; Ebel et al. 2018; Rogé et al. 2014). Residents may also remain rooted due to strong symbolic and economic attachments to land (Eakin 2005). We find support for both these possibilities in our regression models, though a more explicit consideration of each potential explanation remains to be conducted.

Future research should build on these findings in several ways. First, while our analysis reveals asymmetries in weather-related migration and return using municipal-level measures of indigeneity, the MMP lacks individual-level indicators of indigeneity. Our associations may be even stronger among indigenous-speaking or indigenous-identified people in each com-

munity, although our current data do not allow us to test this claim. Second, more granular data could better approximate the context of indigeneity at the community rather than municipal level. Third, exploring cross-level interactions between individual and contextual measures of indigeneity could clarify the mechanisms underlying these patterns. Finally, while our study focuses on Mexico-US migration, results may vary across contexts of indigeneity marked by particular histories of US-bound migration (Fox 2006). They may also differ in other migration corridors beyond Mexico and the United States.

Our findings nonetheless make three contributions. First, we show that, alongside being disproportionately rural, agricultural, and poor, one additional hardship correlated with the context of indigeneity is indigenous communities' disproportionate exposure to weather extremes. Although many studies based in Mexico suggest this relationship using other proxies (for example, rurality or poverty), few explicitly consider the context of indigeneity, in part because most analyses occur at scales that obscure municipal-level variation. Our analysis of Mexican Census data demonstrates that indigenous municipalities, relative to nonindigenous municipalities, already experience greater weather-related threats and are also projected to face more in the future. This result reinforces calls from recent systematic reviews emphasizing the need for subnational and local analyses of climate vulnerability—including indigeneity—in diverse national contexts (Zahnow et al. 2025).

Second, we adopt a social demographic perspective to clarify insights from qualitative research on how the context of indigeneity relates to the migration journey—not just migration to but also return from the United States—following weather extremes. While ethnographic work has documented both migration and adaptation in response to weather deviations (Ebel and Castillo Cocom 2012; Rogé et al. 2014), it typically focuses on a handful of indigenous communities at a single point in time. By contrast, we use fine-grained daily weather data and municipal-level measures of indigeneity across Mexico. We find that, although there are certainly instances of migration from indigenous communities following weather deviations, these are not widespread within the study pe-

riod. Instead, the relationship between weather deviations and migration is most evident in low-indigenous communities. Taken together, these results suggest that immobility—staying in place—may be a common response to weather shocks in the most indigenous communities (Eakin 2006; Schewel 2020).

Finally, by analyzing the full migration journey, we uncover an asymmetry in the relationship between weather extremes, migration, and return by the context of indigeneity. Migrants from low-indigenous communities are more likely to leave for the United States following weather deviations but, once abroad, migrants from all contexts of indigeneity are equally likely to remain as adverse conditions persist in their origin communities. Weather extremes, in other words, reproduce existing inequalities in opportunities for international migration while constraining return across the board. This latter finding remains relatively underexamined (but see Zhu et al. 2024). Since the 1980s, intensified border and interior immigration enforcement in the United States has made return migration to Mexico less feasible (Massey et al. 2016). Our results suggest that sustained weather deviations in origin communities may further deter return, particularly when these shocks disrupt agricultural livelihoods and make continued residence abroad—despite deportation risks—a preferred strategy. These dynamics may help explain stability in the size of the undocumented Mexican population in the United States despite declining inflows, as both enforcement and environmental change reduce the feasibility of return.

In this sense, weather extremes may represent a double disadvantage for undocumented immigrants who experience climate disruptions in their origin communities and face heightened environmental risks on arrival. Many undocumented migrants work in sectors such as agriculture, construction, and landscaping, where exposure to extreme environmental hazards is especially high (Orrenius and Zavodny 2009). If migrants from high-indigenous communities are disproportionately represented in these sectors in the United States, this represents an additional hardship associated with the origin context of indigeneity (Méndez et al. 2024). Moreover, by discouraging return, weather extremes

may indirectly increase migrants' exposure to US immigration enforcement, which lacks legal protections for individuals displaced by climate-related disasters (Waters 2025). Unauthorized entry—even when motivated by climate-related livelihood shocks—carries severe legal consequences, including visa bans and felony reentry charges (Asad 2023; Golash-Boza 2015; Tosh 2023). Our results thus underscore the urgency of integrating climate vulnerability into immigration policy (McLeman 2019).

As climate change intensifies, weather-related migration pressures are likely to grow. Yet current legal frameworks—both in the United States and under international refugee law—offer no recognition or protection for climate-displaced individuals (Garip and Reed 2025). Future policy discussions should consider humanitarian or targeted visa programs for those displaced by extreme weather events (Waters 2025). If our results are any indication, addressing these challenges requires understanding weather-related migration as shaped by overlapping systems of social and environmental inequality.

REFERENCES

- Adger, W. Neil. 2006. "Vulnerability." *Global Environmental Change* 16(3): 268–81. <https://doi.org/10.1016/j.gloenvcha.2006.02.006>.
- Asad, Asad L. 2023. *Engage and Evade: How Latino Immigrant Families Manage Surveillance in Everyday Life*. Princeton University Press.
- Asad, Asad L., and Filiz Garip. 2019. "Mexico-U.S. Migration in Time: From Economic to Social Mechanisms." *Annals of the American Academy of Political and Social Science* 684(1): 60–84. <https://doi.org/10.1177/0002716219847148>.
- Asad, Asad L., and Jackelyn Hwang. 2019a. "Indigenous Places and the Making of Undocumented Status in Mexico-US Migration." *International Migration Review* 53(4): 1032–77. <https://doi.org/10.1177/0197918318801059>.
- Asad, Asad L., and Jackelyn Hwang. 2019b. "Migration to the United States from Indigenous Communities in Mexico." *Annals of the American Academy of Political and Social Science* 684(1): 120–45. <https://doi.org/10.1177/0002716219848342>.
- Bada, Xóchitl, and Jonathan Fox. 2022. "Persistent Rurality in Mexico and 'the Right to Stay Home.'" *Journal of Peasant Studies* 49(1): 29–53. <https://doi.org/10.1080/03066150.2020.1864330>.
- Barbary, Olivier. 2015. "Social Inequalities and Indigenous Populations in Mexico: A Plural Approach." In *Social Statistics and Ethnic Diversity: Cross-National Perspectives in Classifications and Identity Politics*, edited by Patrick Simon, Victor Piché, and Amélie A. Gagnon. IMISCOE Research Series. Springer International Publishing. https://doi.org/10.1007/978-3-319-20095-8_11.
- Barbary, Olivier, and Regina Martínez Casas. 2015. "L'explosion de l'autodéclaration indigène entre les recensements mexicains de 2000 et 2010." *Autrepart* No. 74–75(2): 215–40. <https://doi.org/10.3917/autr.074.0215>.
- Batala, Guillermo Bonfil. 1996. *México Profundo: Reclaiming a Civilization*. Translated by Philip A. Dennis. University of Texas Press. <https://doi.org/10.7560/708440>.
- Batalova, Jeanne. 2024. "Mexican Immigrants in the United States." Migration Information Source. Migration Policy Institute. October 8. <https://www.migrationpolicy.org/article/mexican-immigrants-united-states>.
- Bellon, Mauricio R., David Hodson, and Jon Hellin. 2011. "Assessing the Vulnerability of Traditional Maize Seed Systems in Mexico to Climate Change." *Proceedings of the National Academy of Sciences* 108(33): 13432–37. <https://doi.org/10.1073/pnas.1103373108>.
- Black, Richard, and Michael Collyer. 2014. "Populations 'Trapped' at Times of Crisis." *Forced Migration Review* no. 45: 52–56. <https://www.fmreview.org/crisis/black-collyer/>.
- Boustán, Leah Platt, Matthew E. Kahn, and Paul W. Rhode. 2012. "Moving to Higher Ground: Migration Response to Natural Disasters in the Early Twentieth Century." *American Economic Review* 102(3): 238–44. <https://doi.org/10.1257/aer.102.3.238>.
- Carling, Jørgen. 2002. "Migration in the Age of Involuntary Immobility: Theoretical Reflections and Cape Verdean Experiences." *Journal of Ethnic and Migration Studies* 28(1): 5–42. <https://doi.org/10.1080/13691830120103912>.
- Clement, Matthieu, and Lucie Piaser. 2021. "Ethnic Diversity, Local Redistribution and Income Inequality: An Empirical Analysis Applied to Mexican Municipalities." *Journal of Development Studies* 57(2): 289–309. <https://doi.org/10.1080/00220388.2020.1786060>.

- Colorado-Ruiz, Gabriela, and Tereza Cavazos. 2021. "Trends of Daily Extreme and Non-Extreme Rain-fall Indices and Intercomparison with Different Gridded Data Sets over Mexico and the Southern United States." *International Journal of Climatology* 41(11): 5406–30. <https://doi.org/10.1002/joc.7225>.
- Consejo Nacional de Evaluación de la Política de Desarrollo Social (CONEVAL). 2012. *La Pobreza En La Población Indígena de México, 2012*. Consejo Nacional de Evaluación de la Política de Desarrollo Social.
- Cornelius, Wayne A. 2001. "Death at the Border: Efficacy and Unintended Consequences of US Immigration Control Policy." *Population and Development Review* 27(4): 661–85. <https://doi.org/10.1111/j.1728-4457.2001.00661.x>.
- Cuervo-Robayo, Angela P., Carolina Ureta, Miguel A. Gómez-Albores, Anny K. Meneses-Mosquera, Oswaldo Téllez-Valdés, and Enrique Martínez-Meyer. 2020. "One Hundred Years of Climate Change in Mexico." *PLOS One* 15(7): e0209808. <https://doi.org/10.1371/journal.pone.0209808>.
- de Frece, Annabel, and Nigel Poole. 2008. "Constructing Livelihoods in Rural Mexico: *Milpa* in Mayan Culture." *Journal of Peasant Studies* 35(2): 335–52. <https://doi.org/10.1080/03066150802151090>.
- de Haas, Hein. 2021. "A Theory of Migration: The Aspirations-Capabilities Framework." *Comparative Migration Studies* 9(1): 8. <https://doi.org/10.1186/s40878-020-00210-4>.
- de Haas, Hein. 2023. *How Migration Really Works: A Factful Guide to the Most Divisive Issue in Politics*. Viking.
- de la Peña, Guillermo. 2006. "A New Mexican Nationalism? Indigenous Rights, Constitutional Reform and the Conflicting Meanings of Multiculturalism*." *Nations and Nationalism* 12(2): 279–302. <https://doi.org/10.1111/j.1469-8129.2006.00241.x>.
- Del Popolo, Fabiana, ed. 2017. *Los pueblos indígenas en América (Abya Yala): desafíos para la igualdad en la diversidad*. Libros de la CEPAL 151. Naciones Unidas.
- Dell, Melissa, Benjamin F. Jones, and Benjamin A. Olken. 2012. "Temperature Shocks and Economic Growth: Evidence from the Last Half Century." *American Economic Journal: Macroeconomics* 4(3): 66–95.
- Eakin, Hallie. 2005. "Institutional Change, Climate Risk, and Rural Vulnerability: Cases from Central Mexico." *World Development* 33(11): 1923–38. <https://doi.org/10.1016/j.worlddev.2005.06.005>.
- Eakin, Hallie. 2006. *Weathering Risk in Rural Mexico: Climatic, Institutional, and Economic Change*. University of Arizona Press.
- Ebel, Roland, and Juan Castillo Cocom. 2012. "X-Pichil: From Traditional to 'Modern' Farming in a Maya Community." *Memories of the VIII International Conference on Sustainable Agriculture, Environment and Forestry*.
- Ebel, Roland, María de Jesús Méndez Aguilar, and Heather R. Putnam. 2018. "*Milpa*: One Sister Got Climate-Sick. The Impact of Climate Change on Traditional Maya Farming Systems." *International Journal of Sociology of Agriculture and Food* 24(2): 175–99. <https://doi.org/10.48416/IJSAF.V24I2.103>.
- Estrada, Francisco, Alma Mendoza-Ponce, Oscar Calderón-Bustamante, and Wouter Botzen. 2022. "Impacts and Economic Costs of Climate Change on Mexican Agriculture." *Regional Environmental Change* 22(4): 126. <https://doi.org/10.1007/s10113-022-01986-0>.
- Feng, Shuaizhang, Alan B. Krueger, and Michael Oppenheimer. 2010. "Linkages Among Climate Change, Crop Yields and Mexico-US Cross-Border Migration." *Proceedings of the National Academy of Sciences* 107(32): 14257–62. <https://doi.org/10.1073/pnas.1002632107>.
- Fernández-Kelly, Patricia, and Douglas S. Massey. 2007. "Borders for Whom? The Role of NAFTA in Mexico-U.S. Migration." *Annals of the American Academy of Political and Social Science* 610(1): 98–118. <https://doi.org/10.1177/0002716206297449>.
- Fierros-González, Isael, and Jorge Mora-Rivera. 2022. "Drivers of Livelihood Strategies: Evidence from Mexico's Indigenous Rural Households." *Sustainability* 14(13): 7994. <https://doi.org/10.3390/su14137994>.
- Figuroa-Rodríguez, Oscar L. 2020. "Indigenous Policy and Indigenous Data in Mexico." In *Indigenous Data Sovereignty and Policy*, 1st ed., edited by Maggie Walter, Tahu Kukutai, Stephanie Russo Carroll, and Desi Rodriguez-Lonebear. Routledge. <https://doi.org/10.4324/9780429273957-9>.
- Flores, René D., María Vignau Loria, and Regina Martínez Casas. 2023. "Transitory Versus Dura-

- ble Boundary Crossing: What Explains the Indigenous Population Boom in Mexico?" *American Journal of Sociology* 129(1): 123–61. <https://doi.org/10.1086/725337>.
- Fox, Jonathan. 2006. "Reframing Mexican Migration as a Multi-Ethnic Process." *Latino Studies* 4(1–2): 39–61. <https://doi.org/10.1057/palgrave.1st.8600173>.
- Friedlander, Judith. 2006. *Being Indian in Hueyapan*. Rev. and updated ed. Palgrave Macmillan.
- Galli, Chiara, and Filiz Garip. 2024. "Bringing Children to the Center of Migration Theory." *International Migration Review* 58(4): 1876–912. <https://doi.org/10.1177/01979183241268129>.
- Garip, Filiz. 2008. "Social Capital and Migration: How Do Similar Resources Lead to Divergent Outcomes?" *Demography* 45(3): 591–617. <https://doi.org/10.1353/dem.0.0016>.
- Garip, Filiz. 2016. *On the Move: Changing Mechanisms of Mexico-U.S. Migration*. Princeton University Press.
- Garip, Filiz, and Asad L. Asad. 2016. "Network Effects in Mexico-U.S. Migration: Disentangling the Underlying Social Mechanisms." *American Behavioral Scientist* 60(10): 1168–93. <https://doi.org/10.1177/0002764216643131>.
- Garip, Filiz, and Cody A. Reed. 2025. "Climate Change and Human Mobility: Considering Context, Mechanisms, and Selectivity." *Population and Development Review* 51(1): 449–89. <https://doi.org/10.1111/padr.12716>.
- Golash-Boza, Tanya Maria. 2015. *Deported: Immigrant Policing, Disposable Labor and Global Capitalism*. NYU Press.
- Gonzalez-Barrera, Ana. 2015. *More Mexicans Leaving Than Coming to the U.S.* November 19. Pew Research Center. <https://www.pewresearch.org/race-and-ethnicity/2015/11/19/more-mexicans-leaving-than-coming-to-the-u-s/>.
- González Meza, Luis. 2006. "Transformaciones económicas en México y migración a Estados Unidos." In *Migración México-Estados Unidos. Implicaciones y Retos Para Ambos Países*, edited by Elena Zúñiga, Jesús Arroyo, Agustín Escobar, and Gustavo Verduzco. Consejo Nacional de Población.
- González Rivas, Marcela. 2012. "Why Do Indigenous Municipalities in Mexico Have Worse Piped Water Coverage?" *Development in Practice* 22(1): 31–43. <https://doi.org/10.1080/09614524.2012.630983>.
- Greene, William. 2004. "Fixed Effects and Bias Due to the Incidental Parameters Problem in the Tobit Model." *Econometric Reviews* 23(2): 125–47. <https://doi.org/10.1081/ETC-120039606>.
- Hale, Charles R. 2005. "Neoliberal Multiculturalism." *PoLAR: Political and Legal Anthropology Review* 28(1): 10–19. <https://doi.org/10.1525/pol.2005.28.1.10>.
- Hamilton, Nora. 2011. *Mexico: Political, Social, and Economic Evolution*. Oxford University Press.
- Harris, John R., and Michael P. Todaro. 1970. "Migration, Unemployment and Development: A Two-Sector Analysis." *American Economic Review* 60(1): 126–42. <http://www.jstor.org/stable/1807860>.
- Harvey, Neil. 1998. *The Chiapas Rebellion: The Struggle for Land and Democracy*. Duke University Press.
- Hernández-León, Rubén. 2008. *Metropolitan Migrants: The Migration of Urban Mexicans to the United States*. University of California Press.
- Hoffmann, Roman, Anna Dimitrova, Raya Muttarak, Jesus Crespo Cuaresma, and Jonas Peisker. 2020. "A Meta-Analysis of Country-Level Studies on Environmental Change and Migration." *Nature Climate Change* 10: 904–12. <https://doi.org/10.1038/s41558-020-0898-6>.
- Hoffmann, Roman, Barbora Šedová, and Kira Vinke. 2021. "Improving the Evidence Base: A Methodological Review of the Quantitative Climate Migration Literature." *Global Environmental Change* 71: 102367. <https://doi.org/10.1016/j.gloenvcha.2021.102367>.
- Hunter, Lori M., Jessie K. Luna, and Rachel M. Norton. 2015. "Environmental Dimensions of Migration." *Annual Review of Sociology* 41: 377–97. <https://doi.org/10.1146/annurev-soc-073014-112223>.
- Instituto Nacional de Ecología y Cambio Climático (INECC). 2021. *Municipios Vulnerables al Cambio Climático con Base en los Resultados del Atlas Nacional de Vulnerabilidad al Cambio Climático*. Instituto Nacional de Ecología y Cambio Climático. <https://www.cmic.org.mx/sectores/medioambiente/nacional/CC/Municipios%20Vulnerables%20al%20CC.pdf>.
- Jessoe, Katrina, Dale T. Manning, and J. Edward Taylor. 2018. "Climate Change and Labour Allocation in Rural Mexico: Evidence from Annual Fluctuations in Weather." *Economic Journal* 128(608): 230–61. <https://doi.org/10.1111/ecoj.12448>.

- Jung, Courtney. 2003. "The Politics of Indigenous Identity: Neoliberalism, Cultural Rights, and the Mexican Zapatistas." *Social Research: An International Quarterly* 70(2): 433–61. <https://doi.org/10.1353/sor.2003.0025>.
- Kelly, Thomas J. 2001. "Neoliberal Reforms and Rural Poverty." *Latin American Perspectives* 28(3): 84–103. <https://doi.org/10.1177/0094582X0102800305>.
- Klinenberg, Eric, Malcolm Araos, and Liz Koslov. 2020. "Sociology and the Climate Crisis." *Annual Review of Sociology* 46(1): 649–69. <https://doi.org/10.1146/annurev-soc-121919-054750>.
- Liffman, Paul M. 2014. *Huichol Territory and the Mexican Nation: Indigenous Ritual, Land Conflict, and Sovereignty Claims*. University of Arizona Press.
- Loveman, Mara. 2014. *National Colors: Racial Classification and the State in Latin America*. Oxford University Press.
- Martínez Casas, Regina. 2007. *Vivir invisibles: la resignificación cultural entre los otomíes urbanos de Guadalajara*. CIESAS.
- Martínez Casas, Regina. 2014. "The Different Faces of Mestizaje: Ethnicity and Race in Mexico." In *Pigmentocracies: Ethnicity, Race, and Color in Latin America*, edited by Edward E. Telles. University of North Carolina Press.
- Martínez Novo, Carmen. 2006. *Who Defines Indigenous? Identities, Development, Intellectuals, and the State in Northern Mexico*. Rutgers University Press.
- Martínez, Caroline, Edward Telles, and Florencia Torche. 2025. "From Language to Self-Identification: Indigenous Classification in the Americas." *Social Forces* soaf152. <https://doi.org/10.1093/sf/soaf152>.
- Masferrer, Claudia, Erin R. Hamilton, and Nicole Denier. 2024. "Adding Return Migration to the Equation: U.S. Immigration Policy and Migrant Families in Mexico." In *Immigration Policy and Immigrant Families*, edited by Jennifer Van Hook, and Valarie King. Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-66679-7_2.
- Masferrer, Claudia, and Bryan R. Roberts. 2012. "Going Back Home? Changing Demography and Geography of Mexican Return Migration." *Population Research and Policy Review* 31(4): 465–96. <https://doi.org/10.1007/s11113-012-9243-8>.
- Massey, Douglas S. 1990. "Social Structure, Household Strategies, and the Cumulative Causation of Migration." *Population Index* 56(1): 3–26. <https://doi.org/10.2307/3644186>.
- Massey, Douglas S., Joaquín Arango, Graeme Hugo, Ali Kouaouci, Adela Pellegrino, and J. Edward Taylor. 1993. "Theories of International Migration: A Review and Appraisal." *Population and Development Review* 19(3): 431–66. <https://doi.org/10.2307/2938462>.
- Massey, Douglas S., and Kristin E. Espinosa. 1997. "What's Driving Mexico-U.S. Migration? A Theoretical, Empirical, and Policy Analysis." *American Journal of Sociology* 102(4): 939–99. <https://doi.org/10.1086/231037>.
- Massey, Douglas S., Luin Goldring, and Jorge Durand. 1994. "Continuities in Transnational Migration: An Analysis of Nineteen Mexican Communities." *American Journal of Sociology* 99(6): 1492–533. <https://doi.org/10.1086/230452>.
- Massey, Douglas S., Karen A. Pren, and Jorge Durand. 2016. "Why Border Enforcement Backfired." *American Journal of Sociology* 121(5): 1557–600. <https://doi.org/10.1086/684200>.
- Massey, Douglas S., and René Zenteno. 2000. "A Validation of the Ethnosurvey: The Case of Mexico-U.S. Migration." *International Migration Review* 34(3): 766–93. <https://doi.org/10.1177/019791830003400305>.
- McLeman, Robert. 2019. "International Migration and Climate Adaptation in an Era of Hardening Borders." *Nature Climate Change* 9(12): 911–18. <https://doi.org/10.1038/s41558-019-0634-2>.
- McSweeney, Carol, Gil Lizcano, Mark New, and Xiao Lu. 2010. "The UNDP Climate Change Country Profiles: Improving the Accessibility of Observed and Projected Climate Information for Studies of Climate Change in Developing Countries." *Bulletin of the American Meteorological Society* 91(2): 157–66.
- Méndez, Michael, Manuel Pastor, and Angelu C. Lesaca. 2024. "Climate Change, Migration, and Health Disparities at and Beyond the US-Mexico Border." *JAMA* 331(8): 696–97. <https://doi.org/10.1001/jama.2024.0228>.
- Mesoamerican Migration Project. n.d. Mesoamerican Migration Project Data Archive. Brown University. <https://mmp.research.brown.edu/mmp>.
- Murray-Tortarolo, Guillermo N. 2021. "Seven Decades of Climate Change Across Mexico." *Atmósfera* 34(2): 217–26. <https://doi.org/10.20937/ATM.52803>.
- Oak Ridge National Laboratory Distributed Active

- Archive Center. n.d. Daymet: Daily Surface Weather and Climatological Summaries. Oak Ridge National Laboratory Distributed Active Archive Center. <https://daymet.ornl.gov/>.
- Orrenius, Pia M., and Madeline Zavodny. 2009. "Do Immigrants Work in Riskier Jobs?" *Demography* 46(3): 535–51. <https://doi.org/10.1353/dem.0.0064>.
- Postero, Nancy Grey, and León Zamosc, eds. 2004. *The Struggle for Indigenous Rights in Latin America*. Liverpool University Press.
- Riosmena, Fernando, Raphael Nawrotzki, and Lori Hunter. 2018. "Climate Migration at the Height and End of the Great Mexican Emigration Era." *Population and Development Review* 44(3): 455–88. <https://doi.org/10.1111/padr.12158>.
- Rogé, Paul, Andrew Ronald Friedman, Marta Astier, and Miguel A. Altieri. 2014. "Farmer Strategies for Dealing with Climatic Variability: A Case Study from the Mixteca Alta Region of Oaxaca, Mexico." *Agroecology and Sustainable Food Systems* 38(7): 786–811. <https://doi.org/10.1080/21683565.2014.900842>.
- Ruggles, Steven, Lara L. Cleveland, Rodrigo Lovatón Dávila, et al. 2024. "IPUMS International: Version 7.5 [dataset]." IPUMS. <https://doi.org/10.18128/D020.V7.5>.
- Ruiz Medrano, Ethelia. 2010. *Mexico's Indigenous Communities: Their Lands and Histories, 1500–2010*. Translated by Russ Davidson. University Press of Colorado.
- Schewel, Kerilyn. 2020. "Understanding Immobility: Moving Beyond the Mobility Bias in Migration Studies." *International Migration Review* 54(2): 328–55. <https://doi.org/10.1177/0197918319831952>.
- Schlenker, Wolfram, and Michael J. Roberts. 2006. "Nonlinear Effects of Weather on Corn Yields." *Review of Agricultural Economics* 28(3): 391–98.
- Stark, Oded, and David E. Bloom. 1985. "The New Economics of Labor Migration." *American Economic Review* 75(2): 173–78.
- Stephen, Lynn. 2002. *Zapata Lives! Histories and Cultural Politics in Southern Mexico*. University of California Press.
- Stoney, Sierra, and Jeanne Batalova. 2013. "Mexican Immigrants in the United States." Migration Information Source. Migration Policy Institute. February 28. <https://www.migrationpolicy.org/article/mexican-immigrants-united-states-2011>.
- Telles, Edward E., and Project on Ethnicity and Race in Latin America (PERLA). 2014. *Pigmentocracies: Ethnicity, Race, and Color in Latin America*. University of North Carolina Press.
- Telles, Edward, and Florencia Torche. 2019. "Varieties of Indigeneity in the Americas." *Social Forces* 97(4): 1543–70. <https://doi.org/10.1093/sf/soy091>.
- Thiede, Brian C., and Clark L. Gray. 2017. "Heterogeneous Climate Effects on Human Migration in Indonesia." *Population and Environment* 39(2): 147–72. <https://doi.org/10.1007/s11111-016-0265-8>.
- Tosh, Sarah. 2023. *The Immigration Law Death Penalty: Aggravated Felonies, Deportation, and Legal Resistance*. NYU Press.
- Ureta, Carolina, Edgar J. González, Alejandro Espinosa, Alejandro Trueba, Alma Piñeyro-Nelson, and Elena R. Álvarez-Buylla. 2020. "Maize Yield in Mexico Under Climate Change." *Agricultural Systems* 177: 102697. <https://doi.org/10.1016/j.agsy.2019.102697>.
- Villarreal, Andrés. 2014a. "Ethnic Identification and Its Consequences for Measuring Inequality in Mexico." *American Sociological Review* 79(4): 775–806. <https://doi.org/10.1177/0003122414541960>.
- Villarreal, Andrés. 2014b. "Explaining the Decline in Mexico-U.S. Migration: The Effect of the Great Recession." *Demography* 51(6): 2203–28. <https://doi.org/10.1007/s13524-014-0351-4>.
- Waters, Mary C. 2025. "Preparing for Climate Migration and Integration: A Policy and Research Agenda." *Journal of Ethnic and Migration Studies* 51(1): 4–23. <https://doi.org/10.1080/1369183X.2024.2438449>.
- World Bank. 2022. *Climate Risk Country Profile: Mexico*. World Bank.
- Zahnaw, Renee, Ali Rad Yousefnia, Mahnoosh Haskanhani, and Ali Cheshmehzangi. 2025. "Climate Change Inequalities: A Systematic Review of Disparities in Access to Mitigation and Adaptation Measures." *Environmental Science & Policy* 165: 104021. <https://doi.org/10.1016/j.envsci.2025.104021>.
- Zhu, Julia Li, Nancy Chau, Amanda D. Rodewald, and Filiz Garip. 2024. "Weather Deviations Linked to Undocumented Migration and Return between Mexico and the United States." *Proceedings of the National Academy of Sciences* 121(46): e2400524121. <https://doi.org/10.1073/pnas.2400524121>.

PART II

Labor, Schooling, and Insurance Inequalities in Recovery

Impacts of Climate Hazards on Employment and Earnings by Hazard Type, Industry, Race, and Ethnicity



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We examine the relationship between climate-related disasters and subsequent county-level aggregate employment and earnings. We combine earnings and employment data from 2000 to 2023 with data on disasters to estimate local projection impulse response functions relating extreme disaster events to cumulative percent changes in employment and earnings. On average, disasters appear to reduce employment growth three to five years post disaster. There are small positive impacts on earnings. These results are largely driven by responses to hurricanes and tropical storms. Key rebuilding industries such as construction see short-term gains in employment that turn to losses in the longer-term that are similar to those in other industries. Hispanic and Latino workers see short-term gains in employment in part due to their representation in construction, which again turn to longer-term losses similar to those experienced by other racial and ethnic groups. An analysis of FEMA-supported disasters suggests that FEMA aid may be driving these results.

Keywords: employment, earnings, climate, natural disaster, racial disparities, FEMA aid, construction industry

Across the globe, climate-related hazards are becoming more and more commonplace. Analyses of the NatCatSERVICE natural catastrophes worldwide data clearly show an upward trend revealing an increase by a factor of about three within the last thirty-five years (Hoeppe 2016).

In addition, in the US the federal government is spending an increasingly large sum on aiding local communities in their recovery from these disasters (Ghaedi et al. 2024). In 2023 alone, the Federal Emergency Management Agency (FEMA) allocated over \$27 billion in aid through its Pub-

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lic Assistance (PA) program.¹ As climate-related hazards become more common events, and public assistance in response to these events is not guaranteed, we must understand how these disasters shape local economies. In this article we examine the earnings and employment impacts of a wide range of natural hazards at the county level. We examine impacts within the first few quarters after a natural hazard and up to five years later. This time horizon allows us to observe the immediate short-term responses to the destruction and the medium-term reconstruction efforts. This time period is long enough to allow for post-disaster adaptation to occur, but short enough to attribute changes causally to the disaster. In addition to examining different impacts by hazard type and industry, we are specifically interested in understanding the impacts on Black and Latino/a/x workers. These workers are often the most vulnerable to the negative consequences of climate-related hazards because they have weaker connections to the labor market and fewer personal resources to cushion them from the negative impacts of such a disaster (Ganong et al. 2020).

In this project we use the Census Bureau's Quarterly Workforce Indicators (QWI) dataset from 2000 through 2023, which includes information on county-level earnings and employment by industry and race and ethnicity, combined with the Spatial Hazards Events and Losses (SHELDUS) database, which reports hazard types as well as county-level dollar amounts from damages caused by natural hazards. We follow SHELDUS and operationalize a natural hazard as any event included in the database that is attributable to climatic or weather-related phenomena (for example, floods, hurricanes, wildfires). Together these data shed light on how local labor markets respond to climate hazards. We build on existing knowledge through expanding the set of climate hazards assessed and the types of industries analyzed. Critically, we add the dimension of race and ethnicity, to see if outcomes differ for more vulnerable populations.

We find evidence of heterogeneity of impacts on employment growth and earnings. On aver-

age, we find that natural hazards appear to reduce employment growth in the first two quarters post disaster followed by a return to baseline employment and possibly a slight increase one to two years post disaster (which we refer to as short-term) turning back to a cumulative employment reduction three to five years post disaster (which we consider to be medium-term). When looking separately at hazards by type, we see that the decrease seems to be driven by responses to hurricanes and tropical storms. When examining results by industry, we see that the longer-term losses are driven by outcomes in construction, accommodations and food services, as well as to a lesser extent, the health-care and social services industries. We find that the shorter-term increases are, unsurprisingly, driven by results in the construction sector. Finally, when examining results by race, we see that longer-term losses appear to be spread across all racial-ethnic groups while shorter-term increases are primarily experienced by Hispanic workers.

BACKGROUND AND LITERATURE

A natural disaster can shape a local economy through several pathways. First, a hazard could lead to capital depreciation. Capital depreciation occurs directly as a result of destroyed infrastructure, such as roads, ports, and rail lines. An inflow of aid can counteract these impacts and may even lead to improvements in infrastructure in the longer run, or aid could forestall these negative impacts for a few years. Second, a natural disaster could reduce productivity. This can arise directly by reducing a worker's ability to engage with the local economy if, for example, their own home is ruined. Again, the amount and nature of aid can shape this response in the longer run. A larger amount of aid in the short run could support construction efforts and thus the longer-term impacts on the local economy may not be observed until aid runs out. Third, a natural disaster could change the nature of local amenities. For example, if a nearby forest is burned down, this could impact tourism in the area, or cause people to move away since a key amenity is no longer a part of

1. Authors' calculations using FEMA OpenFEMA data.

the community. Alternatively, local investments that arise as a result of the disaster could also change this trajectory, perhaps even creating new amenities (Bilal and Rossi-Hansberg 2023; Boustan et al. 2020). Ultimately, how local economies respond to natural hazards, and the timing of this response are an empirical question and perhaps a policy choice.

There is a growing body of knowledge examining the economic impacts of natural disasters. A recent review of the literature by W. J. Wouter Botzen and colleagues (2019) synthesizes the significant negative direct and indirect economic consequences of these events, which include outcomes ranging from gross domestic product (GDP), GDP growth rate, trade flows, death counts, employment, per capita income, expenditures, migration, housing and other asset values, and government transfers. Botzen and colleagues (2019) highlight the lack of consensus within this literature. To provide some examples, one key finding in this body of work is a significant negative impact on GDP growth following a disaster. Gabriel Felbermayr and Jasmin Gröschl (2014) find that a hazard in the top 1 percent of the disaster index distribution reduces the GDP growth rate by 7 percent, but that these large impacts only hold for the most significant events. Another well-identified study by Solomon M. Hsiang (2010) examines the effect of cyclone intensity on economic activity in twenty-eight Caribbean-basin countries by sector, finding that agriculture, wholesale, retail, and tourism sectors are all impacted negatively by cyclones, whereas the construction sector grows. More recently, Stephanie Lackner (2018) shows that earthquakes reduce per capita GDP for low- and middle-income countries but may boost it for high-income countries. In an attempt to unify this literature, Laura Bakkensen and Lint Barrage (2025) develop an empirical-structural approach to studying the impacts of climate change on growth, highlighting the need for empirical researchers to understand impacts on the structural determinants of growth rather than growth itself. They provide empirical evidence on impacts of cyclones, finding a wide range of results from substantial negative effects on economic growth in vulnerable small island states to small gains, particularly in countries where risks are predicted to decline.

Examining the set of papers studying local labor market impacts within the United States, which is the focus of this article, we also find heterogeneity in outcomes. Anna Rhodes and Max Besbris (2022) provide a unique view into the responses of households in a middle-class community in Texas following Hurricane Harvey. After following fifty-nine households for two years, they bring to light a few key factors that shaped households' decision-making. Importantly, they note the strong connections many households feel to their community are one of the primary reasons many provide for staying. They also highlight that in addition to the availability of federal support, private insurance is also a key determinant of the households' ability to rebuild. In fact, they find that for households with flood insurance, some residents considered the experience an "opportunity" to rebuild and perhaps even added to the household's savings, whereas those without this additional insurance often had to take on additional debt. There are also a number of quantitative case studies of specific disasters, which again provide mixed results, highlighting the need for work that provides a broader view (see, for example, Vigdor 2008; Hornbeck 2012; Gallagher and Hartley 2017; Kirchberger 2017; Der-yugina et al. 2018; Groen et al. 2020; Meltzer et al. 2021). There are a small set of quantitative studies which examine a wider set of natural hazards within the US, which we summarize in table 1.

Focusing first on studies examining the impacts of hurricanes in the US, the broad consensus is that hurricanes lead to longer-term declines in county-level employment but perhaps increases in earnings. Ariel R. Belasen and Solomon W. Polachek (2008) study hurricanes in Florida using county-level employment data and find that earnings of the average worker in a Florida county rise by over 4 percent within the first quarter of being hit by a major Category Four or Category Five hurricane relative to counties not hit, and simultaneously employment falls between 1 and 5 percent depending on hurricane strength. Brigitte Roth Tran and Danel J. Wilson (2025) examine a wider set of hazards across the US but, when focusing only on hurricanes, find similar results for earnings. Eric Strobl (2011) examines hurricanes across the

Table 1. Summary of Key Empirical Articles on Local Economic Impacts of Climate Hazards in the United States

	Key Dependent Variables	Disaster Type (Data Source)	Main Findings
Belasen and Polachek (2008)	Earnings and employment	Hurricanes (NOAA) Florida	Earnings of average worker in Florida county rise within first quarter of being hit by a hurricane relative to counties not hit. Employment falls.
Strobl (2011)	Growth rate and migration	Hurricanes (NOAA) Coastal counties	County's annual economic growth rate falls as a response to out-migration of wealthier individuals.
Fussell et al. (2017)	Migration	Hurricanes (SHELDUS)	Counties with past population declines hardly experience changes in future populations. In growing counties hurricanes suppress future population growth.
Boustan et al. (2020)	Migration	Wide range (FEMA and American National Red Cross [ARC])	Disasters increase out-migration rates at the county level. Migration response to milder disasters is smaller but is increasing over time.
Noy and Strobl (2023)	Innovation	Hurricanes (NOAA)	Hurricanes lead to a temporary boost in damage-mitigating patents a few years after the event. However, there is long-term general reduction of innovation after a damaging storm.
Pleninger (2022)	Income distribution	Wide range (FEMA)	Natural disasters have a damaging effect on middle incomes and little impact on overall income distribution.
Coulombe and Rao (2025)	Employment	Fires (NOAA)	Increased fire exposure causes lower employment growth in the longer and the medium run.
Tran and Wilson (2025)	Earnings and employment	Wide range (FEMA and SHELDUS)	Disasters increase total and per capita income and employment over the longer run, with impacts strongest for disasters that cause the greatest damage.
Walls and Wibbenmeyer (2023)	Employment	Fires (USGS MTBS)	Major wildfires lead to county-level employment growth for up to a year after a fire but have no significant impacts after that.

Source: Authors' compilation.

coastal USA and finds that hurricanes reduce a county's annual economic growth rate by 0.45 percentage points, with 28 percent of it due to richer individuals moving away from affected counties. Elizabeth Fussell and colleagues (2017) find that counties with past population declines hardly experience changes in population as a result of a hurricane, but in growing counties hurricanes suppress future population growth. Ilan Noy and Eric Strobl (2023) find that hurricanes lead to a temporary boost in damage-mitigating patents a few years after the event, but there is a long-term general reduction of innovation after a damaging storm.

Looking next at studies examining the impacts of wildfires on local economies, here we see results are more mixed. Raphaelle G. Coulombe and Akhil Rao (2025) examine local labor market impacts of fires and find that increased fire exposure causes lower employment growth in the short and medium run, with medium run impacts linked to migration. Tran and Wilson (2025) find no statistically significant impacts of fires on earnings. Margaret A. Walls and Matthew Wibbenmeyer (2023) find positive impacts of major wildfires on county-level employment growth for up to one year after a fire, but no significant effects after that.

There are also a few studies that examine the impacts of a wide range of natural hazards on local economies on a related but different set of outcomes, including mobility and inequality, again finding a mixed set of outcomes. Leah Platt Boustan and colleagues (2020) construct a long panel examining a broad set of natural hazards and find that disasters increase out-migration rates at the county level by 1.5 percentage points and lower housing prices and rents by 2.5–5 percent. They find that migration responses to milder disasters are smaller but increasing over time. When focusing on particular hazard types, they find that wildfires and hurricanes encourage out-migration, while floods actually attract in-migrants to an area.² Storms and tornadoes have no effect on migration flows. Regina Pleninger (2022) examines

the impacts of a wide range of natural hazards on county-level income distributions and finds that impacts are most damaging for middle incomes, with little impact on overall income distribution. She finds results are mostly driven by heavy storms and hurricanes.

Most closely related to our article, Tran and Wilson (2025) examine the impacts of a wide range of natural hazards on earnings and employment and find that disasters increase total and per capita income over the longer run. They find that this effect is driven initially by an employment boost and in the longer run by higher wages. They find that these results are primarily driven by tornadoes and hurricanes. They also find that over the longer run, house prices increase while population is roughly flat, especially in areas with inelastic housing supply. They find that the longer-run increase in income is largest for the most damaging disasters.

Overall, the results from these studies suggest that local economic impacts of climate hazards vary widely, particularly in relation to our key economic constructs of interest, earnings and employment, with some studies finding positive impacts on earnings, others finding no impacts, some finding positive impacts on employment, and others finding negative impacts on employment. One reason that these findings may vary is that impacts of natural hazards will affect individual sectors of a local economy differently. For example, in construction we expect to see increases in both earnings and employment following a natural disaster, but in other industries, particularly those providing services, we may expect to see declines in both earnings and employment.

Only a few of these studies examined impacts on earnings and employment within particular sectors. Beginning with construction, a sector where theory most strongly predicts an increase in employment and earnings, due to the strong demand generated in this sector post-natural hazard, authors find some evidence of a positive impact on earnings and employment and

2. Recent work by Tarikua Erda (2025) examines how manufacturing firms readjust their capital (particularly machinery) in response to federally declared floods. She finds evidence that while floods degrade capital, the firms that survive replace capital and see higher productivity as a result of this upgrading. This provides some evidence that surviving firms “build back better” in response to climate hazards.

some evidence of no impact. Belasen and Polachek (2008) find positive impacts on earnings and no impacts on employment in the construction sector. In contrast, Tran and Wilson (2025) find the initial boost in employment they observe is driven by this sector, with larger impacts for natural hazards causing more damage. Similarly, Walls and Wibbenmeyer (2023) find positive impacts on construction employment growth for up to six quarters after the fire.

In contrast, we expect employment and earnings to be negatively impacted in most other industries, at least in the short run, as a result of individual negative consequences of natural hazards, which is reflected in the literature. Belasen and Polachek (2008) find negative or no impacts on earnings and employment growth in manufacturing, trade, transportation, utilities, finance, investment, and real estate but positive impacts on employment and earnings in the service sector. Walls and Wibbenmeyer (2023) find negative or no effects on employment growth in all non-construction industries, including the service sector. Tran and Wilson (2025) do not separately examine earnings and employment impacts for industries other than construction. Our work examines earnings and employment outcomes in each of these sectors by natural hazard type for the most severe natural hazards to help reconcile existing findings and gain further understanding of how natural hazards shape local economies.

Our work also builds on our understanding of the heterogeneity of impacts by race and ethnicity, an area where there has been even less research. One notable exception is an article by Jeffrey A. Groen and colleagues (2020), who use the Longitudinal Employer-Household Dynamics (LEHD) to examine the impacts of both Hurricane Katrina and Hurricane Rita on individual outcomes. Overall, they find that in the short term, earnings of affected individuals suffer, but in the long term, earnings of affected individuals outpaced the earnings of individuals in the control sample. They include evidence that these earnings gains were a result of wage growth in affected areas relative to control areas, driven by limited labor supply and growing labor demand, particularly in sectors tied to rebuilding. When looking separately at outcomes for Black workers, they find that in the short

run Black workers experience larger earnings losses than White workers and in the longer run, though both White and Black workers experience gains in wage growth; Black workers experience less wage growth than White workers. Our study is the first to estimate heterogeneous earnings and employment impacts of a wide range of natural hazards across counties in the US for Black and Latino workers who overall have less household wealth and therefore less of a buffer against the economic hardships brought on by climate-related disasters (Ganong et al. 2020).

Overall, our work extends existing knowledge by examining a wider set of natural disasters, studying a wider set of industries, and investigating whether there are heterogeneous effects among economically vulnerable populations, specifically Black and Latino individuals.

DATA AND METHODOLOGY

Our analysis draws primarily on two datasets. One is a publicly available data source, the QWI. The other is a proprietary dataset, the SHEL-DUS, currently supported by the Center for Emergency Management and Homeland Security at Arizona State University (ASU).

The QWI contains county-level data on employment, wages, hiring, and layoffs by industry type and worker demographics from 1990 for some states, through the present. These data are generated from unique job-level data, the LEHD, that link workers to their employers. For this reason, these data are available by race and ethnicity, in addition to county and industry. We use data on total county-level employment and earnings, as measured at the start of each quarter. Our baseline sample includes 3,109 counties from the 48 continental states plus Washington, DC. Of these counties, 849 are metropolitan counties.

In tables 2 and 3 we present descriptive statistics drawn from the QWI on employment and earnings. Table 2 shows that across all counties and year-months between 2000 and 2022, the average county had 42,321 workers, who earned on average \$3,698 per month (in 2022 dollars). We see that the highest industry-level employment at the county level is in the health care and social assistance category, and the highest average earnings occur in the utilities sector.

Table 2. Average Quarterly Employment and Earnings (Workers per County) by Industry

	N	Employment	N	Earnings
All workers	279,664	42,321	279,664	3,698
Agriculture, forestry, fishing and hunting	255,808	404	272,504	3,078
Mining, quarrying, and oil and gas extraction	134,452	404	215,283	5,647
Utilities	160,309	293	246,714	7,498
Construction	274,172	2,179	278,205	3,962
Manufacturing	260,513	4,579	273,406	4,597
Wholesale trade	267,996	1,920	276,735	5,076
Retail trade	277,423	4,873	279,221	2,487
Transportation and warehousing	264,052	1,547	275,549	3,915
Information	235,423	1,190	268,606	4,343
Finance and insurance	270,762	1,917	277,826	4,993
Real estate and rental and leasing	239,225	775	265,184	2,982
Professional, scientific, and technical services	269,345	2,657	276,992	4,634
Management of companies and enterprises	131,095	1,472	199,605	6,002
Administration and support and other	251,550	2,919	270,390	2,890
Educational services	155,109	1,449	215,533	2,953
Health care and social assistance	272,363	5,450	277,451	3,406
Arts, entertainment and recreation	214,101	854	258,575	1,835
Accommodation and food services	274,035	3,712	278,265	1,338
Other services	272,892	1,405	277,702	2,578

Source: Authors’ calculations from the Quarterly Workforce Indicators, Longitudinal Employer-Household Dynamics, US Census Bureau.

Note: Sample sizes (N) represent unique observations for county-year-quarter from 2000 to 2022. Earnings are quarterly averages of monthly earnings, adjusted for inflation and reported in 2022 dollars.

Table 3. Average Monthly Employment and Earnings by Worker Race and Ethnicity

	N	Employment	N	Earnings
American Indian or Alaska Native	280,375	228	274,025	3,159
Asian	280,375	2,188	276,149	4,509
Black	280,375	5,107	276,252	2,893
Hispanic or Latino	280,375	5,876	279,092	2,834
Native Hawaiian or Other Pacific Islander	280,375	62	239,105	3,003
Two or more race groups	280,375	529	277,542	3,081
White	280,375	28,217	279,644	3,947

Source: Authors’ calculations from the Quarterly Workforce Indicators, Longitudinal Employer-Household Dynamics, US Census Bureau.

Note: Sample sizes (N) represent unique observations for county-year-quarters from 2000 to 2022. Earnings are quarterly averages of monthly earnings, adjusted for inflation and reported in 2022 dollars.

Table 3 presents earnings and employment by race and ethnicity. We see that Asian workers have the highest average earnings per month (\$4,509) among the identified racial groups, and White workers comprise the largest share of workers in these data. Average monthly earnings in a county by racial and ethnic groups are also presented in table 3. Here we see that Asian workers have the highest average earnings and White workers are just below. The average earn-

ings are lowest for Black and Hispanic or Latino workers.

SHELDUS is a county-level hazard dataset for the country beginning in 1960 that covers disasters such as thunderstorms, hurricanes, floods, wildfires, and tornadoes, in addition to perils such as flash floods and heavy rainfall. These data include information on the type, date, and county of an event as well as the direct losses caused by the event (property and crop losses as well as fatalities). We then assign each hazard to a quarter to align it with the quarterly QWI data. We have acquired SHELDUS data through 2022.³

We present some descriptive statistics on the SHELDUS data in tables 4, 5, and 6 and figures 1, 2, and 3. In table 4 we show that our data cover sixteen different types of natural hazards, with the most common category being wind events, followed by flooding. Figure 1, panel A shows the distribution of each of these events over the course of our study period. Table 5 presents descriptive statistics on the three types of damages in our data: property damages, crop damages, and fatalities. The average property damage is almost \$3 million, but this high average is driven by a few events that caused severe damages, the most significant one being Hurricane Katrina. When looking at crop damages, we see that the averages are already much lower. When looking at fatalities, we see that the county experiencing the largest loss from a natural hazard, lost 638 people, again, attributable to Hurricane Katrina. In table 6 we classify hazards by the amount of property damage caused. We create

five different categories and for the remainder of our analysis we focus on those hazards which we classify as extreme hazards. To create this cutoff we searched for the closest round number that included at least the top 2 percent of hazards, which we found to be \$10 million in property damages. Figure 1, panel B shows the distribution of these hazards over our study period and we see a significant amount of varia-

Table 4. Natural Hazard Types

	Count	Percent
Avalanche	574	0.5
Coastal storm	389	0.4
Drought	1,321	1.2
Flooding	18,219	16.2
Fog	170	0.2
Hail	5,516	4.9
Heat	416	0.4
Hurricane or tropical storm	1,993	1.8
Landslide	428	0.4
Lightning	4,222	3.8
Seismic activity	41	0.0
Severe storm or thunderstorm	1,148	1.0
Tornado	8,098	7.2
Wildfire	1,461	1.3
Wind	59,505	53.1
Winter weather	8,654	7.7
Total	112,155	100

Source: Authors' calculations using SHELDUS data for hazards with nonzero damages from 2000 to 2022.

Table 5. Natural Hazard Damages

	Mean	Standard Deviation	Minimum	Maximum
Property damages	2,976,311	112,408,756	0	21,459,998,720
Crop damages	348,596	7,795,727	0	1,050,000,000
Fatalities	0.08	1.94	0	638

Source: Authors' calculations using SHELDUS data for hazards with nonzero damages from 2000 to 2022.

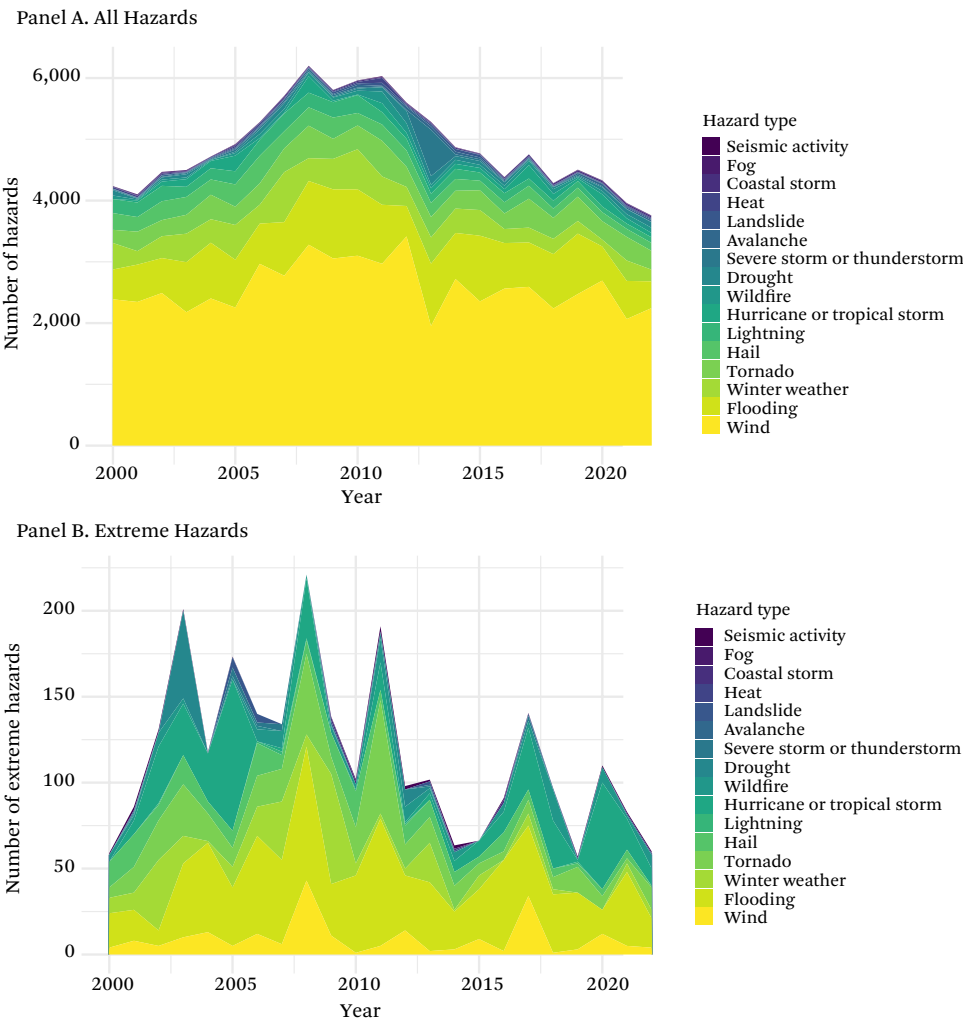
3. This dataset was originally supported by grants from the National Science Foundation and the University of South Carolina's Office of the Vice President for Research and is now managed and supported by the Center for Emergency Management and Homeland Security at ASU. Data for South Carolina and Arizona are publicly available; however, data for the remaining states are the property of ASU and must be purchased.

Table 6. Natural Hazards by Property Damage

	Count	Percent
Minor prop damages (<25k)	50,988	45.5
Moderate prop damages (≥25k and <100k)	25,246	22.5
Significant prop damages (≥100k and <1m)	25,108	22.4
Major prop damages (≥1m and <10m)	8,177	7.3
Extreme prop damages (≥10m)	2,636	2.4
Total	112,155	100

Source: Authors’ calculations using SHELDUS data for hazards with nonzero damages from 2000 to 2022.

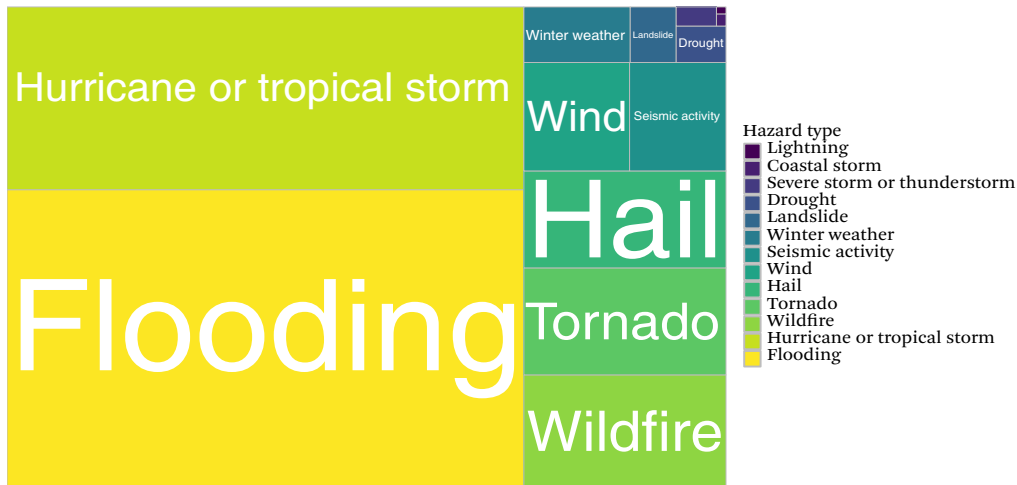
Figure 1. Climate Hazard Counts by Type, 2000–2022



Source: Authors’ calculations from SHELDUS data.

Note: Seismic activity includes earthquakes, tsunamis, and volcanic eruptions. The optimal way to view this figure is in color. We refer readers of the print edition of this article to <https://www.rsfsjournal.org/content/12/4/134> to view the color version.

Figure 2. Extreme Hazards Property Damage Shares by Hazard Type, 2000–2022



Source: Authors' calculations from SHELUDS data.

Note: Seismic activity includes earthquakes, tsunamis, and volcanic eruptions. Damages are measured in real 2022 dollars. The optimal way to view this figure is in color. We refer readers of the print edition of this article to <https://www.rsfjournal.org/content/12/4/134> to view the color version.

tion both in the number and type of hazard over the study period. Figure 2 presents a tree diagram of property damages for extreme hazards, showing that flooding causes the most amount of damage, followed by hurricanes or tropical storms and then wildfires, tornadoes, and hail. Figure 3 shows that for these extreme hazards we see variation within states as well as across states, with variation both in terms of the intensity of the damages caused by these hazards as well as the type of hazard.

To shed light on how natural hazards shape the local labor market immediately after the event, we start with a set of descriptive analyses. We then perform a more systematic examination by following Tran and Wilson (2025) who model the impacts of natural hazards on aggregate county-level earnings and employment as impulse response functions by using a panel-data variation of Òscar Jordà's (2005) local projection method:

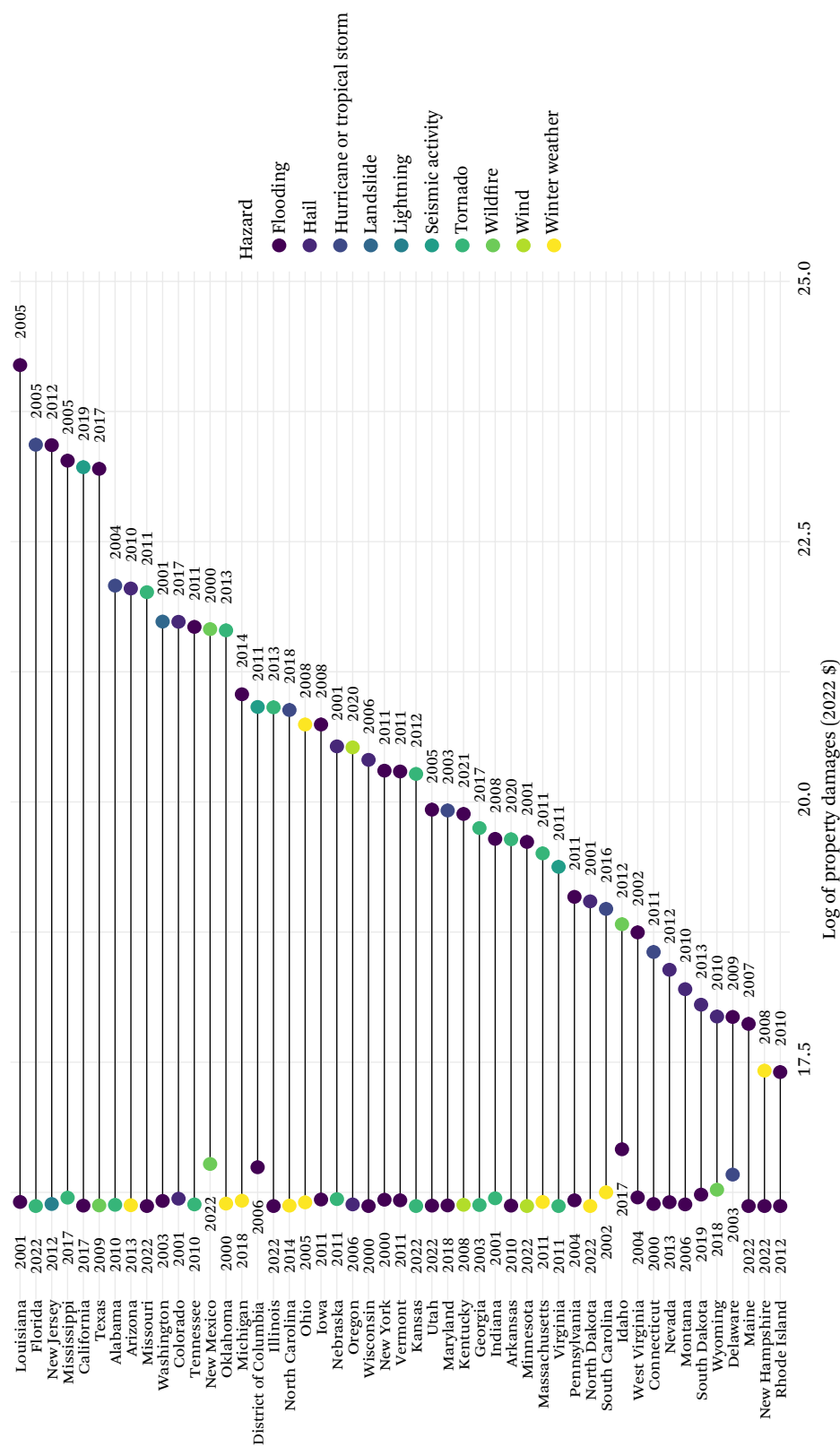
$$y_{c,t+h} - y_{c,t-1} = \beta^h D_{c,t} + \sum_{\tau=-p}^{-1} \delta^\tau D_{c,t+\tau} + \delta^h X_{c,t+h} + \alpha_c + \alpha_q + \alpha_{r(c),t} + \varepsilon_{c,t+h}$$

In this model, $Y_{c,t}$ represents our two outcome variables—employment and earnings—in county c , at time t . We measure employment at

the quarterly level as the number of workers who are employed in a county at the beginning of the quarter. We measure real earnings in 2022 dollars as the quarterly average of average monthly earnings per worker. Both outcome variables are logged. The dependent variable $y_{c,t+h} - y_{c,t-1}$ then measures the cumulative differences in the outcome variables from a baseline quarter ($t-1$) over a horizon of h quarters, where h spans from twelve quarters (three years) before the hazard event to twenty quarters (five years) after the hazard event. A separate regression is run for each value of h . The coefficient of interest is β^h , which measures the relationship between the occurrence of an extreme hazard event in county c at time t —as represented by the indicator variable $D_{c,t}$ —and the cumulative change in the outcome at time horizon h . Using the log form of the outcomes variables means we interpret β^h as a percent change in the outcome variable relative to the baseline value.

The second term on the right-hand side of the regression model represents a series of indicator variables that control for whether any other natural hazard with nonzero property damages occurred p quarters before the extreme hazard event. We choose twelve quarters as the

Figure 3. Minimum and Maximum Property Damages by State of Extreme Hazards, 2000–2022



Source: Authors' calculations from SHELUDUS data.

Note: Seismic activity includes earthquakes, tsunamis, and volcanic eruptions. The optimal way to view this figure is in color. We refer readers of the print edition of this article to <https://www.rsfjournal.org/content/12/4/134> to view the color version.

value of p . We define the pre-disaster period as the twelve quarters (three years) preceding the event because this window provides a stable baseline against which to measure post-disaster deviations, capturing typical economic dynamics while avoiding confounding from earlier hazard events. A three-year period also aligns with the temporal scale used in prior disaster economics studies (Belasen and Polachek 2008; Strobl 2011) and provides sufficient data points for testing pre-trends in our event-study framework.

The third term is a continuous variable that controls for how many additional climate hazards with nonzero property damages occurred in county c between the extreme hazard of interest at time $t = 0$ and the estimation period $t + h$. The variables α_c and α_q represent county and quarter fixed effects, respectively. Including county fixed effect controls for any non-time-varying county characteristics, while including quarter fixed effects controls for the cyclicity of earnings and employment across quarters. We also control for region by quarter fixed effects ($\alpha_{r(c),t}$) to account for any regional trends in employment or earnings that may occur simultaneously with the climate hazard horizon. To identify heterogeneity of these relationships by disaster type, industry, and race and ethnicity, we perform subgroup analyses of the same estimation model.

We split our data into two groups, counties with an extreme hazard and those with a less severe hazard (we drop four counties that have no hazard during the full study period). We then adjust our data so that time zero is the date of the first extreme hazard, or other moderate hazard in that county for the remaining counties. We then examine mean employment and earnings three years before and five years after the hazard.

RESULTS

We begin by presenting uncontrolled means for both employment and earnings in figure 4, separating extreme hazards from all other hazards. In panel A we see that on average employment growth seems to flatten after a county experiences an extreme natural hazard, but we see no change in slope in counties experiencing less severe hazards. When looking at earnings, in

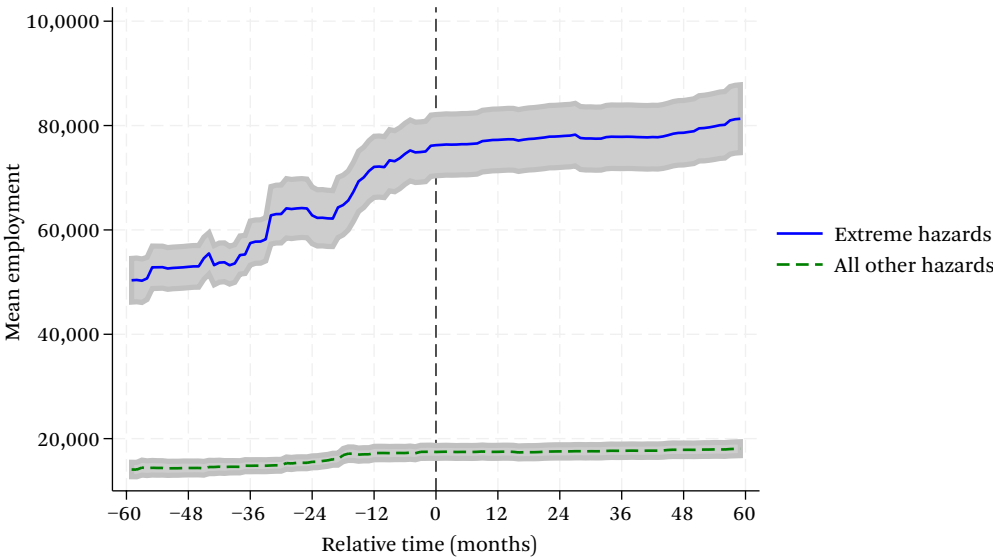
figure 4, panel B, it appears that there is no change in slope after a county experiences a natural hazard, either of the extreme type or one that causes less damage.

We next present results from our regression models. We begin with aggregate results and then present results by hazard type, industry, and race and ethnicity. We present aggregate results for employment in figure 5, panel A. We see here that in the first few quarters after an extreme hazard, employment drops before experiencing a small upward trend, relative to previous trends, but that by the three-year mark it appears that employment growth slows, relative to trends previous to the hazard. These results appear to persist up through five years post hazard. Our estimates show that three to five years post natural hazard, employment growth declines by 0.5 percent. These results are economically meaningful and in line with the literature, which could suggest a slow and perhaps permanent reallocation of labor away from the market following a climate hazard. Specifically, our results align with those of Belasen and Polachek (2008) who look at employment outcomes post hurricane, as well as those of Coulombe and Rao (2025) and Walls and Wibbenmeyer (2023), who examine outcomes post fire exposure. The results are also similar to those of Tran and Wilson (2025) when looking at the five-year time horizon for all hazards. However, Tran and Wilson observe possible gains in employment when looking further out as areas have more time to recover from adverse climate events, and when focusing only on extreme hazards. Given this long time period, the causal link between the climate event and the hazard itself becomes less clear, and thus the majority of the economic literature, including our analysis, focuses on the three- to five-year period post hazard.

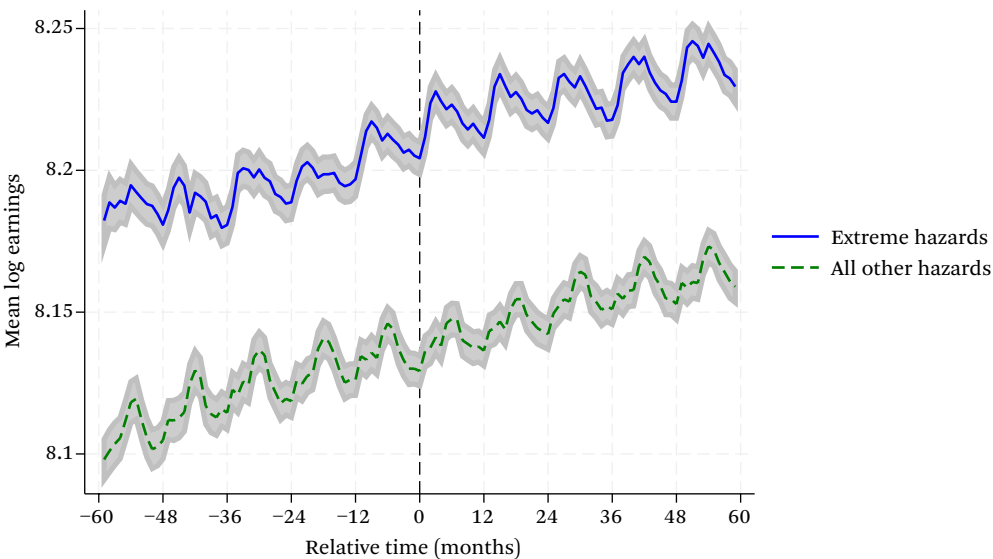
In figure 5, panel B, we see a slight, but sustained, increase in earnings post hazard. When examining each subsequent layer of heterogeneity, however, earnings trends seem largely unchanged by the occurrence of an extreme hazard. For this reason, we focus the remainder of the analysis on results for employment. We include results for earnings in appendix tables and pull out a few key results that appear to be driving the main earnings result in figure 5, panel B.

Figure 4. Means of Outcome Variables over Time by Severity of Climate Hazard Event

Panel A. Employment



Panel B. Earnings

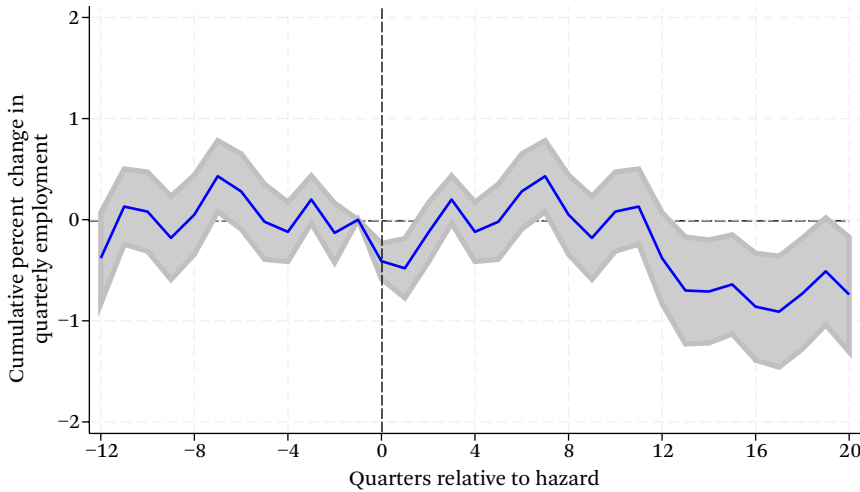


Source: Authors' calculations from the Quarterly Workforce Indicators, Longitudinal Employer-Household Dynamics, US Census Bureau, and SHELDS.

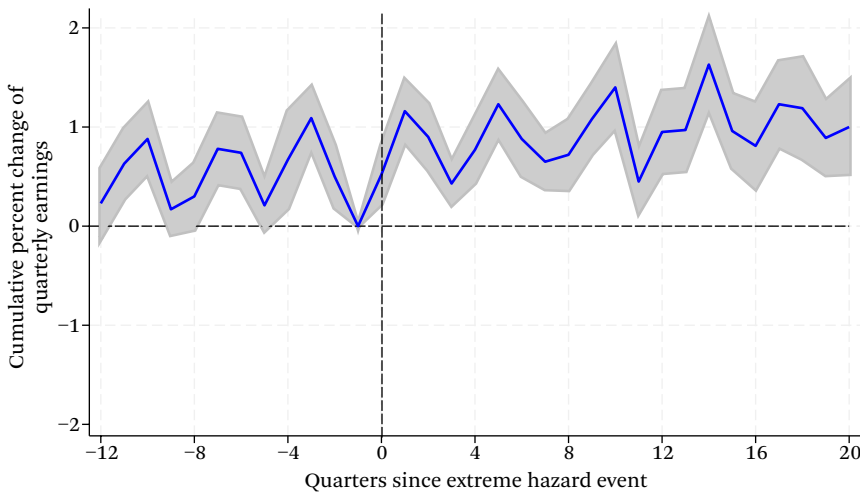
Note: Earnings are quarterly averages of monthly earnings, adjusted for inflation and reported in 2022 dollars.

Figure 5. Impulse Response Functions for Employment and Earnings

Panel A. Employment



Panel B. Earnings



Source: Authors' calculations from model (1) using data from the Quarterly Workforce Indicators, Longitudinal Employer-Household Dynamics, US Census Bureau, and SHELDS.

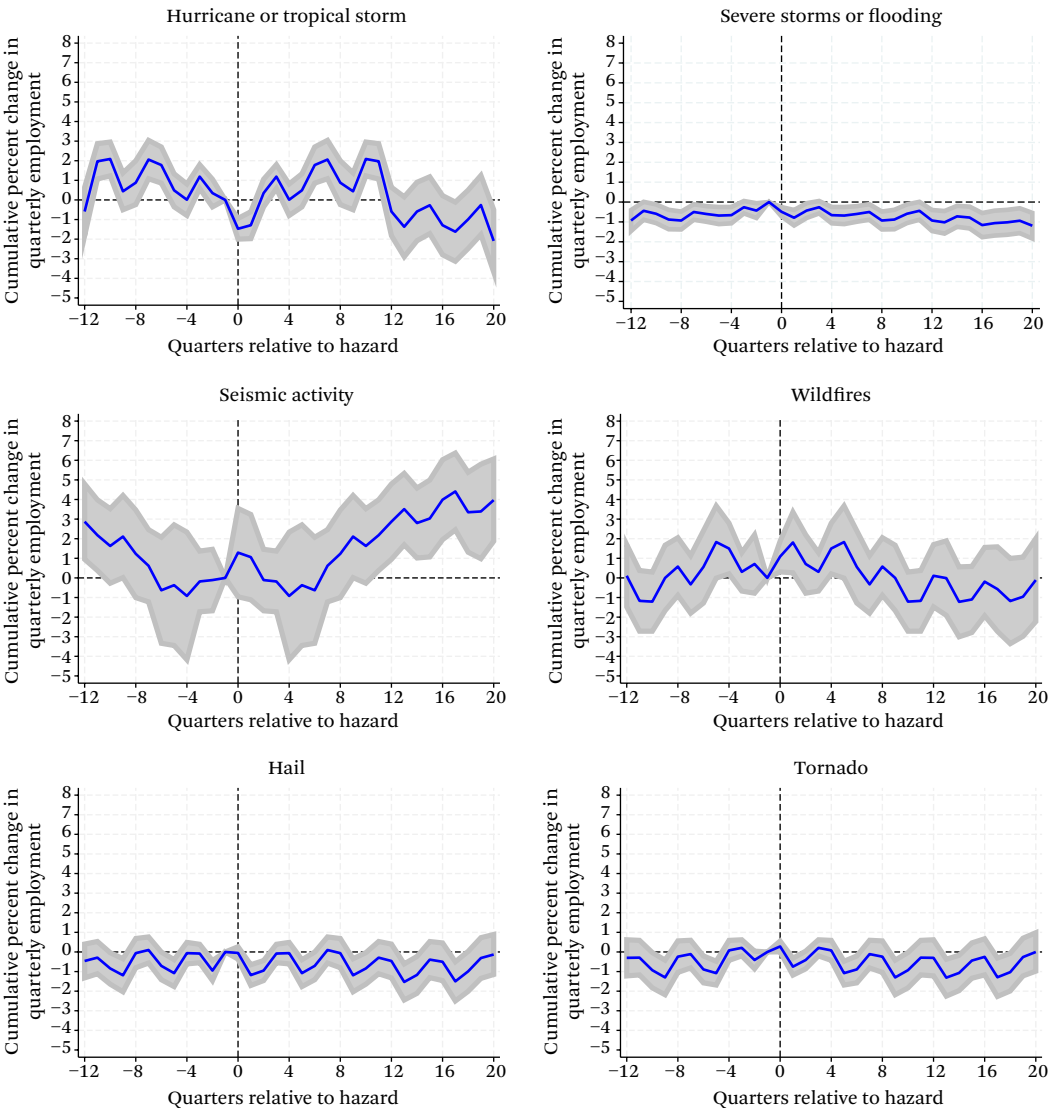
Note: Earnings are quarterly averages of monthly earnings, adjusted for inflation and reported in 2022 dollars.

Figure 6 presents results by hazard type. Here we see that trends look very different for each of these disaster types. Specifically, we see that in the example of Hurricanes and Tropical Storms, there is a decrease in employment in the immediate aftermath of the hazard, but employment actually increases over the course of

the three to twelve quarters post hazard before leveling out to pre-hazard levels. These post-hurricane and tropical storm gains are also realized in earnings as sustained positive earnings growth for the full twenty quarters (see online appendix figure A.1).⁴ No other hazard type exhibits positive earnings growth, leading us to

4. The online appendix can be found at <https://www.rsfjournal.org/content/12/4/134/tab-supplemental>.

Figure 6. Impulse Response Functions for Employment by Hazard Type



Source: Authors' calculations from model (1) using data from the Quarterly Workforce Indicators, Longitudinal Employer-Household Dynamics, US Census Bureau, and SHELDUS.

Note: Earnings are quarterly averages of monthly earnings, adjusted for inflation and reported in 2022 dollars.

believe the overall earnings results in figure 5, panel B, are driven by the results for hurricanes and tropical storms. We hypothesize that this increase in employment and earnings is driven by federal and local investments resulting from the occurrence of named and damaging storms. In contrast, when looking at storms and floods that are not classified as hurricanes and thus

possibly do not receive the same type of aid, but in this case also cause over \$10 million in damages, we find no significant increase in employment post hazard. Surprisingly, we see no evidence of employment impacts post wildfires in contrast to studies by Coulombe and Rao (2025) and Walls and Wibbenmeyer (2023). We also see no impacts post hail or tornadoes. We do, how-

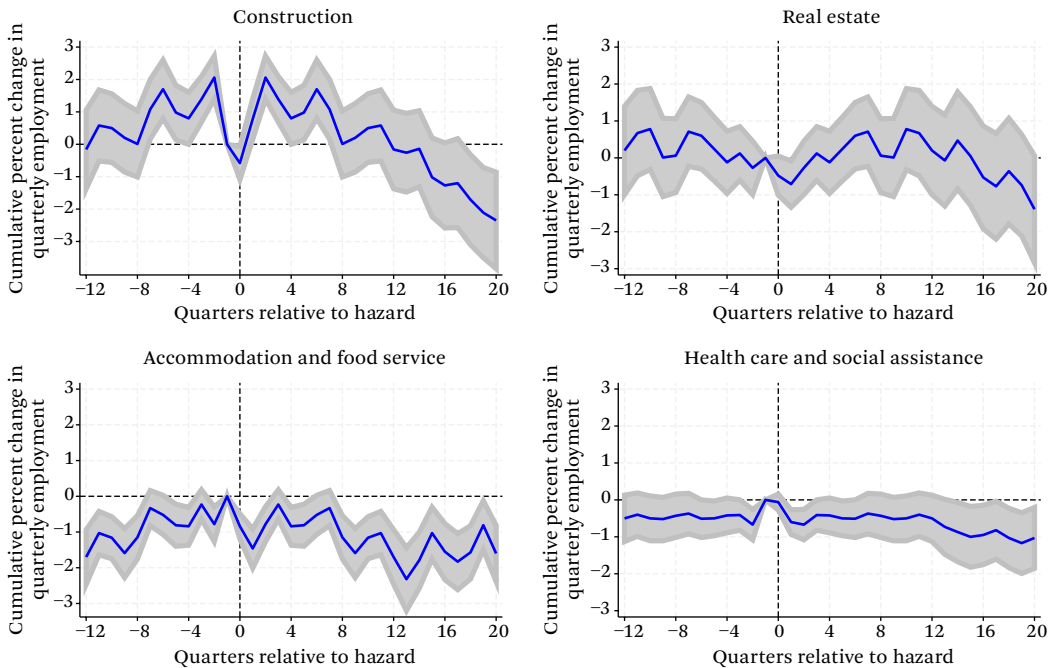
ever, find some evidence that suggests build back better may describe results post seismic activity.

To gain additional insights into the mechanisms driving these findings, we examine employment impacts by industry, presenting results in figure 7. Not surprisingly, we find the increases in employment immediately following a hazard appear to be driven by changes in construction employment. We also see some evidence of elevated churn in the real estate industry, but these impacts are not statistically significant. We do, however, see longer-term declines in both the accommodations and food services industry as well as the health-care and social assistance industries. We do expect to see these longer-term declines in accommodations and food services as places impacted by natural hazards may become less attractive for tourists in the years following a hazard. Results in the health care and social assistance sector appear

more surprising and perhaps could be a result of longer-term losses in local budgets that result from the hazard.

Finally, figure 8 presents results by race and ethnicity. Here we see that the slight increase in employment that occurs in the three to twelve quarters after a natural hazard is primarily experienced by Hispanic households. This could be driven by the fact that they are overrepresented in the construction industry. Three years after an extreme hazard, however, Hispanic workers begin to experience declines in employment that eventually become as large as the declines experienced by all other groups. In contrast, we see little medium-term employment impacts for Black workers, though patterns do follow national trends with a small decrease in the immediate aftermath of the hazard. These results suggest that shorter-term benefits associated with hazards are relatively concentrated, whereas the longer-term costs appear to

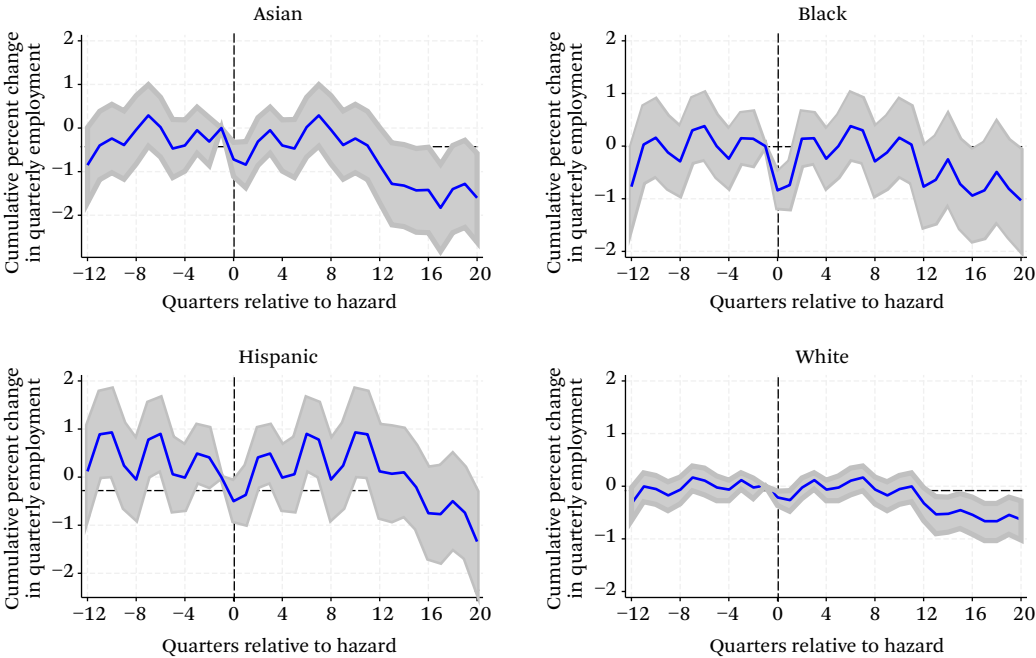
Figure 7. Impulse Response Functions for Employment by Industry



Source: Authors' calculations from model (1) using data from the Quarterly Workforce Indicators, Longitudinal Employer-Household Dynamics, US Census Bureau, and SHELUDS.

Note: Earnings are quarterly averages of monthly earnings, adjusted for inflation and reported in 2022 dollars.

Figure 8. Impulse Response Functions for Employment by Race/Ethnicity



Source: Authors' calculations from model (1) using data from the Quarterly Workforce Indicators, Longitudinal Employer-Household Dynamics, US Census Bureau, and SHEL-DUS.
Note: Earnings are quarterly averages of monthly earnings, adjusted for inflation and reported in 2022 dollars.

be more spread out over these different groups, though overall patterns do look similar for each racial and ethnic group.

FEMA AID AS A MECHANISM

To gain some insight into the impacts of public assistance on county-level employment patterns post-natural hazard, we have matched the extreme hazards we identify in the SHEL-DUS data with the FEMA Presidential Disasters Declarations (PDD) dataset, using FEMA Open-FEMA data. This publicly available dataset is used to track when and where federal assistance is authorized in response to a major disaster declaration issued by the US president. We matched extreme hazard events from these two datasets by county, year, and quarter. For example, if an extreme hazard occurred in the same county and year in both datasets and within a one-quarter window before or after, we considered the extreme hazard in the SHEL-

DUS dataset to be a FEMA declared presidential hazard. We present the results of this merge in table 7. We see that overall 64.5 percent of our extreme hazards from the SHEL-DUS data are identified as FEMA PDDs. We use these matched disasters as a proxy measurement of natural hazards that receive significant aid. Specifically, we are going to argue that an extreme hazard in the SHEL-DUS dataset likely received FEMA aid if it matches to a hazard in the FEMA PDDs dataset. If there is no match between the two datasets, we are going to argue that the SHEL-DUS extreme hazard did not receive FEMA aid. Since we do not have the actual aid dollars received, our second-best alternative is this proxy.

Our strongest predictions about how FEMA aid impacts employment or earnings are through increased investment in the construction industry to build back after a natural disaster. To examine this relationship, we then

Table 7. FEMA/SHELDUS Match Rate by Hazard Type

	Match Number	Total Number	Match Percent
Hail	48	220	21.8
Hurricane or tropical storm	386	409	94.4
Seismic activity	5	15	33.3
Severe storm, thunderstorm, or flood	703	883	79.6
Tornado	213	391	54.5
Wildfire	31	121	25.6
Other	315	597	52.8
Total	1,701	2,636	64.5

Source: Authors' calculations from the match between extreme hazards in SHELDUS data and the FEMA Presidential Disasters Declarations dataset.

stratify our sample by whether or not the SHELDUS extreme disaster was identified in the FEMA dataset and estimate the impulse response functions by industry separately for FEMA-supported disasters and those that did not receive FEMA aid. We present these results in figure 9.

When looking at results within the construction industry, we do see clear differences in employment responses when disasters are FEMA declarations versus not FEMA declarations. The initial bump observed within construction is only apparent in the FEMA declarations, not in the disasters that are not matched to FEMA. This provides some suggestive evidence that initial employment growth is tied to assistance. Additionally, the longer-term decline in employment is only observed in the counties with no FEMA disasters, again suggesting that aid may be a central part of the story. Looking next at the real estate industry, results in the FEMA and no FEMA categories do not appear statistically different from one another, but there are slight differences in trends that perhaps align with theory here. We do see slight increases in employment in real estate in the three- to five-year window after a hazard for FEMA declarations, but no such impact in the non-FEMA hazards. Again, this provides some suggestive evidence that aid does bolster local economic recovery, particularly in the industries where aid is directed. In both the accommodations and health-care industries, we do not see much of a difference in trend in matched versus unmatched hazards, which is perhaps not so surprising as

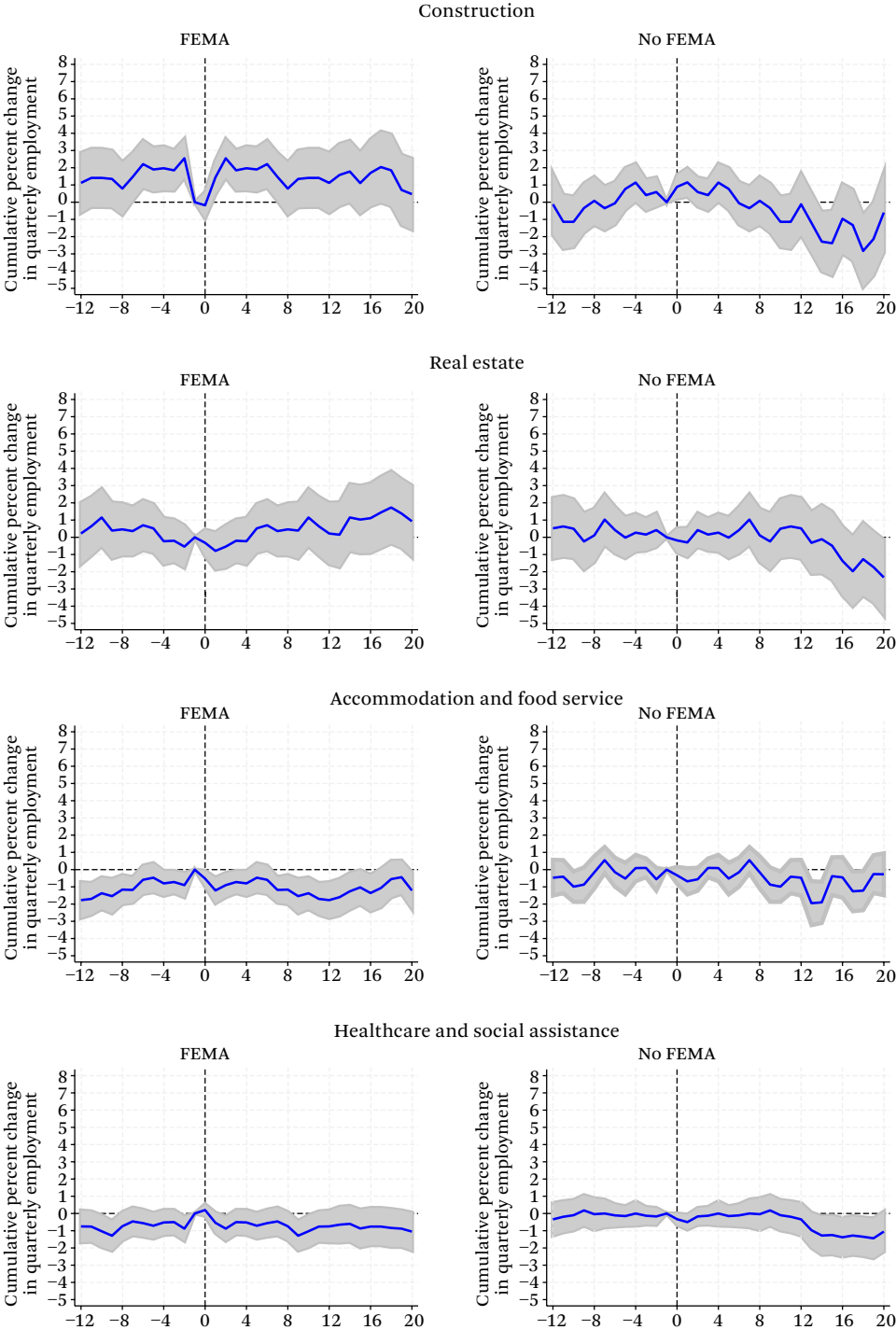
the aid would not be directed toward these industries.

CONCLUSIONS

On average climate-related natural hazards appear to reduce employment growth over the longer term at the county level and have slight but sustained positive impacts on earnings. When examining results by hazard type, we find increases in employment one to two years following hurricanes and then a return to baseline, while we find steady declines in employment following severe storms and floods. We find no impacts on employment or earnings following hail, tornadoes, or wildfires. We find longer-term increases in employment following extreme seismic activity events with no impacts on earnings. This increase in employment is consistent with a build back better mechanism where areas that experience extreme levels of property damage due to seismic events may see an influx of people and capital during the rebuilding period. Previously mentioned work by Erda (2025) uses detailed micro-level firm data to examine how manufacturing plants respond to floods. Her work provides some evidence that surviving firms do invest in capital quickly and that federal disaster spending plays an important role here.

When examining results by industry, we find a post-hazard bump for the construction industry followed by longer-term declines. This is consistent with construction being a necessary industry for rebuilding after an extreme climate

Figure 9. Impulse Response Functions for Employment by Industry and FEMA Support



Source: Authors' calculations from model (1) using data from the Quarterly Workforce Indicators, Longitudinal Employer-Household Dynamics, US Census Bureau, and SHELUDS.

Note: Earnings are quarterly averages of monthly earnings, adjusted for inflation and reported in 2022 dollars.

hazard event. We find some evidence of elevated employment one to two years out in the real estate industry that we hypothesize is related to turnover in sales and rentals of properties as some residents decide to rebuild while others decide to sell and relocate after a hazard event. For health and accommodation related industries, we see declines in employment both immediately post-hazard and over the longer term. Our analysis of FEMA-supported hazards compared with those that did not receive FEMA aid underscores these industry results by demonstrating that the bump in employment in the construction industry (and suggestively in the real estate industry) is driven by those counties that received FEMA aid.

Lastly, when looking at results by race and ethnicity, we find increases in employment (as well as earnings) for Hispanic and Latino workers followed by longer-term employment declines. We attribute this to the high concentration of Hispanic and Latino workers in the construction industry (US Bureau of Labor Statistics 2023), which sees increases in employment post-hazard, with eventual declines. For other racial groupings, we see very little change one to two years after an extreme hazard but larger declines in employment in the longer term.

Our research is important for informing policy responses to climate-related disasters because a large sum of federal dollars is allocated to aiding individuals impacted by disasters each year, and there is evidence that federal emergency aid is exacerbating wealth inequality. Junia Howell and James R. Elliott (2019) find that economic damages from natural disasters increase wealth inequality in counties that experience the disaster, and critically, they find that federal emergency aid further exacerbates that inequality. They argue that this inequality may occur because the majority of funding for disaster recovery is allocated toward property owners. They highlight that for less privileged residents and non-property owners, hazards may lead to increased financial liabilities that result from an increasing risk of losing one's job (Elliott and Pais 2006), an increased chance of mobility (Elliott and Howell 2017), and increased rents that arise from the reduced availability of housing stock (Vigdor 2008).

Our results also highlight key levels of heterogeneity, which may contribute to inequality in the recovery from extreme natural hazards. For example, we see declines in employment in two key sectors, accommodation and food services, as well as health care and social assistance. The most vulnerable workers in these sectors may be the most impacted by these hazards. More work is needed to identify which workers are impacted within these sectors. In future work, we will rely on individual-level employment and earnings to more clearly identify these potential pathways. By focusing on individual workers, we will be able to learn much more about distributional heterogeneity of longer-term impacts of these climate hazards, which may reveal disparities in vulnerability and recovery pathways. Additionally, we will be able to identify whether workers displaced by hazards are more likely to reallocate across sectors or locations, which is not observable in these aggregate county-level statistics. Overall, understanding these individual level patterns could further inform the impact of climate hazards on the relative distribution of earnings and employment, improving our understanding further on how hazards and our policy responses to them may be contributing to patterns of inequality.

REFERENCES

- Bakkensen, Laura A., and Lint Barrage. 2025. "Climate Shocks, Cyclones, and Economic Growth: Bridging the Micro-Macro Gap." *Economic Journal* 136(673): 279–310.
- Belasen, Ariel R., and Solomon W. Polachek. 2008. "How Hurricanes Affect Wages and Employment in Local Labor Markets." *American Economic Review* 98(2): 49–53.
- Bilal, Adrien, and Esteban Rossi-Hansberg. 2023. "Anticipating Climate Change Across the United States." NBER Working Paper No. 31323. National Bureau of Economic Research.
- Botzen, W. J. Wouter, Olivier Deschenes, and Mark Sanders. 2019. "The Economic Impacts of Natural Disasters: A Review of Models and Empirical Studies." *Review of Environmental Economics and Policy* 13(2): 167–88.
- Boustan, Leah Platt, Matthew E. Kahn, Paul W. Rhode, and Maria Lucia Yanguas. 2020. "The Effect of Natural Disasters on Economic Activity in

- US Counties: A Century of Data." *Journal of Urban Economics* 118: 103257.
- Coulombe, Raphaëlle G., and Akhil Rao. 2025. "Fires and Local Labor Markets." *Journal of Environmental Economics and Management* 130: 103109.
- Deryugina, Tatyana, Laura Kawano, and Steven Levitt. 2018. "The Economic Impact of Hurricane Katrina on Its Victims: Evidence from Individual Tax Returns." *American Economic Journal: Applied Economics* 10(2): 202–33.
- Elliott, James R., and Junia Howell. 2017. "Beyond Disasters: A Longitudinal Analysis of Natural Hazards' Unequal Impacts on Residential Instability." *Social Forces* 95(3): 1181–207. <https://doi.org/10.1093/sf/sow086>.
- Elliott, James R., and Jeremy Pais. 2006. "Race, Class, and Hurricane Katrina: Social Differences in Human Responses to Disaster." *Social Science Research* 35(2): 295–321.
- Erda, Tarikua. 2025. "Disasters, Capital, and Productivity." Unpublished paper. https://tarikuaerda.com/resources/papers/TarikuaErda_JMP.pdf
- Felbermayr, Gabriel, and Jasmin Gröschl. 2014. "Naturally Negative: The Growth Effects of Natural Disasters." *Journal of Development Economics* 111: 92–106. <https://doi.org/10.1016/j.jdeveco.2014.07.004>.
- Fussell, Elizabeth, Sara R. Curran, Matthew D. Dunbar, Michael A. Babb, Luanne Thompson, and Jacqueline Meijer-Irons. 2017. "Weather-Related Hazards and Population Change: A Study of Hurricanes and Tropical Storms in the United States, 1980–2012." *Annals of the American Academy of Political and Social Science* 669(1): 146–67.
- Gallagher, Justin, and Daniel Hartley. 2017. "Household Finance After a Natural Disaster: The Case of Hurricane Katrina." *American Economic Journal: Economic Policy* 9(3): 199–228.
- Ganong, Peter, Damon Jones, Pascal J. Noel, Fiona E. Greig, Diana Farrell, and Chris Wheat. 2020. "Wealth, Race, and Consumption Smoothing of Typical Income Shocks." NBER Working Paper No. 27552. National Bureau of Economic Research. <https://doi.org/10.3386/w27552>.
- Ghaedi, Hamed, Kelsea Best, Allison Reilly, and Deb Niemeier. 2024. "Statistical Learning to Identify Salient Factors Influencing FEMA Public Assistance Outlays." *Natural Hazards* 120(12): 10559–82.
- Groen, Jeffrey A., Mark J. Kutzbach, and Anne E. Polivka. 2020. "Storms and Jobs: The Effect of Hurricanes on Individuals' Employment and Earnings over the Long Term." *Journal of Labor Economics* 38(3): 653–85.
- Hoeppe, Peter. 2016. "Trends in Weather Related Disasters – Consequences for Insurers and Society." *Weather and Climate Extremes* 11: 70–9.
- Hornbeck, Richard. 2012. "The Enduring Impact of the American Dust Bowl: Short- and Long-Run Adjustments to Environmental Catastrophe." *American Economic Review* 102(4): 1477–1507.
- Howell, Junia., and James R. Elliott. 2019. "Damages Done: The Longitudinal Impacts of Natural Hazards on Wealth Inequality in the United States." *Social Problems* 66(3): 448–67. <https://doi.org/10.1093/socpro/spy016>.
- Hsiang, Solomon. M. 2010. "Temperatures and Cyclones Strongly Associated with Economic Production in the Caribbean and Central America." *Proceedings of the National Academy of Sciences* 107(35): 15367–72. <https://doi.org/10.1073/pnas.1009510107>.
- Jordà, Òscar. 2005. "Estimation and Inference of Impulse Responses by Local Projections." *American Economic Review* 95(1): 161–82.
- Kirchberger, Martina. 2017. "Natural Disasters and Labor Markets." *Journal of Development Economics* 125: 40–58.
- Lackner, Stephanie. 2018. "Earthquakes and Economic Growth." FIW Working Paper No. 190. FIW – Research Centre International Economics. <https://hdl.handle.net/10419/194225>.
- Meltzer, Rachel, Ingrid Gould Ellen, and Xiaodi Li. 2021. "Localized Commercial Effects from Natural Disasters: The Case of Hurricane Sandy and New York City." *Regional Science and Urban Economics* 86: 103608.
- Noy, Ilan, and Eric Strobl. 2023. "Creatively Destructive Hurricanes: Do Disasters Spark Innovation?" *Environmental and Resource Economics* 84(1): 1–17.
- Pleninger, Regina. 2022. "Impact of Natural Disasters on the Income Distribution." *World Development* 157: 105936. <https://doi.org/10.1016/j.worlddev.2022.105936>
- Rhodes, Anna, and Max Besbris. 2022. *Soaking the Middle Class: Suburban Inequality and Recovery from Disaster*. Russell Sage Foundation.
- Strobl, Eric. 2011. "The Economic Growth Impact of Hurricanes: Evidence from U.S. Coastal Counties." *Review of Economics and Statistics* 93(2): 575–89. https://doi.org/10.1162/REST_a_00082.

- Tran, Brigitte Roth, and Daniel J. Wilson. 2025. "The Local Economic Impact of Natural Disasters." *Journal of the Association of Environmental and Resource Economists* 12(6): 1667–704.
- US Bureau of Labor Statistics. 2023. "Labor Force Characteristics by Race and Ethnicity, 2022." BLS Reports. US Bureau of Labor Statistics. November. <https://www.bls.gov/opub/reports/race-and-ethnicity/2022/>.
- Vigdor, Jacob. 2008. "The Economic Aftermath of Hurricane Katrina." *Journal of Economic Perspectives* 22(4): 135–54. <https://doi.org/10.1257/jep.22.4.135>.
- Walls, Margaret A., and Matthew Wibbenmeyer. 2023. "How Local Are the Local Economic Impacts of Wildfires." Resources for the Future Working Paper. Resources for the Future. <https://www.rff.org/publications/working-papers/how-local-are-the-economic-impacts-of-wildfires/>.

The Impacts of Repeated Disasters on School Attendance and Learning



TYLER W. MCDANIEL 

As more children are exposed to climate disasters, the effects of repeated hazards on education are increasingly important but also unclear: some theories predict compounding negative effects from each consecutive hazard, whereas others suggest attenuating disadvantages. Combining North Carolina's longitudinal student records with fine-grained hurricane flooding data, I estimate the influences of two consecutive hurricanes on K–12 student attendance and learning. Results show that singular and repeated prolonged school closures resulted in similar declines in attendance and learning, and within school districts, singular and repeated exposure to residential flooding led to little or no additional declines. Together, these results suggest that prior exposure neither heightens nor dulls the educational impacts of a second event. Because district-wide closures accounted for most of the academic impacts, efforts to reduce prolonged school closure days in future storms would likely benefit students.

Keywords: disasters, education, cumulative disadvantage, disadvantage saturation, schools, attendance, learning

Flooding—the costliest and most prevalent form of climate disaster—presents nontrivial risks for approximately 41 million US citizens (Kousky 2018; Wing et al. 2018) and is expected to occur more often as sea levels rise, storms proliferate, and development occurs in flood-prone regions. When people are displaced by storms or flood-

ing, they often return and rebuild: Ties to social and institutional contexts, as well as financial incentives and constraints, compel individuals to remain in or move back to climate-risky places (Asad 2015; Logan et al. 2016; Rhodes and Besbris 2022). As a result, students growing up in today's climate will be more likely to experience

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repeated exposure to disasters than previous generations.

Exactly how repeated climate hazards affect students matters for educational stratification. Under certain conditions, disasters could exacerbate preexisting burdens, such that repeated hazards lead to cumulative disadvantages that heighten inequalities between affected and unaffected groups, as well as ethnoracial, socioeconomic, and geographic inequalities. Under different conditions, the effects of repeated climate hazards may be diminished, or saturated, because prior disasters initiate preparation for future events that then dull their impacts. Whether repetitive disasters lead to cumulative or saturated burdens for K–12 students has implications for policies around the allocation of relief funds, operation of school facilities, school finances, teacher training, transportation planning, student mobility, mental health supports, and more. However, there is little existing research on heterogeneous responses to repeated disasters in the educational context.

This article examines how repeated disasters impact student attendance and learning. Drawing from North Carolina’s longitudinal student records, I assess learning and attendance for students who were exposed to one or both of two major hurricanes (Hurricane Matthew and Hurricane Florence), which hit the region in 2016 and 2018, respectively. I find that during both storms, prolonged school closures led to declines in attendance and, for some schools, lower test scores. During each storm, students living in flooded blocks experienced little or no negative impacts on test scores relative to students living in non-flooded blocks. Taken together, these results suggest that at both the school and student level, prior exposure to flooding neither exacerbates nor dulls the impacts of storms for students. Because district-wide closures accounted for most of the storms’ academic impacts, policies to prepare for future storms and minimize prolonged closure days would likely benefit students.

REPEATED DISASTER EXPOSURE AND HETEROGENEOUS SHOCKS

Both globally and within the US, people increasingly live in places prone to repeated flooding. A nascent body of research explores how fami-

lies often move to a neighborhood because of institutions and social networks and are reticent to move away, even when it means placing themselves at risk for future floods. Residents often have strong attachments to schools and wish to see their children graduate from neighborhood schools, compelling them to renovate flooded homes and move back in (Kimbro 2021; Rhodes and Besbris 2022). The National Flood Insurance Program—the only flood insurance option available to US residents—has largely been unsuccessful at moving people away from floodplains due to a lack of political appetite and uneven local implementation (Elliott 2021). As a result, the problem worsens: in North Carolina, from 2006 to 2017, new construction in floodplains has outpaced floodplain buyouts by a ten to one margin (Hino et al. 2024). Moreover, storms sometimes offer opportunities for new development, increasing population density in devastated regions (Ellen et al. 2026, this issue; Pais and Elliott 2008).

As disasters become more commonplace and larger populations live in risky areas, a literature has emerged classifying how disasters overlap and interact with each other. For instance, scholars have defined the ways in which multiple disasters co-occur: consecutive disasters refer to disasters that occur in the same spatial region within a period where full recovery from the first event has not been achieved. These include compound disasters (two or more extreme events that occur simultaneously or successively) (Leppold et al. 2022); cascading disasters (events that occur in a chain or in reaction to each other, such as the 2011 earthquake in Japan, which triggered a tsunami and then a nuclear disaster); and recurring disasters (events that occur in the same region within a one-year period). These classifications lay the groundwork for research on heterogeneity in the effects of each disaster within a set of consecutive disasters.

A related literature has emerged on heterogeneity in the impacts of disruptive events on children. Studies on disruptive events show variation in the effects of shocks such as job loss, divorce, and disasters across socioeconomic status, within-group normativity, and other dimensions (Aquino et al. 2022). For instance, in many cases socioeconomic status is protective against negative impacts. In other

cases, however, unexpected events create greater negative consequences, sometimes meaning that more advantaged children, who face low risks of experiencing these events, experience larger effects (Torche et al. 2024). The time frame of recoveries varies widely, with some occurring over days or months while others occur over years or decades. Features such as age and institutional support help to explain some of these heterogeneous effects. While heterogeneity has been important to understanding shocks in various contexts, there is little research examining how disaster repetition may contribute to heterogeneous impacts among children. In other words, we are missing evidence on differences in disaster impacts for children across levels of prior exposure.

CUMULATIVE OR SATURATED DISADVANTAGES?

Two theoretical approaches—cumulative disadvantage and disadvantage saturation—yield contrasting predictions for how children may be affected by repeated climate disasters. Cumulative disadvantage emerged out of Merton's theory on academic success but has grown to cover impacts of multiple types of social (dis)advantages, including socioeconomic, racial, and spatial (dis)advantages (Diprete and Eirich 2006; Merton 1968). Thomas A. Diprete and Gregory M. Eirich (2006) note that cumulative (dis)advantage broadly refers to temporal processes in which relative benefits in one period are associated with further relative benefits in following periods. This has been called the “Matthew Effect” (Merton 1968). Here, I apply cumulative disadvantage to the impacts of consecutive disasters. Hurricane flooding is associated with material losses, socio-emotional challenges, disruptions to social networks and community, and other negative impacts which may compound. The cumulative disadvantage approach suggests that the material, socio-emotional, and social burdens created by the first disaster would place children in situations where they are less prepared for the second disaster than they would be otherwise.

Studies have found compounding disadvantages when it comes to disasters' effects on health and finances. For example, a growing body of literature examines cumulative disas-

ters in health contexts, and while the results are not uniform, the studies largely show that “multiple exposures were associated with increased risks to mental health (a cumulative effect)” (Leppold et al. 2022, e276). Micah B. Hahn and colleagues (2022) find that multiple disasters “compound” for outcomes such as self-reported poor mental health, high blood pressure, and asthma, with each additional disaster leading to risk ratio increases of 1–2 percentage points in these categories. Analyzing interviews of mother-daughter pairs in Louisiana who experienced multiple disasters, Lubna Mohammad and Lori Peek (2019) note that a lack of socioeconomic resources can lead to problems that “pile up” with each successive event. As a result of these piling burdens, the second disaster may bring about larger negative impacts than the first disaster.

Disadvantage saturation theory, on the other hand, predicts that existing burdens will dull the impacts of other disadvantages (Hannon 2003; Pinchak and Swisher 2022). Two mechanisms could plausibly explain saturation. First, the impacts of the first disaster may diminish societal advantages for affected groups, thus reducing the possible negative effects of a second event. In this vein, Christina J. Cross (2020) finds that preexisting socioeconomic disadvantages mitigate the stress imposed on children by parental absence, and Lance Hannon (2003) finds that delinquency has a smaller association with educational attainment for disadvantaged children. Put another way, the relationship between certain shocks and academic success may be stronger among advantaged children, for whom the shock leads to a larger relative difference in resources. Florencia Torche and colleagues (2024, 4) note that “as a negatively assessed event becomes more prevalent and normative in society, the stigma associated with it becomes less severe because the event represents a smaller deviation from the social norm.” Such findings suggest that students who are affected by the first disaster would feel smaller burdens from the second disaster.

Saturation could also occur because one disaster prompts institutions or individuals to prepare for similar situations. Regions hit by two disasters may have increased opportunities for preparation, as the first event provides a

“window of opportunity for agencies wishing to enhance preparedness” (McClure et al. 2016, 192). At the individual level, Rachel Tolbert Kimbro (2021) calls this “flood capital,” in which people who initially did not imagine that their homes would flood are spurred to develop contingency plans and knowledge about saving personal belongings, evacuating, and navigating insurance or disaster relief agencies. Cheongil Kim and colleagues (2024) find that direct experience with an earthquake is associated with substantial gains in emergency preparedness and insurance uptake. These results highlight the plausibility of one disaster spurring precautionary actions that then mitigate the impacts of a second event.

PATHWAYS CONNECTING STORMS TO DISADVANTAGES

To evaluate the impacts of repetitive hazards, I focus on attendance and learning, which are important educational outcomes and consequential for school operations, governance, and finance. In the US, states set mandatory requirements for instructional days and attach funding to these requirements; schools that experience drops in attendance may experience diminished capacity to hire teachers or fund other school operations (Schlemmer 2020). Attendance is vital to school operation and academic activities and makes other school services possible: when students are in attendance, schools can provide meal services and extracurricular activities. In the wake of disasters, schools can appeal for exceptions to instructional day requirements when they are unlikely to reach the number of required days. In this way, schools may opt to offer fewer instructional days because of the disaster. Between 2011 and 2019, as many as 75 million student days may have been lost due to climate disasters and weather (Jahan et al. 2022).

I operationalize learning as statewide tests. Unlike indicators such as graduation, which might be subject to looser standards during periods of crisis (Harris et al. 2024), statewide tests capture rigid learning benchmarks that cannot be adjusted at the school or district levels. Past research in the US has focused on the impacts of Hurricane Katrina on learning and achievement and has estimated small negative impacts or even some benefits (Kousky 2016). For in-

stance, Michael E. Ward and colleagues (2008) find displaced students received more disciplinary actions following the storm but higher levels of promotion. Bruce Sacerdote (2012) finds academic achievement increases among students displaced to higher-performing schools, and Douglas N. Harris and Matthew F. Larsen (2023) find academic benefits for students who returned to New Orleans. In the sections that follow, I explore pathways through which repeated floods may affect student learning and attendance.

Pathway 1: School Closures to Learning and Attendance

When schools are impacted by storms, they may experience facility damages and organizational challenges in providing education (Davis et al. 2022; Kousky 2016). Disruptions to broader social and physical infrastructure, including power and transportation, may also create challenges for school districts, spurring leaders to initiate temporary closures. Prolonged school closures can reduce instructional time in ways that schools are unable to compensate for. While teachers may be able to adapt and negate the impacts of short-term closures (Goodman 2014), longer closures are likely to cause significant reorganization of learning plans at the classroom, school, and district levels. As a result, unplanned closures generally result in greater learning losses than the number of instructional days missed would suggest (Kuhfeld et al. 2025). In North Carolina, Melinda Morrill and John Westall (2023) show that hurricane-induced loss of instructional time led to lower test scores in both mathematics and reading across demographic groups.

Closures can also impact students through a collective sense of trauma. Early disaster research, as well as literature on mental health and disasters, suggests that societal responses define disasters, and that a collective sense of upheaval can trigger post-traumatic symptoms even among those who were not directly impacted (Goldmann and Galea 2014). For example, the community level effects of the Flint Water Crisis, rather than direct residential exposure to lead pipes, appeared to drive educational impacts on students (Trejo et al. 2024). Following earthquakes in Chile, the largest negative effects

on learning were concentrated in municipalities with inexperienced mayors (Alcaino and Argote 2024), demonstrating that local governance can shape how disaster impacts are felt by residents. These findings suggest that prolonged school closures—which affect all students in a school or district—may be a critical pathway through which hurricanes affect students.

Question 1: How are consecutive prolonged school closures related to students' attendance and learning?

Pathway 2: Residential Flooding to Learning and Attendance

Beyond school closures, flooding could also affect students directly through their residential settings. Students whose residences flood may experience material damages or costs as well as physical and emotional damages. These students may experience temporary displacement or ongoing housing instability, as recovery trajectories are often long and uneven (Fothergill and Peek 2015). Throughout recoveries, students may experience logistic and social challenges in regularly attending school, including material hardship, loss of means of transportation, disruption to social networks, and uncertainty in long-term residential plans.

Residential flooding could also be harmful because it differentiates students from their classmates. The relative deprivation theory suggests that students experience negative impacts within the context of what their peers are experiencing (Pinchak and Swisher 2022). According to this theory, the consequences of events vary depending on whether students experience hazards alone or along with their peers. In this study, because most students' blocks were not flooded, even in the most-impacted schools,¹ relative deprivation approaches would predict that students in flooded homes would experience the brunt of the disaster burdens.

Question 2: How are consecutive residential flooding events related to students' attendance and learning?

DATA

To address the research questions, I analyze longitudinal student records from the North Carolina Education Research Data Center, which maintains a comprehensive collection of K–12 student information including details on residential blocks, enrollments, demographics, transfers, attendance, and test scores from 2014 to 2022. North Carolina contains several of the highest-ranking counties both in terms of population growth and hurricane flooding risks (Bhatia 2023; Pew Charitable Trusts 2017), placing the region at the forefront of climate challenges in the US. Two major storms, Hurricanes Matthew and Florence, hit regions of Eastern North Carolina in 2016 and 2018, respectively, with many people affected by both, but also each individually (Fuller and Davis 2021).

In the school sample, I include all public schools in North Carolina that were operational during the entire study period (2,929 schools). In the student sample, I focus on a cohort of students in grades K–9 during the 2015–2016 school year. These students were typically in grades 1–10 by the 2016–2017 school year (when Hurricane Matthew occurred) and in grades 3 or higher by the 2018–2019 school year (when Hurricane Florence occurred). I limit the student sample to students with sufficient information on the outcomes of interest (enrollment days, absences, reading and mathematics test scores), within districts that have sufficient residential information.² All together, these restrictions yield a sample of 544,118 unique students, or roughly 34 percent of all K–12 students in North Carolina's public school system during a given year. Students who move schools or residences are included in the sample, but if students exit the sample districts during the study

1. In the school with the most flooding, 24 percent of students experienced residential flooding (of 20 percent of their block at 20 cm).

2. Districts with more than 75 percent residential completeness, on average, during the years of the two storms. In online appendix E, I replicate the main findings using districts with at least 85 percent residential completeness.

period, they are excluded. While uneven attrition is a plausible concern, exits are relatively stable across time, representing roughly 11 percent of students and 1 percent of schools each year, which are similar to rates reported by Morrill and Westall (2023). Online appendix A provides further information on attrition for schools and students.³

Measuring Attendance and Learning

Attendance consists of both enrollment days and student absenteeism. Enrollment days—the number of school days in which the student is enrolled and the school is open—depend on school calendars. In 2012, the state of North Carolina required schools to provide a minimum of 185 instructional days (or 1,025 instructional hours) (NCDPI 2024b), higher than that of all other US states but Kansas, which requires 186 days. Local education boards have considerable autonomy over how school days are allotted, granted they meet certain requirements.⁴ Such flexibility is expressly to allow districts autonomy in reaching achievement goals: the legislature states that “schools are encouraged to use the calendar flexibility in order to meet the annual performance standards set by the State Board” (North Carolina General Assembly 2022). Schools are required to schedule make-up days so that inclement weather closures can be accommodated, but if they exceed these days, schools can request state vouchers to lessen the 185-day requirement. I top-code attendance values at 185, as exceeding this requirement is rare (less than 2 percent of observations) and cases where it is exceeded may be prone to either clerical errors or alternative types of schooling (such as year-round).

Absenteeism describes days in which children are enrolled but do not attend school. Absenteeism is associated with lower achievement and progression through school, and recent data show a stark rise in chronic absenteeism

in the post-COVID-19 period (Dee 2024). The student record data report the number of days enrolled and absent (including excused and unexcused absences) at the student level. For each student-year observation, attendance values reported as “0” are changed to missing. For students who report attending multiple schools in one year, attendance is measured using sums of enrollment days and absences from each school.

To measure learning, I use North Carolina End-of-Grade (EOG) test results for mathematics and reading. The EOGs are administered to all public school students during the spring of each year from third grade through eighth grade. The EOGs are consequential in grade promotion and are used in school and district accountability metrics. For example, stated goals of these tests include ensuring that children obtain skills and knowledge, improving the educational process, and providing a tool for public accountability (NCDPI 2024a). For each year, I standardize test scores within each subject. At the school level, I average student attendance and learning measures. Due to the COVID-19 pandemic, these metrics are not reported for the 2019–2020 school year.

Measuring School Closures

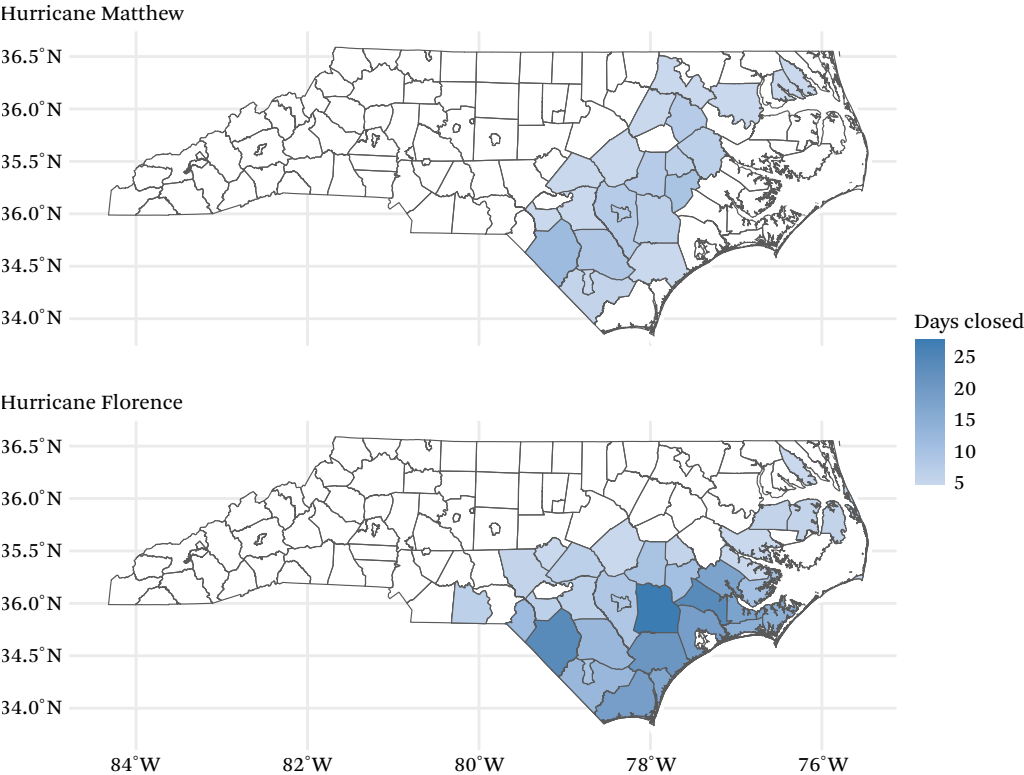
I gather information on school closures from the Prolonged Unplanned School Closures (PUSC) dataset (Jahan et al. 2022), which contains closure and reopening dates for closures lasting at least five school days in the US. Figure 1 shows the spatial distribution of prolonged closure days for Hurricanes Matthew and Florence. The data mostly report district-level closures but also include school-level closures in the case that individual schools within districts operated differently.⁵ For Hurricanes Matthew and Florence, all recorded closures were district-wide. In online appendix B, I compare the prolonged closures information with data from the

3. The online appendix can be found at <https://www.rsfjournal.org/content/12/4/156/tab-supplemental>.

4. The school year must begin by August 26 and end by June 15. School must not be held on Sundays, and certain holidays must be observed. Some schools, such as year-round schools, are exempt from the calendar legislation, and other schools can apply for case-by-case exemptions.

5. District-wide closures account for 97.6 percent of all prolonged closures in the PUSC data (with individual school closures accounting for 2.4 percent).

Figure 1. Prolonged School Closures, Hurricanes Matthew and Florence



Source: Jahan et al. 2022.

North Carolina Department of Public Instruction, which collected information on school-level days missed from Hurricane Florence (the number of total missed days minus those that were made up). The PUSC data capture 97 percent of prolonged closures reported to the state, and I make one correction to the data.⁶

Measuring Flood Impacts

During Hurricanes Matthew and Florence, most storm damage was caused by flooding rather than wind. The National Oceanic and Atmospheric Administration notes that “most of the structural damage caused by Matthew’s wind was described as minor, which is a stark contrast to the moderate to severe structural damage that was associated with the storm surge”

(National Weather Service 2017). Similarly, the flood damage from Hurricane Florence “caused more than 10 times as much loss as the damage from wind” (Grzadkowska 2019). These factors mitigate concerns about multiple treatments (flooding and wind damages) potentially violating the stable unit treatment value assumption that causal inferences require (Rubin 1974).

I identify impacts of storms on residential blocks by spatially joining block-level student residential information with detailed flood inundation information from First Street Foundation on the two storms of interest (Wing et al. 2018). For each block, I use flood inundation information and a structure inventory from the North Carolina Building Footprint Database

6. In the PUSC data, Robeson County is unlisted for Hurricane Matthew (implying a closure of less than five days). However, according to local reporting (Overton 2016), all Robeson County schools were closed on October 25, indicating twelve closure days. I consider Robeson County Schools closed for twelve days, which may be an undercount for some schools.

(State of North Carolina Emergency Management 2021) to calculate the proportion of residential structures where inundation levels exceeded 20 cm, following Kevin T. Smiley and colleagues (2022, 8), who note that flood levels below this threshold “are unlikely to cause much damage from surface water or pluvial flooding.” The proportion of residential buildings flooded is positively correlated with average flood depths ($\rho = 0.72$ for both Matthew and Florence, separately) but is less likely to be skewed by extreme values.

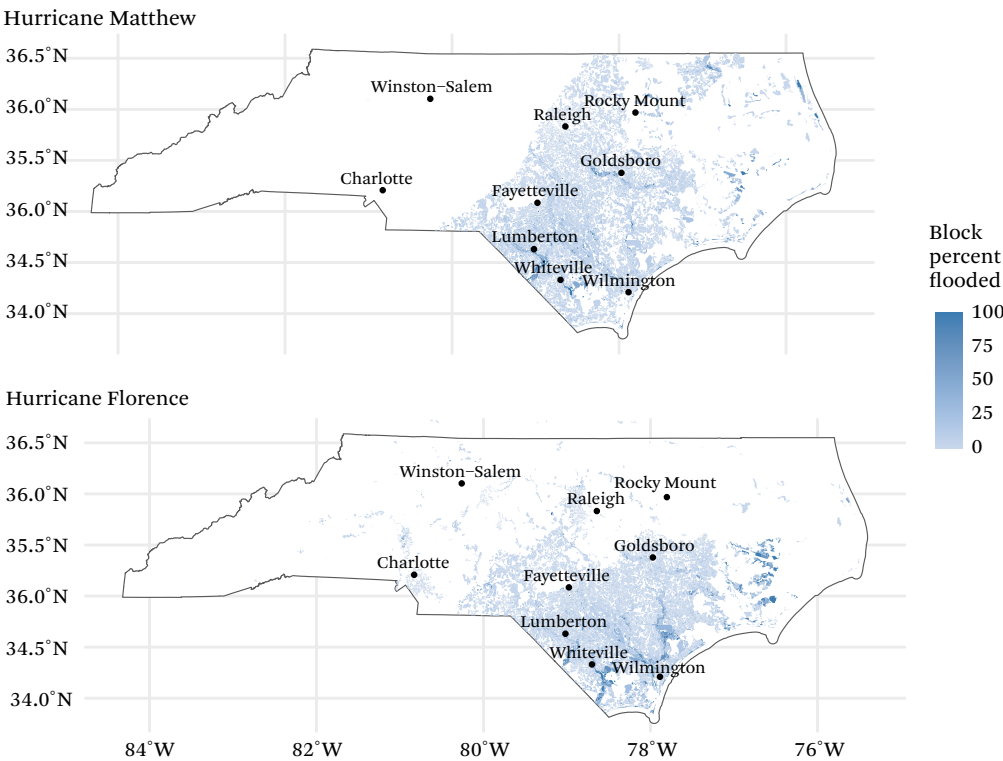
Figure 2 shows residential block flooding across the state. To capture different levels of flood exposure, I consider two treatments: whether students experienced flooding for at least 20 percent and 50 percent of residential structures in their block, respectively. Alternative flood thresholds (10 percent, 80 percent) and an alternative measure of inundation (Schaffer-Smith et al. 2020), which uses a binary

measure of “flooded” or “not flooded,” are presented in the online appendix.

METHODS

Several methodological challenges make it difficult to causally differentiate the effects of repeated hazards. Disasters can have effects that last several years (see Gibbs et al. 2019 for an example in the context of children and disasters), possibly interacting with the influences of subsequent events. Brian Y. An and colleagues (2026, this issue) describe problems related to how researchers define each disaster’s influence, which include indeterminate length, temporal overlap, and units switching in and out of treatments. If researchers define the influence narrowly, they may neglect lagged effects; if researchers define influences as permanent (a “staggered” approach), they may neglect consecutive events. The omission of lagged effects from events that occurred before the study pe-

Figure 2. Block-Level Flooding, Hurricanes Matthew and Florence



Source: First Street Foundation.

Table 1. Student and School Sample Sizes by Flooding Exposure

Treatment	Outcome	Matthew Affected	Florence Affected	Both Affected	Unaffected
School sample (number of schools)					
Prolonged school closure	Attendance	100	232	360	1,868
	Test scores	74	184	278	1,492
Student sample (number of students)					
20 percent of residential blocks flooded	Attendance	3,188	3,826	2,237	534,867
	Test scores	1,012	1,215	718	178,098
50 percent of residential blocks flooded	Attendance	804	1,060	356	541,898
	Test scores	255	343	109	180,336

Source: Restricted-access NCERDC data, 2014–2022.

Note: Test score samples are smaller because EOG tests are taken in grades 3–8 only.

riod could also be problematic. These challenges lead Ram Krishna Mazumder and colleagues (2023, 90) to lament researchers’ “inability to analyze the impacts of multiple disaster events similar to the sequential events of Hurricanes Matthew and Florence and followed by the COVID-19 pandemic.”

However, when the number of events is small, a dynamic treatment design offers a viable approach for estimating effects of consecutive treatments. Under the dynamic treatment design, the sample is split into subsamples, each of which experience a different treatment sequence (such as unaffected, affected by Matthew only, affected by Florence only, and affected by both events). Table 1 shows the number of observations for each treatment path under different treatment specifications. I use such a design to measure repeated flooding impacts.

Before analyzing the impacts of closures on students, I note that schools and districts may respond differently, in terms of closure days, to singular and repeated flooding events. If they do, this could confound the estimation of repeated closures on student outcomes. Therefore, in online appendix C, I investigate the relationship between prior flooding and closure days. Because closures occur at the district level, the number of observations in each treatment path is small; however, I find no significant effect of prior flooding on closure length during Hurri-

cane Florence. In other words, I find no differences in closure days by whether the district was previously flooded. I therefore proceed with the estimation of closures’ impacts on student outcomes.

To measure the relationship between prolonged closures and student outcomes, I focus on the school level, where a path-specific event study is appealing given the completeness of each school’s data over long time periods. Clément de Chaisemartin and Xavier D’Haultfœuille (2024) note that when the total number of treatment paths (in this case, four) is low relative to the number of groups (students), there may be sufficient information to estimate path-specific effects, rather than overall effects. For each of the four treatment groups (affected by Hurricane Matthew, affected by Hurricane Florence, affected by both, and affected by neither), this approach allows for estimation of treatment leads and lags. This event study approach is also less restrictive in terms of identifying possible confounders (because fixed effects net out unobservable characteristics), and relies on the parallel trends and no anticipation assumptions, which can be examined using placebos. The general event study model is:

$$y_{jt} = \alpha_j + \gamma_t + \sum_{k \in K} \beta_k D_{jt} + \varepsilon_{jt} \tag{1}$$

Where α_j is a school fixed effect, γ_t is a time fixed effect, and D_{jt} is an indicator for school j ’s treatment status at time t . K refers to a set of pre- and

post-event periods such that β_k is either a placebo estimate or a treatment effect estimate. I use the modified event study model detailed by de Chaisemartin and D'Haultfœuille (2024), which is robust to bias when treatment effects are heterogeneous across groups or time periods.

I next estimate the impacts of residential flooding on students. At the student level, a straightforward estimation of dynamic treatment effects is possible under the assumption that treatment selection in each period is unconfounded, conditional on time-varying covariates (which may include past outcomes) and treatment histories. This assumption may appear problematic, as flooding is not random: proximity to flood-prone regions is strongly associated with a milieu of socio-demographic characteristics. However, the path of any storm is highly variable until shortly before landfall, and conditional on flood risks, it is difficult to anticipate storm flooding.

I use a combination of propensity score matching and Covariate Balancing Propensity Score weighting (Imai and Ratkovic 2014, 2015) to adjust samples for pretreatment differences and create comparable control and treatment groups. I include estimations of residential flood risks,⁷ official floodplain boundaries, as well as social and demographic information and past outcomes (including absences, enrollment days, and reading and mathematics test scores) in the propensity score matching. Within each school, I match treated students with up to five non-treated students. I use a limited set of variables, including floodplain boundaries, demographic information, and past outcomes, to weight the sample so that treatment groups are balanced across covariates. I then estimate effects with OLS using the following linear model:

$$Y_{id} = \alpha_d + \beta_1 \text{Matthew}_{id} + \beta_2 \text{Florence}_{id} + \beta_3 \text{Matthew}_{id} \text{Florence}_{id} + \beta_4 X_{id} + \varepsilon_{id} \quad (2)$$

Where Y_{id} is the outcome of interest for student i in district d , α_d is a district level fixed effect to

control for differences in school closures and other district characteristics, Matthew_{id} is an indicator for whether the student experienced flooding during Hurricane Matthew and Florence_{id} is an indicator for whether the student experienced flooding during Hurricane Florence. Covariates, X_{id} , are the same as those used in weighting. I also report an unweighted version of Equation 2 using only covariates from 2016. Such a comparison is useful in assessing potential posttreatment bias (Blackwell 2013). Observations are grouped according to sequences of treatments at two time periods, 2016 and 2018, and outcomes are measured in the final period.⁸

RESULTS

Descriptive Findings

Table 2 presents geographic and demographic information on students and schools impacted by each sequence of treatments. Unsurprisingly, students affected by the storms lived in more flood-prone places than unaffected students. This is especially clear comparing students affected by both storms (for whom 2.0 percent live in low flood risk blocks) to unaffected students (84.8 percent of whom live in low flood risk blocks). Still, on average, students affected by both storms lived in blocks where only 36.9 percent of residences were within the 100-year floodplain, aligning with reports of substantial flooding occurring outside of official flood zones (National Weather Service 2017). Schools were mostly in low-flood risk areas. While there is often little official legislation preventing schools from being sited in flood zones (Pew Charitable Trusts 2017), few schools were located within the floodplains (ranging from 1.5 percent to 7.7 percent across treated groups), suggesting that local authorities often successfully located the school buildings in less risky locations.

Several relationships between demographics and flooding exposure are noteworthy. Compared to students affected by Hurricane Florence alone, students affected by Hurricane Matthew alone tended to be disproportionately

7. First Street Foundation estimates "Flood Factors" and probability of future flooding events at the parcel level; I aggregate these to block-level averages of residential buildings.

8. Main models use 2019 as the outcome period. Additional models also predict outcomes for 2021 and 2022.

Table 2. Student and School Characteristics by Flooding Exposure

Variable	Matthew Affected	Florence Affected	Both Affected	Unaffected
Student sample				
Asian	0.4	1.2	0.3	2.5
Black	40.4	29.2	50.3	23.1
Latine	8.3	15.7	11.0	18.1
Native	29.6	3.8	12.6	1.4
White	15.0	47.6	22.8	50.9
Economically disadvantaged	79.5	58.7	74.4	51.8
Block urban	64.7	59.1	77.5	63.5
Block homeownership	46.3	50.3	48.4	64.4
Block residences within floodplain	44.9	29.8	36.9	2.0
Block low flood risk	17.2	30.8	2.0	84.8
Block moderate flood risk	59.1	44.2	59.3	13.7
Block high flood risk	23.8	25.0	38.8	1.5
Enrolled days (count)	166.5	167.1	168.3	167.8
Absences (count)	9.2	7.4	7.6	7.0
Reading (standardized score)	-0.42	-0.09	-0.42	0.02
Mathematics (standardized score)	-0.37	-0.10	-0.41	0.03
School sample				
Asian	0.7	1.4	0.9	3.1
Black	56.9	24.3	33.4	22.8
Latine	9.8	13.2	18.5	16.8
Native	1.0	1.2	6.0	0.5
White	28.7	55.0	36.5	53.2
Economically disadvantaged	76.2	55.7	69.9	56.9
Total enrollment (students)	538.4	594.5	609.8	635.3
School low flood risk	83.1	69.8	85.2	91.2
School moderate flood risk	12.7	18.5	13.1	5.2
School high flood risk	4.2	11.6	1.7	3.5
School in floodplain	2.2	7.7	1.5	1.0
Average enrolled days (count)	166.0	165.8	163.7	163.2
Average absences (count)	8.3	7.78	7.84	7.66
Reading (standardized score)	-0.32	-0.00	-0.17	-0.03
Mathematics (standardized score)	-0.30	-0.03	-0.19	-0.02

Source: Restricted-access NCERDC data, 2014–2022.

Note: All variables are measured pre-floods (2016). All variables are percentages unless otherwise indicated. “Affected” refers to students whose blocks were at least 50 percent flooded and schools that experienced prolonged closures. Low flood risk, moderate flood risk, and high flood risk refer to average Flood Factor scores of less than or equal to 2, between 2 and 6, and greater than 6, respectively. First Street Foundation labels these risks as minimal-minor, moderate-major, and severe-extreme.

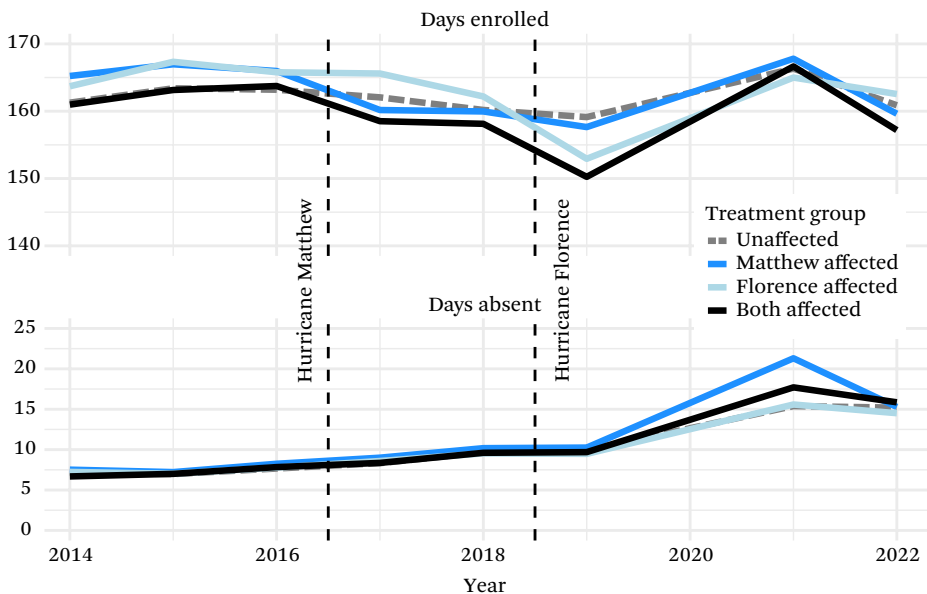
Native (29.6 percent versus 3.8 percent), Black (40.4 percent versus 29.2 percent), and economically disadvantaged (79.5 percent versus 59.7 percent). Students impacted by Florence alone are ethnoracially similar, but more disadvan-

taged than unaffected students (who are 51.8 percent economically disadvantaged), while students affected by both hurricanes fall between those affected by Matthew and Florence alone. Schools follow a similar pattern, with

Matthew-impacted schools consisting of 56.9 percent Black students, compared to 22.8 percent for unaffected schools. There are also differences in achievement outcomes across treatment groups. Students affected by Matthew and by both storms scored roughly half a standard deviation below average on reading assessments (0.42 for both), whereas students affected by Florence alone scored only 0.09 standard deviations below average. Similar differences are present for mathematics assessments. Schools affected by prolonged closures from Florence alone also scored better than schools affected by Matthew or both storms in reading. Together, these differences highlight how various demographic and geographic factors are associated with flooding exposure across space. While researchers have noted the disproportionate risks that Black residents face in the US South, less attention has been given to flood risks for Native residents. As Max Besbris and colleagues (2026, this issue) note, residential segregation creates uneven exposures to climate hazards, but economic and political mechanisms can reinforce inequalities in disaster recoveries.

Figures 3 and 4 show school attendance and test scores, among the restricted sample, for the school years 2013–2014 through 2021–2022. For students in schools that experienced prolonged closures, there are large drops in enrollment days (ranging between five and nine days) and small rises in absences (less than one day) in the years immediately following the events. Schools affected by Matthew and by both storms experienced large increases in absenteeism during 2021 (rising from ten to twenty-one and ten to eighteen, respectively). This surge in absenteeism is partially—but not fully—explained by a broader trend of rising absences during the COVID-19 period, which has been noticed by education researchers (Dee 2024), and appears for the unaffected group (rising from ten to fifteen absences between the 2019 and 2022 school years). Figure 4 also shows that schools affected by Matthew experienced small declines in reading and mathematics test scores immediately following the hurricanes (0.03 and 0.05 standard deviations), while schools affected by Florence and by both storms saw dips in 2019 mathematics scores (both 0.04 standard deviations).

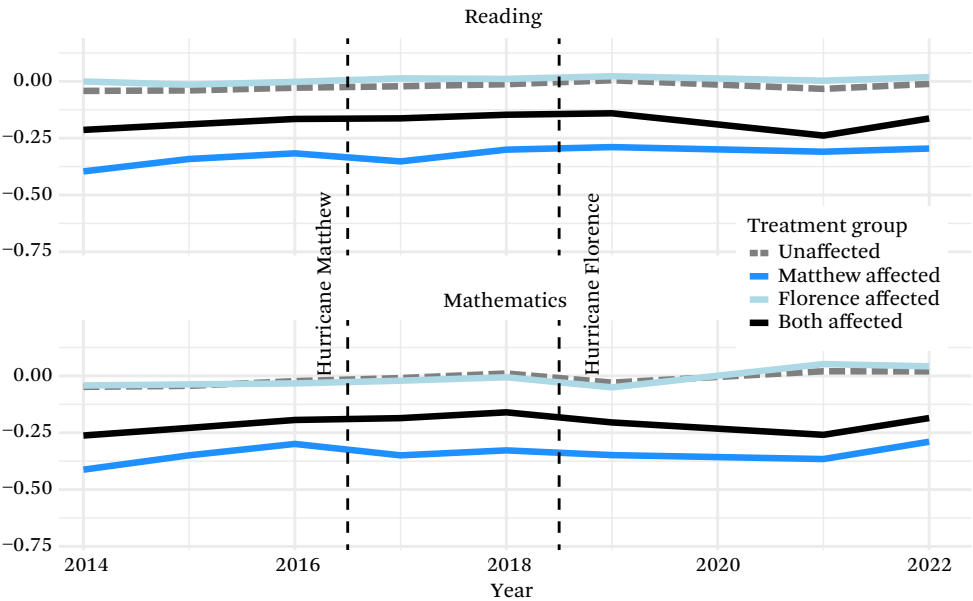
Figure 3. Average Enrollments and Absences over Time, by School Closure Status



Source: Restricted-access NCERDC data, 2014–2022.

Note: Data are missing for the 2020 school year. “Affected” refers to students whose schools experienced a prolonged closure.

Figure 4. Average Test Scores over Time, by School Closure Status



Source: Restricted-access NCERDC data, 2014–2022.

Note: Data are missing for the 2020 school year. “Affected” refers to students whose schools experienced a prolonged closure.

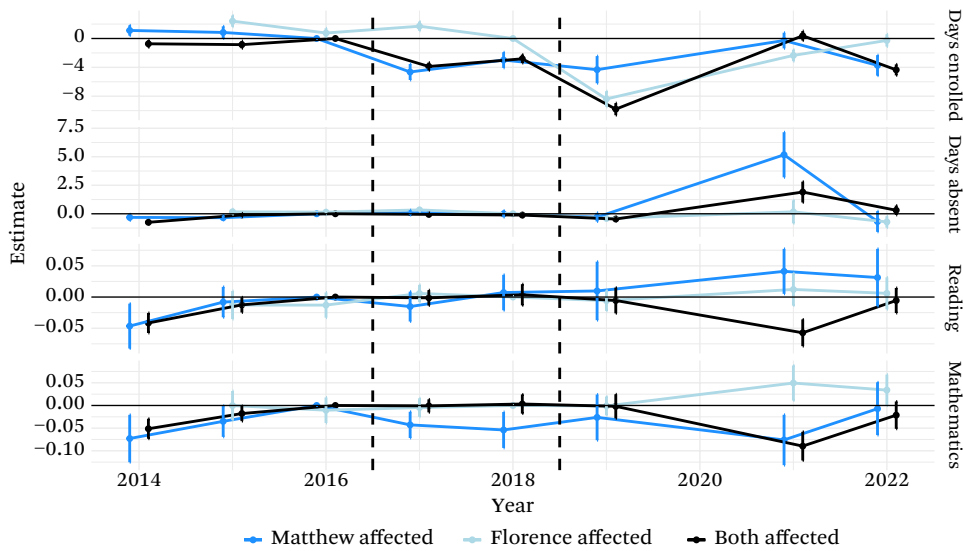
Pathway 1: Impacts of Closure Days

Turning to the event study analysis, figure 5 reports attendance and test score estimates for schools across time. I first note the placebo estimates, which assess differences in trends prior to the year of each group’s first hurricane (for example, years 2015, 2016, and 2017 for the Florence affected group). The goal of these placebo estimates is to test the plausibility of the parallel trends assumption. The placebo estimates (shown in online appendix D) are mostly null or very small, indicating a lack of meaningful pre-event differences in trends between unaffected and affected groups of schools. I therefore proceed to the post-event estimates.

The effects of prolonged school closures on enrollment days range between four and ten lost days. Longer-term impacts of the storms are also apparent: for example, schools affected by Hurricane Matthew experienced losses of five school days in the 2016–2017 school year, followed by additional losses of three days in the 2017–2018 school year, and four days in the 2018–2019 school year. Matthew-affected schools also experienced later rises in absences (5.2 days)

during the 2020–2021 school year. Effects on test scores are smaller, but schools affected by Matthew and both storms experience losses in mathematics achievement (on the scale of 0–0.09 standard deviations) and schools affected by both storms experience losses in reading achievement (0.06 standard deviations) in the 2020–2021 school year (although in the same year, schools affected by Florence alone see gains of 0.05 standard deviations). Overall, there are slightly larger negative impacts for students who are affected by both storms than for singularly affected students, although Matthew-affected students and schools experience sizable attendance declines during Hurricane Florence. The impacts of school flooding, shown in online appendix C, are smaller and limited to enrollment days but generally mirror the prolonged closure results.

Figure 6 reports school effects across baseline (2016) achievement levels. Schools with pre-storm low and mid achievement levels (less than –0.5 and between –0.5 and 0.5, respectively, on a student standardized scale) show similar effects to the overall trends, with losses in enroll-

Figure 5. Effect Estimates of Prolonged Closures on Attendance and Learning over Time

Source: Restricted-access NCERDC data, 2014–2022.

ment days, gains in absences during COVID-19, and some small losses in mathematics test scores. Mid-achieving schools impacted by Matthew also show increases in absences in the 2021–2022 school year. However, high-achieving Matthew-impacted schools show little or no negative impacts in the years following the storm, but rather, experience long-run gains in enrollment days, losses in absences, and gains in reading and mathematics test scores. These surprising gains, which culminate with six additional enrollment days, losses of three absence days, and 0.2 and 0.3 standard deviation increases in reading and mathematics scores in the 2021–2022 school year, occur while the rest of the Matthew-impacted schools experienced negative or null impacts on the same outcomes.

Pathway 2: Impacts of Residential Block Flooding, Net of School District Closures

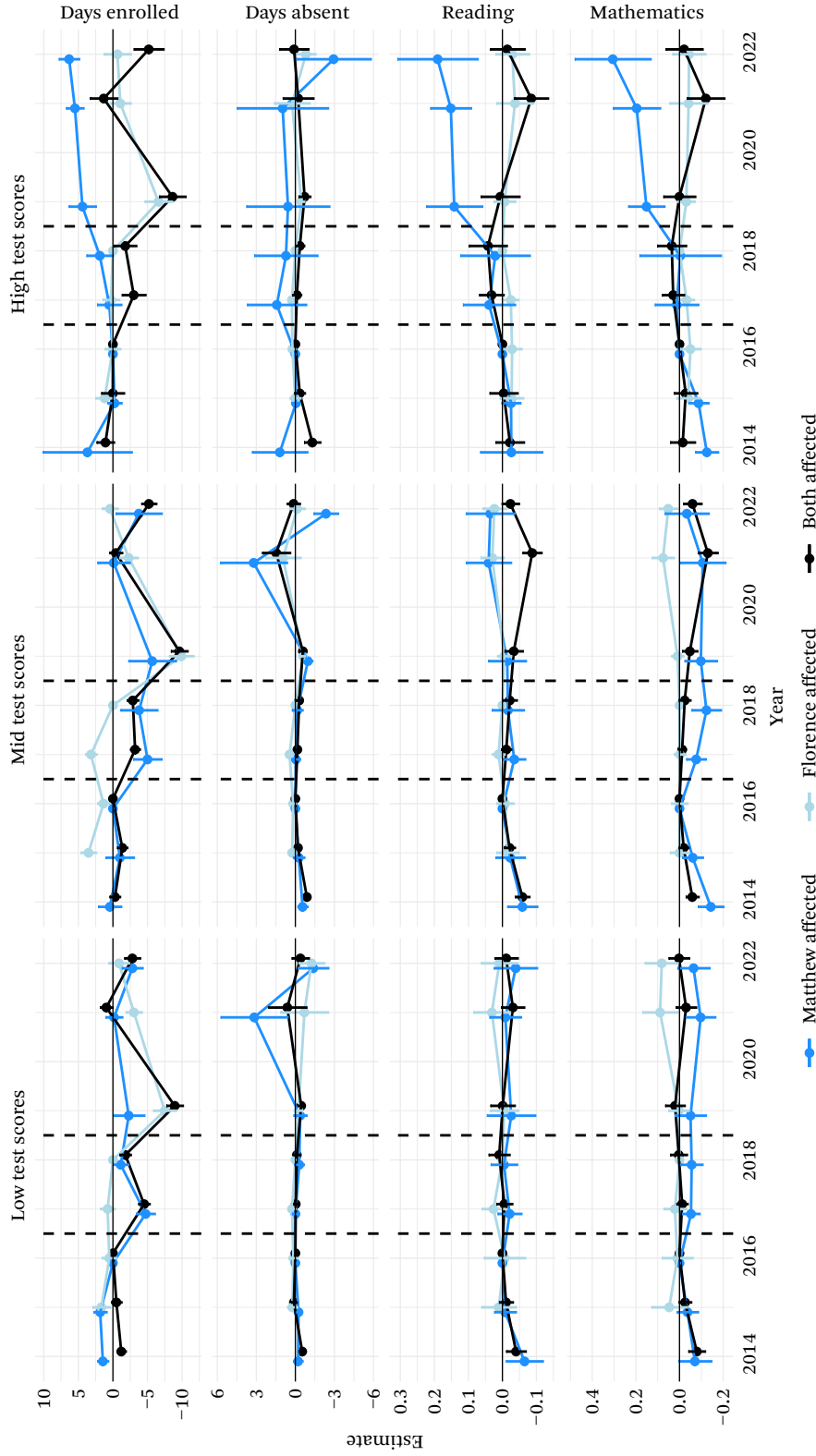
Figure 7 presents estimates from weighted linear models, which account for selectivity in treatment and school features, to test for differences between students in flooded and non-flooded residential blocks. Beginning with students in blocks with at least 20 percent flooding, one observes that net of school districts, each of the treatment sequences is mostly unassociated with attendance days and absences, although

students impacted by Matthew gained 0.5 school enrollment days and 0.4 absence days, during the 2018–2019 school year. For other treatment groups, and for students affected by flooding at the 50 percent residential block level, there are no significant effects on reading or mathematics test scores.

The results also show losses in mathematics scores—but not reading scores—for some students in flooded blocks. Students affected by Hurricane Florence at the 20 percent residential block flooding level see declines of 0.07 standard deviations in mathematics scores. Unweighted models, reported in online appendix E, also point to small declines in mathematics for students affected by Matthew and by both storms. I also report results for student models in 2019, 2021, and 2022 separately. Except for increases in absences for Matthew-affected students, impacts were concentrated in 2019.

In short, these results suggest that residential block flooding had little impact on student outcomes, beyond the district-level effects of the storms, although some affected students experienced further declines in mathematics scores. There are few differences, in terms of attendance or test score impacts, between students who experienced singular flooding as opposed to consecutive residential flooding. In

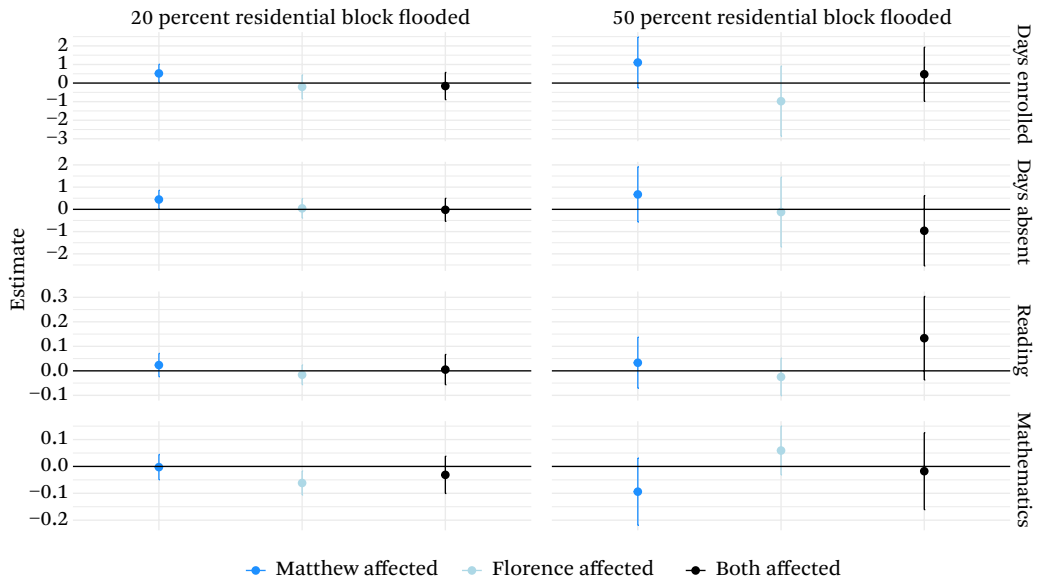
Figure 6. Effect Estimates of Prolonged Closures on Attendance and Learning over Time, by Test Scores



Source: Restricted-access NCERDC data, 2014–2022.

Note: “Low,” “Mid,” and “High” refer to schools with average 2016 test scores below –0.5, between –0.5 and 0.5, and above 0.5 (measured in standard deviations).

Figure 7. Effect Estimates of Residential Flooding



Source: Restricted-access NCERDC data, 2014–2022.

online appendix E, I investigate heterogeneity in student-level models across student characteristics (poverty status, ethnoracial status, and achievement). With a couple of exceptions, the effects are not statistically different across subgroups.⁹ It is possible that differences in residential information completeness led to confounding in the sample of students affected by residential flooding. To investigate this possibility, I also run the student analyses for districts with at least 85 percent residential completeness, and report results that are very similar to those in figure 7.

DISCUSSION AND CONCLUSION

As children inside and outside the US face increasing flooding risks, the successive hurricane flooding events in North Carolina between 2016 and 2018 provide a useful case for what the climate-changed future may look like. This article investigates the effects of these consecutive hazards on educational outcomes. Leveraging a dynamic treatment design, I estimate the ef-

fects of singular and repeated hurricane flooding through two pathways: school closures and residential flooding. I find that closures resulted in large declines in attendance, which were similar each time that schools were affected. On average, schools that experienced prolonged closures during Hurricane Florence singularly lost about ten enrollment days in the period from 2017–2022, whereas schools impacted by Hurricane Matthew lost about fifteen enrollment days and schools impacted by both storms lost about twenty-one enrollment days during the same period. The prolonged closures—whether singular or repeated—were related to long-run increases in absences and, for some schools, declines in test scores. Net of school closures, students who lived in residential blocks where flooding occurred experienced little or no negative impacts on test scores, which were similar each time the students were affected.

Overall, the results align with a middle of the road scenario where prior exposure to flood-

9. Students with below average test scores affected by Hurricane Matthew experience losses in days enrolled, compared to their peers, and non-economically disadvantaged students affected by both storms see larger negative effects on mathematics test scores.

ing or school closure neither heightens nor dulls the impacts of a second event. In other words, the storms caused disadvantages, mostly through lost school days, but I find no evidence that disadvantages from a second exposure are substantially different than those from initial exposure. Similarly, An and colleagues (2026) find that the effects of multiple disasters on rent hikes and vacancy are similar in scale for each successive storm. Even if the effects of a second storm are close in magnitude to the first, these can still lead to cumulative disadvantages if some groups are disproportionately affected by the hazards.

Some schools affected by Hurricane Matthew alone also experienced losses in enrollment days, higher absences, and lower mathematics scores during Hurricane Florence. Transportation—often schools’ “biggest challenge” in these circumstances (Schlemmer 2018)—could play a role in these effects if challenges in staffing and rerouting buses affected otherwise unaffected districts. In online appendix F, I investigate average school bus route times for Matthew-affected districts. Most of these districts had long bus routes relative to the state average, but the data are unable to provide decisive evidence on whether Florence-related transit disruptions resulted in spillover effects in Matthew-affected districts.

The COVID-19 pandemic introduces a third disruption which, to some extent, all students and all schools experienced.¹⁰ Figure 6 illustrates that during the pandemic, cumulative disadvantages fell on students and schools that were still recovering from prior events—for example, schools impacted by both flooding events appear to experience worse long-run trends than unaffected schools, including increases in absences and decreases in mathematics and reading test scores. The negative outcomes during COVID-19 could be the result of sustained disaster impacts: research has found long-lasting effects of disasters on students’ education (Deuchert and Felfe 2015; Gibbs et al. 2019) and increases in mental health support services needed by both teachers and students (Davis et al. 2021; Kousky 2016).

A small group of Matthew-affected schools that were already high performing appear to benefit from the storm sequence. These schools are all located in a single district (Pitt County Schools), and are less poor (30.7 percent), and Whiter (62.0 percent), on average, than the rest of the sample. Sometimes, due to insurance processes and relief programs, more affluent households benefit during the disaster recovery period (Rhodes and Besbris 2022; Howell and Elliott 2019). Here, one observes that some schools that were already advantaged were able to increase academic advantages, with better performance in terms of days enrolled, absences, and reading and math test scores. Relative deprivation may facilitate some of these gains: perhaps because disadvantaged students were displaced during the storms or because their peers at other schools fell behind, other students at these schools were able to excel. However, these students represent a small portion of the overall sample, and these academic gains could be unrelated to the storms.

Several limitations are noteworthy. The student-level model relies on the assumption of unconfounded treatment, given time-varying covariates. While I include relevant variables at multiple levels (a full list of covariates is available in online appendix G), unobserved variables could have created confounding here. Similarly, the event study models show some placebo effects, violating the no anticipation restriction. While these effects are small relative to the main effects, endogeneity in treatment groups may not be fully accounted for. Missingness in district residential reporting also limits the measurement of residential flood impacts. I provide a supplemental analysis of districts with at least 85 percent completeness in online appendix E, but beyond this threshold, the number of treated units becomes too small for covariate balancing. While attrition rates for schools and students were similar between affected and unaffected groups, storm-induced school closures or student exits may have changed the composition of the sample. In both cases, however, one would expect effect estimates to be biased toward zero due to these exits. Flood exposure

10. According to the COVID-19 School Data Hub, there are no clear differences in learning modality policies across districts affected and unaffected by hurricanes (COVID-19 School Data Hub, n.d.).

estimates also may contain errors. In online appendix H, I use a secondary source of flooding estimates (Schaffer-Smith et al. 2020) to reproduce the main student effect estimates, which are similar but smaller. Lastly, there are several mechanisms by which storms could plausibly affect students that I do not test for in this article. For instance, storms have immediate and long-term consequences for various labor sectors (Francis and Horn 2026, this issue), which could influence teachers as well as students' home lives. Storm-induced preparations for future events and cumulative burdens may also offset each other. Such mechanisms are outside the scope of this analysis but could be explored in future studies.

Limitations notwithstanding, the article extends previous research on consecutive disasters in several ways. First, this article offers a longitudinal analysis on consecutive disaster impacts for a population of children with minimal selectivity. Existing work has mostly studied the impacts of singular disasters in the school context, and little is known about how children experience cumulative shocks. Research has shown that disasters can have long-lasting impacts on educational outcomes (Gibbs et al. 2019; Deuchert and Felfe 2015); by analyzing students across a period of several years, I am able to disentangle the effects of singular and cumulative disasters. Second, I measure flood impacts at both the residential and school levels, allowing for more detailed exploration of mechanisms than previous work, which has mostly identified hurricane impacts in schools and districts (Sacerdote 2012; Fuller and Davis 2021).

One policy-relevant finding from this study is that school closures, rather than residential impacts, appear to be the main source of hurricane-related losses in attendance and learning. Like prior literature on community-level trauma (Trejo et al. 2024; Goldmann and Galea 2014), I find that disaster impacts are not limited to those who experience direct residential exposure. While more than 9,000 students experienced residential flooding (at the 20 percent residential block level), over 395,000 students experienced a prolonged school closure during the study period. These results beg the question: how many of these prolonged closures could have been avoided or shortened? Because

the district closures affected so many students, and closure days appear to be responsible for much of the storms' academic impacts, policies that prepare districts to safely reopen quickly following hurricanes would likely benefit students and families. For schools and governments to increase their preparedness strategies, research on municipalities suggests that low-cost incentives may be useful (Brody et al. 2009).

As children in the twenty-first century experience disasters with greater frequency, questions around how consecutive hazards impact students become increasingly relevant. Future generations affected by multiple storms may no longer be "exposure outliers" (Mohammad and Peek 2019), and further research is needed to fully explore the consequences of these repeated exposures. Disasters may occur in unexpected places, and a lack of expectation may contribute to the disaster itself (Quarantelli 1998). A community member who experienced flooding during Hurricane Matthew described anxiety during subsequent storms, saying, "I believe that anyplace can flood with enough water" (PBS North Carolina 2017). Given updates in flooding projections (Wing et al. 2018), large swaths of the US landscape could indeed be flooded.

While schools are positioned to be sites of resilience and protection during extreme weather events, this article shows that many are not prepared for the repeated disasters that a climate-changed future will bring. Schools are community assets and often a reason that families return and rebuild after being displaced by a natural disaster: Kimbro (2021, 208) argues that "the school must be viewed as a core component of family life, a key neighborhood institution that threaded itself through the families in ways that increased social cohesion as well as neighborhood attachment." In Hurricanes Matthew and Florence, as well as in the recent Hurricane Helene, schools were some of the first organizations to coordinate information about relief services, water and material supplies, and charging stations. Because schools are sites of refuge and information, and often the first places that people go in times of crisis, it is especially important that we make them more resilient to future singular and repeated flooding events.

REFERENCES

- Alcaino, Manuel, and Pablo Argote. 2024. "Politics Matter: How Political Experience Mitigates Learning Losses Caused by Natural Disasters." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 10(1): 181–204. <https://doi.org/10.7758/RSF.2024.10.1.08>.
- An, Brian Y., Andrew Jakabovics, Anthony W. Orlando, Seva Rodnyasky, and Raphael W. Bostic. 2026. "The Trajectory of Rental Housing in the Wake of Natural Disasters: Evidence from California and Florida." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 54–76. <https://doi.org/10.7758/RSF.2026.12.4.03>.
- Aquino, Taylor, Jennie E. Brand, and Florencia Torche. 2022. "Unequal Effects of Disruptive Events." *Sociology Compass* 16(4): e12972. <https://doi.org/10.1111/SOC4.12972>.
- Asad, Asad L. 2015. "Contexts of Reception, Post-Disaster Migration, and Socioeconomic Mobility." *Population and Environment* 36(3): 279–310. <https://doi.org/10.1007/s11111-014-0221-4>.
- Besbris, Max, Manuel Pastor, Anna Rhodes, Wolfram Schlenker, and Pamela Winston. 2026. "The Social, Political, and Economic Consequences of Climate Hazards." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 1–32. <https://doi.org/10.7758/RSF.2026.12.4.01>.
- Bhatia, Aatish. 2023. "'A Beautiful Place That Has a Dragon': Where Hurricane Risk Meets Booming Growth." *New York Times*, November 19. <https://www.nytimes.com/interactive/2023/11/19/upshot/carolina-hurricanes.html>.
- Blackwell, Matthew. 2013. "A Framework for Dynamic Causal Inference in Political Science." *American Journal of Political Science* 57(2): 504–20. <https://doi.org/10.1111/J.1540-5907.2012.00626.X>.
- Brody, Samuel D., Sammy Zahran, Wesley E. Highfield, Sarah P. Bernhardt, and Arnold Vedlitz. 2009. "Policy Learning for Flood Mitigation: A Longitudinal Assessment of the Community Rating System in Florida." *Risk Analysis* 29(6): 912–29. <https://doi.org/10.1111/j.1539-6924.2009.01210.x>.
- COVID-19 School Data Hub. n.d. "COVID-19 School Data Hub." Accessed March 25, 2024. <https://www.covidschooldatahub.com/>.
- Cross, Christina J. 2020. "Racial/Ethnic Differences in the Association Between Family Structure and Children's Education." *Journal of Marriage and Family* 82(2): 691–712. <https://doi.org/10.1111/JOMF.12625>.
- Davis, Cassandra R., Sarah R. Cannon, and Sarah C. Fuller. 2021. "The Storm After the Storm: The Long-Term Linger Impacts of Hurricanes on Schools." *Disaster Prevention and Management* 30(3): 264–78. <https://doi.org/10.1108/DPM-03-2020-0055>.
- Davis, Cassandra R., Sarah R. Cannon, and Sarah C. Fuller. 2022. "The Disruptive Effects of Hurricanes on School Operations and Reopening." *Natural Hazards Review* 23(3): 05022004. [https://doi.org/10.1061/\(ASCE\)NH.1527-6996.0000569](https://doi.org/10.1061/(ASCE)NH.1527-6996.0000569).
- de Chaisemartin, Clément, and Xavier D'Haultfœuille. 2024. "Difference-in-Differences Estimators of Intertemporal Treatment Effects." *Review of Economics and Statistics*, February 9. https://doi.org/10.1162/rest_a_01414.
- Dee, Thomas S. 2024. "Higher Chronic Absenteeism Threatens Academic Recovery from the COVID-19 Pandemic." *Proceedings of the National Academy of Sciences* 121(3): e2312249121.
- Deuchert, Eva, and Christina Felfe. 2015. "The Tempest: Short- and Long-Term Consequences of a Natural Disaster for Children's Development." *European Economic Review* 80: 280–94. <https://doi.org/10.1016/j.eurocorev.2015.09.004>.
- Diprete, Thomas A., and Gregory M. Eirich. 2006. "Cumulative Advantage as a Mechanism for Inequality: A Review of Theoretical and Empirical Developments." *Annual Review of Sociology* 32: 271–97. <https://doi.org/10.1146/ANNUREV.SOC.32.061604.123127>.
- Ellen, Ingrid Gould, Katharine Harwood, and Rachel Meltzer. 2026. "Tale of Two Storms: Neighborhood Racial Change After Hurricanes Sandy and Harvey." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 77–101. <https://doi.org/10.7758/RSF.2026.12.4.04>.
- Elliott, Rebecca. 2021. *Underwater: Loss, Flood Insurance, and the Moral Economy of Climate Change in the United States*. Columbia University Press.
- Fothergill, Alice, and Lori Peek. 2015. *Children of Katrina*. University of Texas Press.
- Francis, Dania, and Keren Horn. 2026. "Impacts of Climate Hazards on Employment and Earnings by Hazard Type, Industry, Race, and Ethnicity." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 134–55. <https://doi.org/10.7758/RSF.2026.12.4.06>.

- Fuller, Sarah C, and Cassandra R Davis. 2021. *Academic Progress for Students Following a Hurricane*. Education Policy Initiative at Carolina, University of North Carolina at Chapel Hill. https://epic.unc.edu/wp-content/uploads/sites/1268/2021/09/NSF-1-Academic-Progress_Final_1.15.21.pdf.
- Gibbs, Lisa, Jane Nursey, Janette Cook, et al. 2019. "Delayed Disaster Impacts on Academic Performance of Primary School Children." *Child Development* 90(4): 1402–12. <https://doi.org/10.1111/CDEV.13200>.
- Goldmann, Emily, and Sandro Galea. 2014. "Mental Health Consequences of Disasters." *Annual Review of Public Health* 35: 169–83. <https://doi.org/10.1146/annurev-publhealth-032013-182435>.
- Goodman, Joshua. 2014. "Flaking Out: Student Absences and Snow Days as Disruptions of Instructional Time." NBER Working Paper No. 20221. National Bureau of Economic Research. June. <https://doi.org/10.3386/W20221>.
- Grzadkowska, Alicja. 2019. "The Implications for Insurers If a Hurricane Is a Wind Versus Water Event." *Insurance Business*, June 3. <https://www.insurancebusinessmag.com/us/news/catastrophe/the-implications-for-insurers-if-a-hurricane-is-a-wind-versus-water-event-168911.aspx>.
- Hahn, Micah B., Rebecca Van Wyck, Lauren Lesnard, and Ruby Fried. 2022. "Compounding Effects of Social Vulnerability and Recurring Natural Disasters on Mental and Physical Health." *Disaster Medicine and Public Health Preparedness* 16(3): 1013–21. <https://doi.org/10.1017/dmp.2020.476>.
- Hannon, Lance. 2003. "Poverty, Delinquency, and Educational Attainment: Cumulative Disadvantage or Disadvantage Saturation?" *Sociological Inquiry* 73(4): 575–94. <https://doi.org/10.1111/1475-682x.00072>.
- Harris, Douglas N., Feng Chen, Rylie C. Martin, Ann F. Bernhardt, Christopher R. Marsicano, and Paul T. von Hippel. 2024. "The Effects of the COVID-19 Pandemic on Educational Attainment." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 10(1): 152–80. <https://doi.org/10.7758/RSF.2024.10.1.07>.
- Harris, Douglas N., and Matthew F. Larsen. 2023. "Taken by Storm: The Effects of Hurricane Katrina on Medium-Term Student Outcomes in New Orleans." *Journal of Human Resources* 58(5): 1608–43. <https://doi.org/10.3368/jhr.58.5.0819-10367r2>.
- Hino, Miyuki, Todd K. BenDor, Jordan Branham, Nikhil Kaza, Antonia Sebastian, and Shane Sweeney. 2024. "Growing Safely or Building Risk?" *Journal of the American Planning Association* 90(1): 50–62. <https://doi.org/10.1080/01944363.2022.2141821>.
- Howell, Junia, and James R. Elliott. 2019. "Damages Done: The Longitudinal Impacts of Natural Hazards on Wealth Inequality in the United States." *Social Problems* 66(3): 448–67. <https://doi.org/10.1093/socpro/spy016>.
- Imai, Kosuke, and Marc Ratkovic. 2014. "Covariate Balancing Propensity Score." *Journal of the Royal Statistical Society Series B: Statistical Methodology* 76(1): 243–63. <https://doi.org/10.1111/RSSB.12027>.
- Imai, Kosuke, and Marc Ratkovic. 2015. "Robust Estimation of Inverse Probability Weights for Marginal Structural Models." *Journal of the American Statistical Association* (110)511: 1013–23. <https://doi.org/10.1080/01621459.2014.956872>.
- Jahan, Ferdous A., Nicole Zviedrite, Hongjiang Gao, Faruque Ahmed, and Amra Uzicanin. 2022. "Causes, Characteristics, and Patterns of Prolonged Unplanned School Closures Prior to the COVID-19 Pandemic—United States, 2011–2019." *PLOS One* 17(7): e0272088. <https://doi.org/10.1371/journal.pone.0272088>.
- Kim, Cheongil, Sanghoon Jang, and Ji-Bum Chung. 2024. "Differences Between the Effects of Direct and Indirect Earthquake Experiences on Disaster Preparedness." *Natural Hazards Review* 25(1): 05023015. <https://doi.org/10.1061/NHREFO.NHENG-1840>.
- Kimbro, Rachel Tolbert. 2021. *In Too Deep: Class and Mothering in a Flooded Community*. University of California Press.
- Kousky, Carolyn. 2016. "Impacts of Natural Disasters on Children." *Future of Children* 26(1): 73–92. <https://dx.doi.org/10.1353/foc.2016.0004>.
- Kousky, Carolyn. 2018. "Financing Flood Losses: A Discussion of the National Flood Insurance Program." *Risk Management and Insurance Review* 21(1): 11–32. <https://doi.org/10.1111/rmir.12090>.
- Kuhfeld, Megan, Jim Soland, and Sofia Postell. 2025. *The Impact of Severe Weather Events on Education: Revisiting Hurricane Katrina While Preparing for the next Disaster*. NWEA Research. August.

- https://www.nwea.org/uploads/The-impact-of-severe-weather-on-education-revisiting-hurricane-katrina-while-preparing-for-the-next-disaster_NWEA_researchBrief.pdf.
- Leppold, Claire, Lisa Gibbs, Karen Block, Lennart Reifels, and Phoebe Quinn. 2022. "Public Health Implications of Multiple Disaster Exposures." *Lancet Public Health* 7(3): e274–e286.
- Logan, John R., Sukriti Issar, and Zengwang Xu. 2016. "Trapped in Place? Segmented Resilience to Hurricanes in the Gulf Coast, 1970–2005." *Demography* 53(5): 1511–34. <https://doi.org/10.1007/s13524-016-0496-4>.
- Mazumder, Ram Krishna, S. Amin Enderami, Nathanael Rosenheim, Elaina J. Sutley, Michelle Stanley, and Michelle Meyer. 2023. "Estimating Long-Term K–12 Student Homelessness After a Catastrophic Flood Disaster." *Resilient Cities and Structures* 2(2): 89–92. <https://doi.org/10.1016/j.rcns.2023.07.005>.
- McClure, John, Liv Henrich, David Johnston, and Emma E.H. Doyle. 2016. "Are Two Earthquakes Better than One? How Earthquakes in Two Different Regions Affect Risk Judgments and Preparation in Three Locations." *International Journal of Disaster Risk Reduction* 16: 192–99. <https://doi.org/10.1016/J.IJDRR.2016.03.003>.
- Merton, Robert K. 1968. "The Matthew Effect in Science: The Reward and Communication Systems of Science Are Considered." *Science* 159(3810): 56–63. <https://doi.org/10.1126/science.159.3810.56>.
- Mohammad, Lubna, and Lori Peek. 2019. "Exposure Outliers: Children, Mothers, and Cumulative Disaster Exposure in Louisiana." *Journal of Family Strengths* 19(1): 4. <https://doi.org/10.58464/2168-670X.1401>.
- Morrill, Melinda, and John Westall. 2023. "Heterogeneity in the Educational Impacts of Natural Disasters: Evidence from Hurricane Florence." *Economics of Education Review* 94: 102373. <https://doi.org/10.1016/j.econedurev.2023.102373>.
- North Carolina Department of Public Instruction (NCDPI). 2024a. "End-of-Grade (EOG)." North Carolina Department of Public Instruction. <https://www.dpi.nc.gov/districts-schools/accountability-and-testing/state-tests/end-grade-eog>.
- North Carolina Department of Public Instruction (NCDPI). 2024b. "School Calendar Legislation."
- North Carolina Department of Public Instruction. <https://www.dpi.nc.gov/districts-schools/district-operations/financial-and-business-services/school-calendar-requirements>.
- National Weather Service. 2017. "Hurricane Matthew in the Carolinas: October 8, 2016." National Weather Service. <https://www.weather.gov/ilm/matthew>.
- North Carolina General Assembly. 2022. "G.S. 115C-84.2 School Calendar." North Carolina General Assembly. https://www.ncleg.net/enacted-legislation/statutes/html/bysection/chapter_115c/gs_115c-84.2.html.
- Overton, Rodney. 2016. "No Date Set for Reopening Robeson Co. Schools as 80+ Roads Still Affected by Matthew." CBS17. October 25. <https://www.cbs17.com/news/no-date-set-for-reopening-robeson-co-schools-as-80-roads-still-affected-by-matthew/>.
- Pais, Jeremy F., and James R. Elliott. 2008. "Places as Recovery Machines: Vulnerability and Neighborhood Change After Major Hurricanes." *Social Forces* 86(4): 1415–53. <https://doi.org/10.1353/sof.0.0047>.
- PBS North Carolina. 2017. "After the Storm Part 1 - The Staff." May 25. PBS North Carolina. <https://video.pbsnc.org/video/after-the-storm-part-1-the-staff-vskOst/>.
- Pew Charitable Trusts. 2017. *Flooding Threatens Public Schools Across the Country*. August. Pew Charitable Trusts. https://www.pew.org/-/media/assets/2017/08/fpc_flooding_threatens_public_schools_across_the_country.pdf.
- Pinchak, Nicolo P., and Raymond R. Swisher. 2022. "Neighborhoods, Schools, and Adolescent Violence: Ecological Relative Deprivation, Disadvantage Saturation, or Cumulative Disadvantage?" *Journal of Youth and Adolescence* 51(2): 261–77. <https://doi.org/10.1007/s10964-021-01551-8>.
- Quarantelli, Enrico L., ed. 1998. *What Is a Disaster?: A Dozen Perspectives on the Question*. Routledge.
- Rhodes, Anna, and Max Besbris. 2022. *Soaking the Middle Class: Suburban Inequality and Recovery from Disaster*. Russell Sage Foundation.
- Rubin, Donald B. 1974. "Estimating Causal Effects of Treatments in Randomized and Nonrandomized Studies." *Journal of Educational Psychology* 66(5): 688–701. <https://doi.org/10.1037/h0037350>.

- Sacerdote, Bruce. 2012. "When the Saints Go Marching Out: Long-Term Outcomes for Student Evacuees from Hurricanes Katrina and Rita." *American Economic Journal: Applied Economics* 4(1): 109–35. <https://doi.org/10.1257/app.4.1.109>.
- Schaffer-Smith, Danica, Soe W. Myint, Rebecca L. Muenich, Daoqin Tong, and Julie E. Demeester. 2020. "Repeated Hurricanes Reveal Risks and Opportunities for Social-Ecological Resilience to Flooding and Water Quality Problems." *Environmental Science and Technology* 54(12): 7194–204. <https://doi.org/10.1021/acs.est.9b07815>.
- Schlemmer, Liz. 2018. "Schools Face Flooded Buildings and Impassable Bus Routes After Florence." WUNC News. <https://www.wunc.org/education/2018-09-19/schools-face-flooded-buildings-and-impassable-bus-routes-after-florence>.
- Schlemmer, Liz. 2020. "'Attendance is Everything': If Public Schools Lose Enrollment, Funding Is Probably Next." WUNC News. <https://www.wunc.org/education/2020-08-28/attendance-is-everything-if-public-schools-lose-enrollment-funding-is-probably-next>.
- Smiley, Kevin T., Ilan Noy, Michael F. Wehner, Dave Frame, Christopher C. Sampson, and Oliver E. J. Wing. 2022. "Social Inequalities in Climate Change-Attributed Impacts of Hurricane Harvey." *Nature Communications* 13: 3418. 1–10. <https://doi.org/10.1038/s41467-022-31056-2>.
- State of North Carolina Emergency Management. 2021. "Buildings Footprints (2010)." NC OneMap. <https://www.nconemap.gov/datasets/NCEM-GIS::building-footprints-2010/about>.
- Torche, Florencia, Jason Fletcher, and Jennie E. Brand. 2024. "Disparate Effects of Disruptive Events on Children." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 10(1): 1–30. <https://doi.org/10.7758/RSF.2024.10.1.01>.
- Trejo, Sam, Gloria Yeomans-Maldonado, and Brian Jacob. 2024. "The Effects of the Flint Water Crisis on the Educational Outcomes of School-Age Children." *Science Advances* 10(11): 4737. <https://doi.org/10.1126/sciadv.adk4737>.
- Ward, Michael E., Kyna Shelley, Kristopher Kaase, and John F. Pane. 2008. "Hurricane Katrina: A Longitudinal Study of the Achievement and Behavior of Displaced Students." *Journal of Education for Students Placed at Risk (JESPAR)* 13(2–3): 297–317. <https://doi.org/10.1080/10824660802350391>.
- Wing, Oliver E. J., Paul D. Bates, Andrew M. Smith, et al. 2018. "Estimates of Present and Future Flood Risk in the Conterminous United States." *Environmental Research Letters* 13(3): 034023. <https://doi.org/10.1088/1748-9326/aaac65>.

“Do Battle with Insurance”: Post-Hurricane Insurance Litigation in Southwest Louisiana



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Property insurance is essential for hurricane recovery, yet timely and fair claims payouts are not guaranteed. Post-disaster litigation over denied or delayed claims is common but understudied in who sues and how this varies sociodemographically. Southwest Louisiana is well situated for such an analysis, where within two years after Hurricane Laura and Hurricane Delta hit the region in 2020, one in five federal civil litigation cases were filed, most regarding insurance. We collate 5,476 court records to geocode implicated properties and assess litigation patterns using property and sociodemographic data. We find litigation is 43 percent more likely in higher percent Black residential areas, with property value amplifying this disparity. Additionally, case duration is longer for residents in these areas, suggesting systemic procedural inequities. Our findings reveal how race, class, and geography relate to insurance litigation, a critical yet overlooked facet of procedural vulnerability that may contribute to inequitable disaster recovery outcomes in the United States.

Keywords: insurance, hurricane damage, civil litigation, claims disputes, procedural vulnerability, Southwest Louisiana, sociodemographic difference

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Property insurance is a critical backstop for financial losses from damaged property from weather- and climate-related hazards in the United States (Kousky 2019). Yet, disasters bring homeowners into contestation with their insurers through litigation—lawsuits homeowners bring against their insurers—to resolve disputed claims. Despite the security property insurance guarantees in the event of a catastrophic loss, insurance companies may undervalue losses, incorrectly adjust or deny claims, or delay payouts, violating insurance contracts and altogether deferring residents' home reconstruction (Dulin 2008). Delayed housing recovery is consequential for impacted residents' livelihoods, including housing stability, employment and educational activities, and financial well-being (Fussell 2015; Peacock et al. 2014). Insurers' "bad faith" practices in delaying payouts for home repairs can be rampant and even expected among consumer groups and insureds (Feinman 2010). Following disasters, resolving property claims disputes through litigation is a common legal need (Finger 2022). Among the array of civil legal issues the American public encounters, insurance contract disputes are a common type of litigation. Yet, many affected individuals may not recognize insurers' malfeasant actions as lawful or as matters that can be resolved through legal pathways (Sandefur 2014). Understanding these processes is urgent, as minority and low-income populations face barriers or are hesitant to participate in the civil justice legal system in post-disaster contexts (Simington 2023).

Despite well-established evidence of insurance's role, sparse public administrative records on who is insured impede characterizing the adequacy of insurance for advancing recovery and for whom (Kousky 2019; Squires et al. 2001; You and Kousky 2024). Moreover, a lack of available data prevents documenting any disparate impact or discriminatory practices of insurance companies (Schwarcz 2019; Squires 2003). Given that insurance claims lawsuits are among the most prevalent types of suits on the federal civil court docket following large disasters, these processes have yet to be subjected to social scientific analysis, and the extent of socioeconomic differences in insurance litigation participation is unclear. The role

of property insurance litigation in enabling recovery and for whom is a prescient question, particularly given what the pattern foretells amid frequent, severe loss events and narrowing coverage access. The high frequency of insurance litigation following storms raises an important question: Who initiates these lawsuits? This is particularly pertinent as severe weather events become more frequent and insurance coverage narrows.

This gap stands amidst the role of the legal system as a key backdrop to social life and behavior (Friedman 1975), yet one that is undertheorized in how legal participation or lack thereof engenders inequities among impacted residents following disasters. Understanding the policies, planning processes, and institutions that create and sustain racial, class, housing tenure, and gender-based inequalities in recovery following disasters is needed to elucidate why and how inequities occur (Rivera et al. 2022). Procedural vulnerability refers to the disadvantages individuals or groups face due to inequities in processes, systems, and structures (Veland et al. 2013). In this research, we use procedural vulnerability to structure our hypotheses and to motivate insurance litigation as another apparatus through which socioeconomic differences persist post-disaster.

To begin to unpack this dynamic, we present the first study, to our knowledge, to analyze geolocated individual litigation against insurers and examine variation in litigation incidence across property type, demographics, and hazard magnitude. While previous research has mapped and examined the socioeconomic characteristics of individuals in civil litigation cases, such as eviction proceedings (see Hepburn et al. 2020), we do so specifically in insurance suits arising from post-hurricane claims. Our findings have significant policy implications, as states have recently instituted reforms to curb litigation.

There are few places in the United States where insurance litigation is as prominent as Southwest Louisiana, where Hurricanes Laura and Delta struck in the fall of 2020. Within two years, one in five federal civil cases across the US were filed in the United States District Court for the Western District of Louisiana, most of them insurance suits (TRAC 2022). This study

interrogates whether and to what degree socioeconomic differences exist in litigation participation, and, among those who participate, the characteristics of the plaintiff, the date of case filing, and case duration. We analyze 5,476 insurance litigation suits tied to disputed claims from Hurricanes Laura and Delta.

In the absence of an empirical summary of these patterns, this study makes three significant contributions to current understandings of property insurance claims participation and the timing of claims following large hurricane events in the United States. First, we present the first empirical, case-level analysis of insurance litigation following a major US disaster, achieved by collating litigation court records. Second, we use statistical regression to evaluate the probability of litigation in Southwest Louisiana, finding that litigation is more likely in higher-percentage Black residential areas and that this effect increases with property value. Importantly, our analysis suggests that the litigant type, as a resident or nonresident, relates to differences in when cases are filed and how long litigation cases last from filing to closure, or settlement.

Our findings suggest that, while residents of diverse socioeconomic, racial, and ethnic backgrounds filed lawsuits against their insurers, plaintiffs are more likely to live in a high-percentage Black residential area, and that income is not a strong predictor of litigation. Instead, property value strengthens this disparity. Who you are as a plaintiff, be it a resident or commercial business, also relates to differences in the length of cases, with residents in higher percent Black areas engaged in cases that last longer. Notably, we are unable to directly measure and account for property-level damage, closed insurance claims that did not result in litigation, or an individual- or group-level indicator of willingness or ability to participate in legal action. So, while our findings suggest that typical plaintiffs in this case are more likely Black or own a higher-valued property, our findings cannot surmise if this pattern is linked to racially motivated practices, such that Black residents experienced discriminatory claims handling or are more inclined to engage in legal actions. These findings advance empirical ap-

proaches to document patterns of litigation participation, motivating further hypothesis-driven interrogation of how race, property ownership, and socioeconomics shape legal claims-making in post-disaster contexts.

THEORETICAL BACKGROUND

Situating insurance litigation within broader structures of inequality requires attention to how race and class shape both access to insurance and the capacity to seek legal redress. We draw on multiple bodies of literature on discriminatory insurance practices, the role of law in post-disaster governance, and the social dimensions of civil litigation participation to motivate our theoretical orientation of procedural vulnerability in shaping litigation participation.

Differential Treatment in Insurance Claims Handling

Homeowners insurance is a form of privatized social welfare that protects policyholders against losses from damaging hazard events. Like other forms of social protection, homeowners' insurance coverage gaps are highest in communities of color and low-income communities (Cornelissen et al. 2024). Leigh Johnson (2015) refers to the resulting protection gap as "splintering protectionism," in which insurance serves to distinguish the haves from the have-nots in disaster preparedness and recovery (Peacock and Girard 1997). Barriers to accessing insurance, including property insurance, can undermine the ability of homeowners of color to protect their property assets (Squires 2003). Likewise, discriminatory claims-handling practices have been documented for low-income, minority groups (Baker and McElrath 1996; Bolin and Bolton 1986; Lin 2022). Weak and lax insurance regulation can perpetuate discriminatory practices. Federal protection against redress for alleged discriminatory acts is the "Disparate Impact Rule" of the Fair Housing Act, issued by the Department of Housing and Urban Development (HUD) in 2013. The rule defined the term *disparate impact* as the production or reinforcement of segregated housing patterns. Although the rule can be used to protect against discriminatory insurance practices, it has rarely been used because of the high costs of litigation, and

oversight of insurance companies has been weakened and then reinstated under the first Trump and Biden administrations, respectively (Kousky and French 2023). Under the second Trump administration, this rule faces a more tenuous future. Despite the high costs associated with class action lawsuits, the need for redressing discriminatory practices exists, as demonstrated by a recent survey among Black and White policyholders that exposed racial discrimination in claims handling, which has led to an ongoing class action lawsuit against State Farm (Flitter 2022).

Post-Disaster Legal Claims and Insurance Litigation

Insurance companies seize opportunities in large, correlated losses to engage in bad faith practices that delay payouts, deny coverage, or underpay claims (Feinman 2010). As part of the claims adjustment process, homeowners can file disputes and may arrive at negotiated payouts. Following certain disasters, state-run mediation programs provide third-party mediators between policyholders and insurers (Schwarcz 2008), as was the case after Hurricane Sandy (Ballard 2013). Homeowners may also voice their concerns by filing public complaints with state regulatory bodies. Should claims remain unresolved through these pathways, or if no settlement is reached between insurer and insured within the statutory prescriptive period, insureds may sue. Litigation allows insureds to file complaints against their insurance companies for alleged violations of bad faith laws. These statutes, which exist in all states, require insurers to handle claims fairly and promptly, per the Model Unfair Claims Settlement Practices Act (Schwarcz 2008).

In hurricane claims litigation, most discussions of the role of the law in compensating hurricane victims hinge on the questions of fault attribution and standing (Zink 2014). But often, denied insurance claims are blatant acts of neglect and breaches of contract. The egregious nature of denied or delayed claims explains why, in hurricane insurance litigation, legal representation follows a contingency-fee model in which plaintiffs pay lawyers' fees only if they lose; the business case for contingency-fee mod-

els makes sense when the plaintiffs' representation sees a clear winning case. The often obvious fault of insurers is also why cases settle pretrial, a predictable outcome in insurance litigation (Dulin 2008).

The legal system plays an important role in the governance of disasters (Tierney 2012). Through cases brought and adjudicated, the courts and the legal apparatus address issues that other institutions, firms, and governments deflect (Sterett and Mateczun 2020). Legal scholars argue that judicialization, or the increasing role of courts and judicial processes in resolving political, social, and administrative issues, is particularly apt for addressing social and economic suffering and legal wrongs, including property loss from climate-related hazards (Sterett and Mateczun 2022).

Raced and Classed Participation in Civil Litigation

Scholars have studied the complex social contexts for differences in individual- and group-level proclivities and decisions to engage the law (Ewick and Silbey 1998). Participation, or lack thereof, of affected people in litigation over post-disaster recovery disputes reveals how the legal process and the governance of law can function as exclusionary mechanisms (Nalla et al. 2021). Legal processes can alienate and estrange minority groups during disaster recovery, leading to mistrust of legal remedies (Simington 2023). Restricted and unequal access to justice can lead to significant socioeconomic and racial group differences in familiarity with the law, recognition of the legal system as a resource, and the capacity to exercise legal rights to resolve civil legal disputes (Sandefur 2019). A lack of comprehensive sociodemographic data on parties in civil cases limits understanding of how access to justice differs across geographies and different populations (Sandefur 2008). Yet, it has been widely documented that there are racial, class, and gendered gaps in how people understand and use the law, and in their ability to engage with the legal system (Greene 2015; Legal Services Corporation 2022; Silbey et al. 1993). Access to legal services is a key component in shoring up these gaps in legal access post-disaster (Finger 2015).

Procedural Vulnerability to Frame Disparities in Insurance Litigation

Procedural vulnerability examines how institutions, actors, and systems (re)produce, distribute, contest, and sustain risk (Hsu et al. 2015) and how this is negotiated through everyday struggles (Marino and Faas 2020). In the context of disasters, procedural vulnerability examines how institutions, policies, and plans reflect the social hierarchy imposed by systems of oppression, producing uneven power relations and differential recovery (Rivera et al. 2022). Property insurance has received significant attention for its historic discriminatory roots, disenfranchising non-White homeowners from accessing insurance (Squires et al. 2001) and discriminatory claims-handling practices for low-income minority groups (Baker and McElrath 1996; Bolin and Bolton 1986). Procedural vulnerability sets the expectation that social hierarchies structure the unequal delivery and experience of procedural services, such as implicit biases that shape differential treatment from insurance adjusters or legal services. Here, procedural vulnerability serves as a framing for the ways oppression operates to disadvantage populations who may experience disparate treatment from insurers and discourage or prevent those same populations from taking legal action.

LITIGATION OF INSURANCE CLAIMS FROM HURRICANES LAURA AND DELTA IN SOUTHWEST LOUISIANA

In fall 2020, Hurricanes Laura and Delta caused extensive damage to homes in Calcasieu Parish, a low-lying area about thirty miles inland from the coast in Southwest Louisiana. Hurricane Laura alone severely damaged or destroyed roughly 50 percent of Calcasieu Parish's housing stock (Community Foundation of Southwest Louisiana 2020). As a result of the extreme losses in Calcasieu Parish, there were practical and logistical challenges in having adjusters inspect properties. Mandatory evacuations were still in effect three weeks after Laura's landfall (Li et al. 2024). Supply chain shortages of construction materials due to the COVID-19 pandemic inflated construction costs. In Louisiana, a total of 177,691 and 89,451 claims were reported for Hurricanes Laura and Delta, respectively, with

\$7.4 billion in paid loss for Laura and \$750 million for Delta (Louisiana Department of Insurance 2021). Despite these large payouts, slow insurance payouts, and denials of federal government assistance among uninsured households have deferred home repairs. According to an audit of all Louisiana residential property complaints in 2020 and 2021, most delayed claims were due to changes in adjusters assigned to individual claims and lagging communication (Louisiana Legislative Auditor 2022). Other complaints included lower-than-expected claim offers, improper claim denial, and adjuster handling of claims, such as non-thorough or incomplete inspections.

There are numerous stages in loss adjustment, and the handling of claims can differ among insureds. For example, differences can arise in how soon after a declared loss the damaged property is inspected, how thoroughly and fairly the field adjuster inspects the property, how smoothly claims are managed between one or multiple adjusters, how aligned the adjustment is with coverages stated in one's policy or quoted costs of damage from contractors, or how quickly the claim is settled and a payout is made. Throughout this process of claims adjustment, disagreements or delays can drastically alter how insureds benefit from insurance in terms of repairing damage. Following large disaster events, delays and under-compensation are common, leading to litigation against insurers (Dulin 2008).

At the time of Laura, there were two bad faith statutes in Louisiana, §22:1892 and §22:1973, through which litigants brought claims. Under §22:1892, insurers must make a written offer to settle and pay a claim amount within thirty days of "satisfactory proof of loss" from the insured. Any "arbitrary, capricious, or without probable cause failure" to fulfill this statute results in penalties for the insurer for up to 50 percent of the unpaid amount in addition to the amount of loss and attorney's fees if the statute is violated. The second statute, §22:1973, further ensures fair practices whereby if an insurer fails to pay claims pursuant to §22:1892, thereby breaching its duty of good faith and fair dealing, penalties up to 200 percent may be imposed. In most cases, the §22:1892 statute applies when

settlements are reached before or during mediation, thereby triggering the 50 percent penalties and attorney's fees.

In 2021, a year after Hurricanes Laura and Delta, the United States District Court for the Western District of Louisiana (LAWD) had the largest number of federal court civil lawsuits of any district in the nation (2,194), 91 percent of which were filed in Lake Charles (TRAC 2021). Within two years of Laura and Delta's passing, nearly one in five lawsuits filed in federal court were filed in Lake Charles (TRAC 2022). The total reported litigation rates for Laura were 8.33 percent and for Delta, 6.92 percent.

The LAWD quickly became the clearinghouse for all federal cases. Taking cues from the Southern District of Texas Federal Court, which experienced an exponential uptick in cases related to insurance following Hurricane Harvey, Judge James Cain, a federal LAWD judge, created a Case Management Order, which is a court order outlining the procedure for cases on a court's docket, often setting timelines for discovery. Acknowledging the need to expediently handle the large number of case filings over first-party insurance claims disputes from Hurricanes Laura and Delta, the Case Management Order presents a Streamlined Settlement Process, which provides clear instructions on the timelines for filing defense responses, initial discovery, scheduling pretrial negotiations, and mediation (Western District of Louisiana 2023). Additionally, cases were also filed in the 14th Judicial District Court (14JDC) of Louisiana, which also adopted the Case Management Order enacted and filed in the LAWD. The factors that determine if a case is filed in a state judicial court or a federal court are the monetary amount in question and the diversity of parties; if the disputed claim amount is greater than \$75,000

and the plaintiff is a resident of Louisiana but their insurance carrier is domiciled outside the state of Louisiana, these are both criteria for a suit being filed in federal court.¹ According to personal correspondence with an attorney in Lake Charles who handled several hurricane claims litigation cases, by early 2024, the majority of the cases had closed with pretrial settlements, a common outcome in insurance litigation of this nature (Sterett and Mateczun 2022).

Insurance is a key concern for Louisianans, and policymakers have pointed to legal system abuse as a key instigator of rising insurance premiums and coverage limits. In response, the insurance industry and industry-aligned legislatures advocate for tort reform, changes in laws that are designed to limit the number of lawsuits brought after large losses and reduce the amount of money insurance companies might have to pay in claims or legal damages.² Reforms of this type are often introduced after major storms when a surge in insurance disputes and lawsuits can strain insurers and the court system. Proponents of tort reform, notably insurance industry lobbyists and political actors, argue that tort reform stabilizes insurance costs and prevents excessive litigation, while critics argue that it weakens consumer protections. Most of the literature suggests that litigation is valid (Klein 2022).

Despite evidence that tort reform does not lead to reduced premiums (Mower 2023), the 2023–2024 Louisiana State Legislative session has rolled out sweeping changes to how insurance is regulated in the state, including changes to litigation (for example, Landry 2024). The rates of litigation have been debated among state legislatures, industry commentators, legal actors, and consumer advocates, each arriving at different conclusions about the root causes of

1. According to the Louisiana Department of Insurance, the average severity per claim in litigation is \$99,500 versus \$22,500 for non-litigated claims.

2. Common tort reform measures include caps on the amount of money policyholders can recover, stricter filing deadlines after the event, restrictions on how much lawyers can earn from insurance lawsuits, which can make it harder for policyholders to find legal representation, and altering "bad-faith" laws. These changes can make it harder for policyholders to find legal representation and raise the bar for policyholders to sue insurers for acting unfairly or denying claims improperly. In the 2024 State Legislative Session, Senate Bill 113 was signed into law, which deems Louisiana Citizens Property Insurance Cooperation, the state insurer of last resort, exempt from litigation.

insurance unaffordability and the role of litigation in moderating insurance costs. Despite growing concerns among residents, consumer advocates, industry affiliates, and policymakers across the nation about rising insurance premiums, industry and tort reform politics routinely label litigation as frivolous and the root cause of those premiums (Jefferson 2024). Under the new changes is Act No. 3 (formerly Senate Bill 323) which repeals La. R.S. 22:1973, thereby removing the 200 percent penalty provision and allowing a longer time for insurers to adjust claims. As these recent legislative changes make it more difficult for people to bring complaints, they raise further questions about who will continue to receive improper claims handling after these new statutes are in place to abate insurance bad faith tactics, and whether the changes will entrench any existing disparities in litigation.

Following the devastating 2020–2021 hurricane seasons, insured policyholders experienced enormous premium increases or experienced cancellations, and approximately fifteen companies left the state entirely (Finch II 2022). Concerns over insurance affordability and access have grown, complicating the rebuilding process. Recovery from Hurricanes Laura and Delta was largely fast-tracked in wealthier, Whiter neighborhoods and delayed in poorer, Black neighborhoods (Maschke 2024). The racialized inequities in recovery in Lake Charles are inherently spatial, with Interstate 10 bifurcating the city into majority-white and majority-Black neighborhoods. Delays in repairs also occurred for uninsured properties, common among heirship properties found within Black households, where inheritors cannot afford to clear title, purchase insurance, or obtain loans to make repairs without insurance (Kane et al. 2019). This differential recovery further motivates interrogation of the sociodemographic pattern of litigation for this study.

HYPOTHESES

Socioeconomic differences in insurance claim experiences, coupled with research showing unequal access in decisions and the ability to invoke the law when there is harm (Ewick and Silbey 1998), create competing expectations about who will pursue litigation. On one hand,

minority and lower-income populations may receive poorer treatment from insurers (for example, Flitter 2022), prompting the need for litigation. Yet, race and income play significant stratifying roles in seeding different levels of trust and use of the legal system (Greene 2015). Previous studies examining differences use survey-based data and claims records (for example, Lin et al. 2022), which are often privately held by the insurance industry. However, litigation records alone do not reveal whether socioeconomic dimensions influenced differential claims handling. To determine whether there were disparate experiences with claims adjustment following Hurricanes Laura and Delta would require a systematic sample of insurance claims, which was not provided on request from the Louisiana Department of Insurance. Given our inability to control for disparate experiences with poor insurance claims handling, we cannot assess this as a mechanism in our study.

Instead, we leverage patterns of insurance litigation as evidence of “turning to the law” to resolve disputes. This sample, therefore, may not fully represent all households experiencing poor treatment from their insurance company and does not identify mechanisms that explain any differences in participation. Empirical legal studies demonstrate that affluent, White individuals are more likely than non-White, lower-income individuals to initiate civil litigation and secure legal representation (Myrick et al. 2012). This disparity is driven in part by greater access to legal resources, ease and confidence in navigating the legal system, and the systematic disenfranchisement of minority groups from accessing and trusting the legal system (Simington 2023). This research builds from evidence of legal participation to examine patterns of sociodemographic differences in insurance litigation. We rest our analysis on four hypotheses:

1. Insurance litigation is more likely in socioeconomically privileged areas.
2. Plaintiffs in insurance litigation cases are more likely to be residents than nonresidential parties in socioeconomically privileged areas.
3. Insurance litigation cases are filed earlier in socioeconomically privileged areas.

4. Insurance litigation cases are resolved more quickly in socioeconomically privileged areas.

DATA

This analysis collates data on litigation at the parcel level along with various other parcel, census block group, and tract-level data for the study area of Calcasieu Parish to test the four hypotheses (table 1).

State and Federal Court Records of First-Party Insurance Litigation Cases

Data on state and federally filed first-party insurance lawsuits were collected to create parcel-level data on the incidence of insurance litigation, plaintiff type, and temporal characteristics of case filing dates and durations. For cases filed in the 14JDC, data on first-party insurance lawsuits were provided by the Calcasieu Parish Clerk of Court. The dataset contained 1,998 records and provided the address of the property associated with the litigation, the full name of the plaintiff and defendant, and the date of the case filing. For the cases filed in LAWD, a total of 7,363 first-party insurance lawsuit case dockets were obtained via Public Access to Court Electronic Records. Data on the address of the property associated with the litigation, the full name of the plaintiff and defendant, the date of the case filing, and the date of the case closing were systematically extracted from dockets. Using the addresses in the combined state and federal cases, we geocoded the records and spatially intersected the point locations with the parcel boundary dataset provided by the Calcasieu Parish Police Jury GIS Office. Each parcel boundary is assigned a parcel number (UID), which links to other parcel-level variables described in the following section.

Manual cleaning of the combined litigation records was undertaken, resulting in the removal of 3,883 cases that were either duplicates or irrelevant cases from the federal case set. A first manual check was performed to drop duplicates in both the state and federal case sets. This duplication was expected, as cases were “removed” from the state 14JDC to the federal

LAWD, a common practice in which the details of the case, such as the total amount in dispute or the insurer’s out-of-state domiciliary status, would require litigation in federal court. Second, cases were dropped from the federal set if, within the Petition of Damages document that is filed with all cases’ dockets, the nature of the action did not pertain to alleged bad faith actions of the insurer (the “Defendant”) or if complaints were for damages separate from Hurricanes Laura and Delta (for example, an April 2020 hail event). For instance, cases were dropped if they entailed businesses seeking remediation for business interruption for all-risk commercial property insurance policies. Third, records were manually cleaned if the provided address was a post office box, as this did not represent a physical structure. For instances where no known addresses were stated, 2020 tax assessment records were used to locate the property of the plaintiff if only one property was associated with the name of the indicated plaintiff. Lastly, 1,642 cases were removed in which the plaintiff’s lawyer was McClenny Moseley & Associates, as these cases were later dropped following Judge Cain’s order due to fraudulent case management.³ After removing duplicates and cases with addresses outside of Calcasieu Parish, there are 5,476 unique records of litigation participation. The majority of litigation occurs in Lake Charles, the urban area of the Parish (figure 1).

For each case, the plaintiff type indicator variable was created and classified as either residential or nonresidential. Specifically, any case where the plaintiff type is residential represents a case in which the plaintiff is the residential owner of that property. In nonresidential cases, the plaintiff was a commercial business, a public entity, or another organized entity, such as a church. The plaintiff’s name was used to designate the plaintiff type. If the plaintiff’s name was a single individual (for example, John Smith) or, in some cases, a couple’s names (for example, John and Petra Smith), the plaintiff type was classified as residential. If the terms “Inc.,” “LLC,” “LLP,” or “Co.” were included in the name, they were designated as nonresidential. Remain-

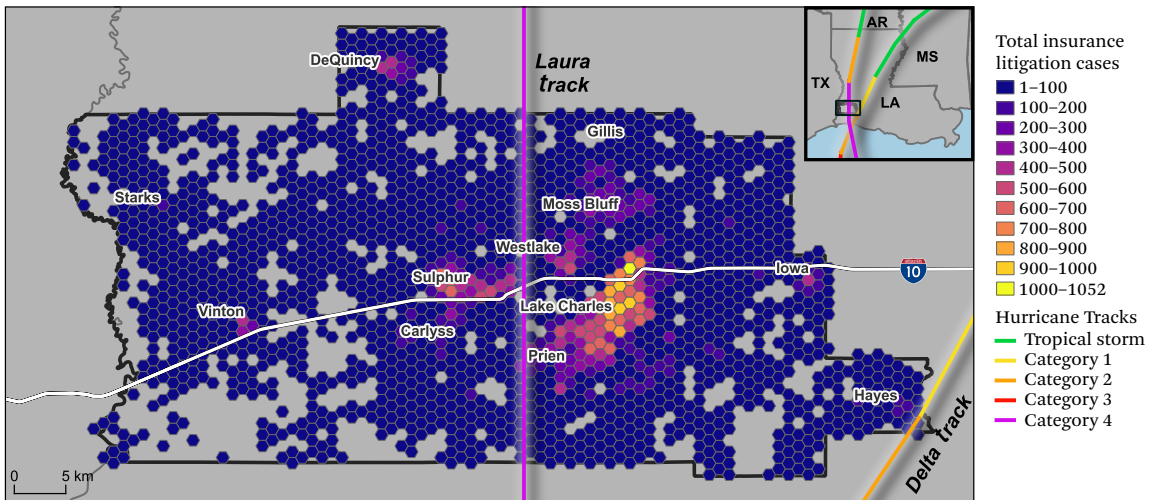
3. It is beyond the scope of this article, but the McClenny Moseley & Associates court order has embroiled and fueled political arguments that all instances of insurance litigation are frivolous.

Table 1. Description of Variables Used to Test Hypotheses

Usage	Variable(s)	Description	Unit, <i>N</i>	Time Range	Source
Outcome to test H1	Litigation	Indicator of participation as plaintiff in insurance litigation	Parcel, 94,820	August 2020–October 2024	Coded from 14JDC LAWD
Outcome to test H2	Plaintiff type	Indicator of plaintiff as resident or nonresident	Parcel, 5,476		
Outcome to test H3	Case filing	Total time since Hurricane Laura landfall until case was filed (days)			
Outcome to test H4	Case duration	Total time from litigation filing to closing (days)	Parcel, 4,776		
Parcel-level predictors to test H1-4	Property value	Assessed property value (USD)	Parcel, 94,820	2020	Louisiana Tax Commission
	Owner occupied	Indicator of property receiving homestead exemption			CoreLogic Mortgage
	Insured	Indicator of insured property proxied on active 2020 mortgage			
Block-group level predictor to test H1-4	Percent Black	Percent non-Hispanic Black	Block Group, 159	2018–2022	ACS 2018–2022 Five-Year Estimates
Tract-level predictors to test H1-4	Population density	Total population divided by total area (square mile) of tract	Tract, 54		
	Income	Median household income in 2022 inflation-adjusted dollars			
	Percent bachelor's	Percent of population over the age of 25 with bachelor's degree			
	Laura maximum wind	Modeled maximum windspeed of Hurricane Laura (mph)		August 2020	NIST / ARA

Source: Authors' calculations.

Note: The tract-level percent Black variable is only included in models as a robustness check. The specific data tables for the American Community Survey 2018–2022 Five-Year Estimates are DP05_0001 (total population to calculate population density), DP05_0080P (percent Black), DP03_0062 (income), DP02_0065P (percent bachelor's), and DP04_0017P, DP04_0018P and DP04_0019P (summed to derive percent new build homes).

Figure 1. Calcasieu Parish Study Area with Counts of Litigation and Hurricanes Laura and Delta Tracks

Source: Authors' calculations based on recorded litigation from LAWD and JDC14 case dockets. Hurricane tracks are from the National Oceanic and Atmospheric Administration Historical Hurricane Tracks database.

Note: The inset map in the upper right shows the study area as located within Louisiana and surrounding states. Each symbolized hexbin is an area of approximately 1.2 square kilometers. Any location without a hexbin within Calcasieu Parish indicates no record of insurance litigation. The optimal way to view this map is in color. We refer readers of the print edition of this article to <https://www.rsjournal.org/content/12/4/178> to view the color version.

ing records were manually coded to ensure all records where the plaintiff did not appear to be a resident (for example, terms like “Restaurant” or “Church”) were accurately classified as non-residential. Residential properties accounted for 82 percent of all cases. Resident plaintiffs are distributed across the study area, with higher densities clustered in Lake Charles, whereas nonresidential plaintiffs are mainly located in urban areas (online appendix figure A.1).⁴

Next, we construct two data variables using the case filing and closing dates. First, we calculate the total time in unit months from Hurricane Laura's landfall on August 27, 2020, until the date of the filing to create the case filing date variable. Second, for cases closed at the time of data collection in September 2024, we calculate the total time in unit months between

the case filing and closing dates to construct the case duration variable. If cases were still ongoing (not closed) at the time of data collection, they were not assigned a case duration value.

Parcel-Level Variables

We collected three variables at the parcel level, relevant for deriving socioeconomic variation in litigation incidence, plaintiff type, and case timing. The first two originate from the 2020 Calcasieu Parish tax assessment records that were obtained from the Louisiana Tax Commission and contain information on the parcel assessment number, the total assessed value of the property, including the lot and property improvements, and whether a property has received a homestead exemption.⁵ From these

4. The online appendix for tables A.1 through A.10 and for figures A.1 through A.7 can be found at <https://www.rsjournal.org/content/12/4/178/tab-supplemental>.

5. In the state of Louisiana, the homestead exemption is an exemption from state and parish taxes up to \$7,500 of the total assessed value for primary residences where the property is owner-occupied.

records, we first calculate the total property value and, given the pronounced right skew in the data, we top code at the 90th percentile, or \$2,272,000. Second, we use the homestead exemption as an indicator for owner-occupied property.

The third parcel-level variable is a time-invariant indicator of insured property indirectly estimated using the CoreLogic Mortgage dataset, which includes property-level data on active mortgages in 2020. Using mortgages as a proxy for insured property is a well-supported approach, as lenders typically require properties with mortgages to be insured, corroborated by a recent study that found 98 percent of mortgaged owner-occupied homes had property insurance (Cornelissen et al. 2024; Keys and Mulder 2024). The insurance indicator controls for insured and uninsured properties with a mortgage that are not involved in insurance lawsuits. Notably, the insurance indicator does not capture insured properties owned outright, which may bias insurance estimates downward. Additionally, this indicator variable does not capture instances of underinsurance, in which insurance coverage limits or the total coverage of policies are less than the property's total replacement value. Of the total 94,838 parcels, 35,845 (38 percent) were matched to active mortgages at the time of Hurricane Laura's landfall on August 27, 2020. This figure is reasonable, as not all parcels are residential; they can be commercial, industrial, agricultural, or other zoned land uses. Using the parcel number as the unique identifier, the tax assessment records containing the total assessed value and homestead exemption, along with the mortgage records used to proxy for insured properties, were joined to the parcel layer containing the data on litigation involvement.

Block Group- and Tract-Level Variables

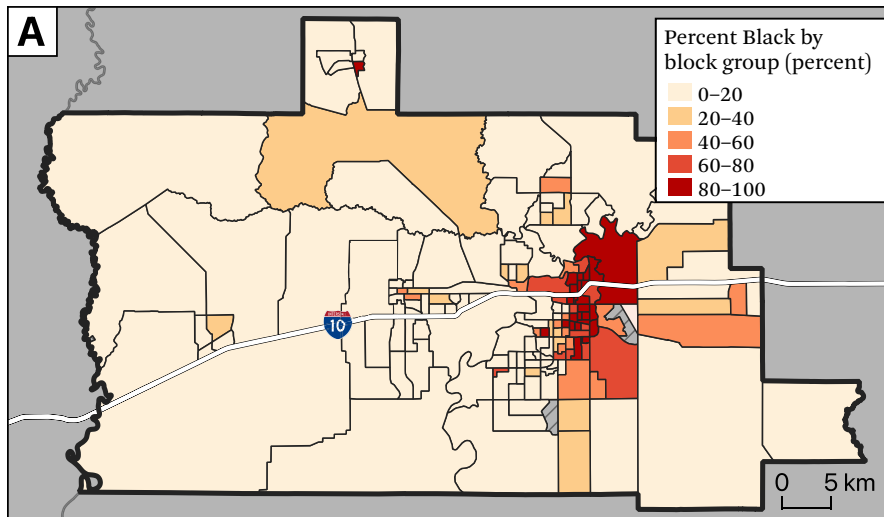
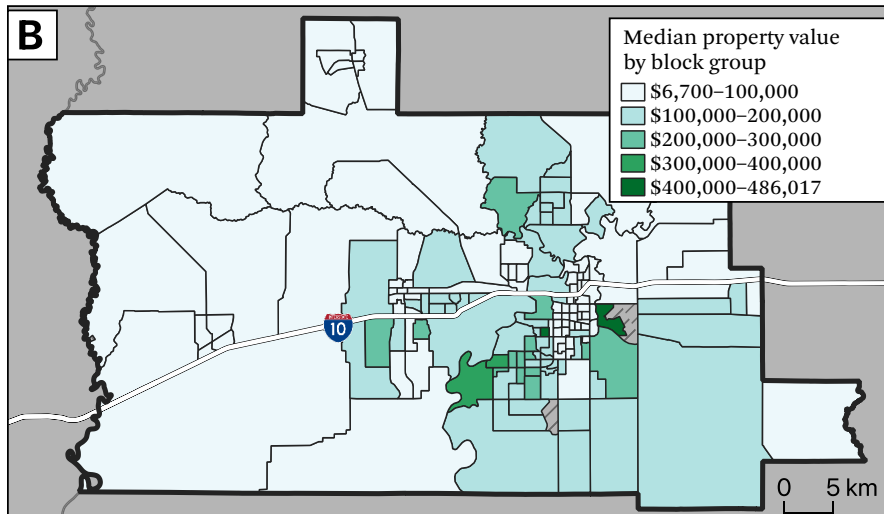
We collect block group- (j) and tract-level (k) data for additional predictors of socioeconomic estimates and hazard impact, which act as groups within which all individual parcels are nested. We assign the parcel-level records that include the litigation and property to census data block groups and tracts, which allows us to merge data from the American Community Survey 2018–2022 Five-Year Estimates. First, we

compile block group-level estimates of Hispanic, non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, and non-Hispanic American Indian and Alaska Native (AIAN) populations. At the block group level, we renormalize the group-level percentages by summing across all five race and ethnicity categories. Because the largest racial and ethnic populations within Calcasieu Parish are non-Hispanic White (66 percent) and Black (25 percent), we further renormalize the data to remove the total estimate of Hispanic, non-Hispanic Asian, and non-Hispanic AIAN to calculate the percent non-Hispanic White and non-Hispanic Black populations relative to one another, with the non-Hispanic White later used as the reference in modeling.

We acknowledge trade-offs in using block group-level data with higher margins of error (MOE) at smaller geographic units (Jurjevich 2019). However, because race and ethnicity have a lower relative sampling error given that these data are benchmarked to the 2020 Decennial (US Census Bureau 2024) and because we maximize data heterogeneity at the smaller block group scale, we decide to use the larger variation provided in the block group-level estimates for percent Black since it outweighs the inherent bias present in smaller geographic estimates. For other predictors where the data are not benchmarked to the 2020 Decennial Census and given concerns about large MOE in small population subsets and rural geographies, we use tract-level estimates.

Moreover, the tract-level variables also include population density, median household income, and the percentage of the population with a bachelor's degree. As with the renormalization procedure for the block group-level variable percent Black, we also calculate it for the tract-level estimate. While there are 161 block groups and 56 total tracts within Calcasieu Parish, 2 block groups and tracts are uninhabited, and 1 block group contains no instances of litigation, resulting in 159 block groups and 54 tracts for which the predictors were compiled. All census tract-level variables are time-invariant. The economic and racially segregated residential geography of Calcasieu Parish is evident in figure 2.

Additionally, the joint National Institute of

Figure 2. Percent Black Population and Median Property Value in Calcasieu Parish, Louisiana**Panel A. Percent Black Population by Block Group****Panel A. Aggregated Median Property Value by Block Group**

Source: Authors' calculations based on estimates from the ACS 2018–2022 five-year estimates.

Note: Symbolized proportions are displayed for 159 of the 162 census block groups in Calcasieu Parish.

Standards and Technology–Applied Research Associates, Inc. rapid-response wind contours are used to generate tract-level maximum peak wind speeds (mph) for both Hurricanes Laura and Delta (NIST/ARA 2020). We disaggregate vector-based wind contours to the tract level. While extreme winds and rain characterized both Hurricanes Laura and Delta, we chose to include only the maximum wind speed for Hur-

ricane Laura, as it was predominantly a wind-driven event, whereas Delta was a rain-driven event (Cangialosi and Berg 2021; Pasche et al. 2021). Of the two hurricanes, Laura wrought the most damage to structures; therefore, estimates of maximum peak wind speed are used to control for geographic variation in hazard magnitude. The decision to include wind data is motivated by the need to control for the exogenous

and heterogeneous impact of the hazard when statistically modeling variation in disaster outcomes (Kousky 2019). We use wind speed to account for variation in hazard, as there is no publicly available data to control for property-level damage. We caution against using damage estimates, given the possible endogeneity and omitted-variable bias in underlying population and housing characteristics that determine both damage and litigation participation, which could therefore bias estimates (Bakkensen and Larson 2014).

Descriptive Statistics

Summary statistics showcase the differences in litigation across parcels, as well as the tract-level sociodemographic variables. First, 5,476 (about 6 percent) parcels in Calcasieu Parish filed property claims lawsuits following Hurricanes Laura and Delta (table 2). The median assessed property value of households filing claims was \$115,200 compared to \$53,100 for parcels not involved with litigation. Of the litigated parcels, 66 percent were owner-occupied. These statistics highlight that litigation entails mainly private, owner-occupied residents suing their insurance company. This high proportion of owner-occupied properties for parcels with litigation tracks with the 82 percent of plaintiff types classified as “residential” as compared to 18 percent as “nonresidential.” The difference between the percent of owner-occupied parcels and those assigned “residential” plaintiff type is likely because not all residents claim the homestead exemption.

Defendants are not presented in the summary statistics; however, State Farm and Allstate are involved in the most cases, accounting for nearly 40 percent of defendants in insurance

litigation cases. While the filing or opening and closing dates are available for federal cases, only the filing dates are provided for state cases. Therefore, the summary statistics for the filing date pertain to both state and federal cases filed with the state JDC14 and the federal LAWD court, while the summary statistics for the closing date include only cases filed with LAWD. The most frequent filing date is August 25, 2022, immediately before the two-year prescriptive period. The median duration from filing to closure is thirteen months, with a maximum of forty-three months, indicating the case was still open at the time of data collection in September 2024 (table A.1). Table A.2 presents summary statistics for the block group- and tract-level variables. There is no strong indication of correlations among the variables, with a moderate negative correlation seen among percent Black and income (figure A.2).

EMPIRICAL APPROACH

We use general linear mixed models (GLMMs) to test all four hypotheses. In all models, the dependent variable is parcel-level, the independent variables are parcel-level (*i*), block group-level (*j*), and tract-level (*k*), and depending on the hypothesis being tested, the total *N* varies (table 3). Mixed models are well-suited to handle the hierarchical structure of a parcel-level dependent variable and a combination of parcel-, block group, and tract-level predictors with the inclusion of fixed and random effects. All GLMM modeling is conducted using the lme4 package in R (Bates 2015). We use a binary logistic GLMM to assess socioeconomic predictors of the probability of insurance litigation (model 1) and plaintiff type (model 2) and a Poisson GLMM to estimate case filing date (model 3) and case

Table 2. Summary Statistics for Parcel-Level Records

	Count	Median Property Value	Percent Owner Occupied	Percent Insured
Litigation participation	5,476	\$115,200	66	59
No litigation participation	89,344	\$53,100	49	36

Source: Authors’ calculations based on parcels associated with hurricane claims litigation from the LAWD and JDC14 case dockets, Calcasieu Parish tax assessments listings, and parcels data, and CoreLogic mortgage records.
Note: There is a total of 94,828 parcels.

Table 3. Models and Variables Used to Test Hypotheses

Hypothesis	Model	Dependent Variable	Independent Variables	<i>N</i>
H1. Insurance litigation is more likely in socioeconomically privileged areas.	Logistic mixed effects	Litigation (indicator)	Parcel-level (<i>i</i>) Property value, owner-occupied, insured	94,820
H2. Plaintiffs in insurance litigation cases are more likely to be residents than nonresidential parties in socioeconomically privileged areas.		Plaintiff type (residential indicator)	Block group-level (<i>j</i>) Percent Black	5,476
H3. Insurance litigation cases are filed earlier in socioeconomically privileged areas.	Poisson mixed effects	Case filing date (months)	Tract-level (<i>k</i>) Population density, income, percent bachelor's, percent Black	4,776
H4. Insurance litigation cases are resolved more quickly in socioeconomically privileged areas.		Case duration (months)	(only used as a robustness check), Laura maximum wind	

Source: Authors' calculations.

Note: The *N* column refers to the total number of samples for each hypothesis test. The difference in the *N* stem arise from dependent variable being estimated. As H2 and H3 only concern variation among litigation cases (*N* = 5,476), the *N* drops from the full study wide sample in H1 (*N* = 94,820) which estimates litigation for all parcels in the study area. H4 only concerns cases that were closed, thus only a portion of the cases with litigation are included in the sample (*N* = 4,776).

duration (model 4). We use a Poisson count model to estimate case filing date and duration as both represent counts in months and are nonlinear as they do not take on negative values, and are censored since not all cases were closed at time of analysis.

For model convergence, z-scores are produced for the parcel-level top-coded property value variable and the tract-level variables of population density, income, percent Bachelor's, and Hurricane Laura maximum wind speed to reduce variable skew. Across models 1–4, we specify a baseline model and a model with two interactions. In the baseline specification (models 1–4A), there are eight independent variables in the model, which include the parcel-level property value, the owner-occupied indicator, the insured indicator, the block group-level percent non-Hispanic Black, and tract-level population density, income, percent Bachelor's, and Laura maximum wind speed. Interactions are also performed between percent Black and top-

coded property value (models 1–4B) and percent black and income (models 1–4C) to evaluate the direction and magnitude of the association between the various outcomes and socioeconomic privilege. In models 3 and 4, an additional interaction between plaintiff type and percent black is added (models 3–4D). Coefficients for model 3–4 estimates are presented as incident rate ratios, which represent the multiplicative change in the expected count of months given a one-unit increase in each predictor. Because they are ratios, they signify relative change rather than absolute change in time units of months. To avoid multicollinearity, the variable inflation factor (VIF) is calculated for each model to ensure that no predictors are multicollinear, with the square root of the VIF not exceeding 2 (Fox 2020).

Across all models, random effects are included at the block group and tract levels. With the random effects in GLMMs, we adjust for group-level correlation by allowing the inter-

cepts to vary across groups. With the GLMM specifications, we were unable to obtain robust clustered standard errors, a challenge with GLMM models. While coefficients would remain the same, standard errors may be underestimated, and significance may therefore be overstated. To address some of these concerns, we apply numerous robustness checks to reestimate models and test the sensitivity of our results. Moreover, even if clustered robust standard errors were obtained, they may not substantively alter coefficient magnitudes, as there is no clustering in the sampling design or in the assignment of effects in our empirical design (Abadie et al. 2023). We then perform model diagnostics by computing the log-likelihood.

Tests for Spatial Autocorrelation

Given the spatial character of the data, we test for spatial autocorrelation to account for any spatial dependency in the outcome, which, if left uncontrolled, can bias standard errors (Anselin 2003). For models 1 and 2, where the dependent variable is binary, the joint-count statistics test for spatial autocorrelation, and in models 3 and 4, where the outcome is numeric, we use Moran's I statistic to test for spatial autocorrelation. The spatial lag for all models is calculated using the dependent variable for each parcel centroid and an inverse distance weighted matrix of the four nearest neighboring parcel centroids. The *spdep* package in R is used to construct the spatial lag and test for dependence in the model residuals, first without the model's associated spatial lag and later with the spatial lag. If autocorrelation is present, signaling that litigation incidence (H1), plaintiff type (H2), time of litigation filing (H3), or case duration (H4) are spatially clustered, a spatial lag is included in the respective models.

Robustness Checks

We performed four robustness checks to ensure model results hold across different data subsets and variable definitions. If spatial autocorrelation was detected in the model without the spatial lag, prompting the inclusion of the spatial lag in the models, the first robustness check is to ensure model results hold across different data subsets and variable definitions without the spatial lag (models 1–4E). Second, because

the proxy for insured properties is inferred indirectly from mortgage records, we run all baseline models without the insured variable (models 1–4F). Third, given the trade-offs discussed in using block-group versus tract-level estimates for the racial and ethnic composition variables, there are trade-offs in data scale and potential underlying error in the estimates. Given the trade-offs of using block groups, which capture larger variability at the cost of a high margin of error, we also specify all baseline models using percent Black at the tract-level to determine whether results hold with this lower-resolution variable (models 1–4G). Lastly, while we control for population density at the block-group or tract level, we perform a robustness check on samples within urban areas, as there may be an inherent bias toward litigation due to proximity to lawyers' offices, which may facilitate easier access and a higher proclivity to litigate. To check whether results hold in the face of this geographic factor, we use Census Place boundaries (figure A.3), which encompass higher-populated areas, to restrict the total sample across all four models (models 1–4H).

RESULTS

All models exhibited significant positive spatial autocorrelation, indicating spatial dependency. Therefore, the spatial lag terms were included in all models, except where noted for robustness checks.

Estimates of Litigation Probability

Parcel-level predictors showed that higher-valued, owner-occupied, and insured properties are significantly more likely to be involved in litigation (table A.3). Notably, areas with higher percentages of Black residents and higher population density also showed significantly increased litigation rates. In the baseline scenario, the odds of litigation increase by 43 percent in an all-Black populated area, suggesting that the probability of litigation increases with the percent Black population. Income had a negligible and statistically insignificant effect on litigation probability.

The interaction between property value and percent of Black residents is positive and significant (figure 3, panel A). For each standard deviation increase in property value (z-score),

the odds of litigation increase by 13 percent. This suggests that higher property values in areas with more Black residents may be associated with a higher probability of litigation compared to areas with fewer Black residents (figure 4, panel B). However, because this interaction is smaller than both main effects, it suggests that the joint impact of high property value and high percent Black is not as pronounced as their individual contributions alone might suggest. The interaction between income and percent of Black residents was negative, indicating that the positive relationship between Black population and litigation was weaker in higher-income areas.

The differences in the estimated odds of litigation between the two interaction terms can be better understood by examining the relationship between property value and income. While these variables exhibit a weak positive correlation (figure A.2) and binned median income generally increases with property value (figure A.4), this pattern is not uniform across the study area. Geographic mismatches exist, with regions showing high aggregated median property value not always aligning with areas of high income by tract (figure A.5). Estimates remain stable across robustness checks (table A.7). In addressing hypothesis 1, we find that litigation participation is less likely in socioeconomically privi-

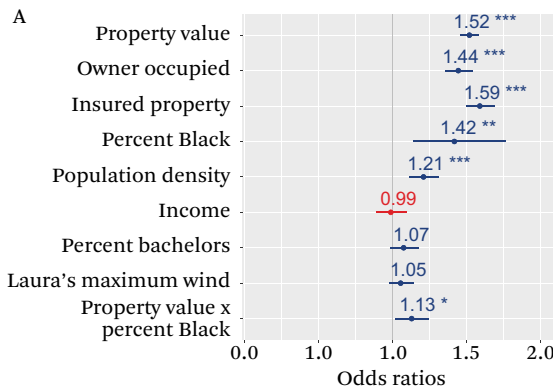
leged areas by race and ethnicity, but that property value strongly increases odds of litigation. This suggests that property value is a characteristic of litigation across sociodemographics and an expression of privilege in insurance litigation.

Estimates of Plaintiff Type

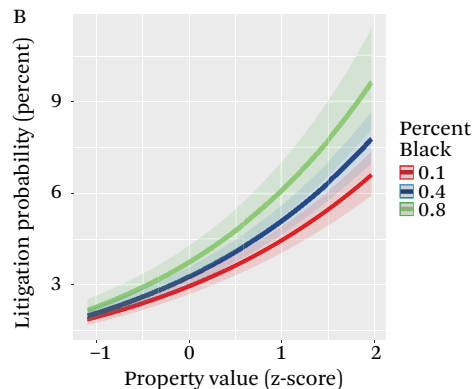
Estimates from model 2 show that parcel-level property value is a negative and significant predictor of plaintiffs in which the litigant is a resident rather than a nonresident (figure 4, panel A; table A.4). The estimates for the percent Black population are negative but insignificant. Interestingly, the interaction between property value and percent Black remains negative and significant, suggesting that as property value increases, the likelihood of being a resident plaintiff decreases, and that this effect is even more pronounced in higher percent Black areas (figure 4, panel B). Importantly, income is a positive and significant predictor of residential plaintiffs. The distribution of property values for nonresident plaintiffs was higher than for resident plaintiffs (figure A.6, panel A), likely due to higher valued commercial properties. Resident plaintiffs were more concentrated in higher-income areas (figure A.6, panel B). These findings help disentangle litigation's unique economic and racial geography for different ac-

Figure 3. Sociodemographic and Property-Related Estimates and Predicted Probability of Property Insurance Litigation

Panel A. Coefficients for Estimated Litigation (Model 1B)



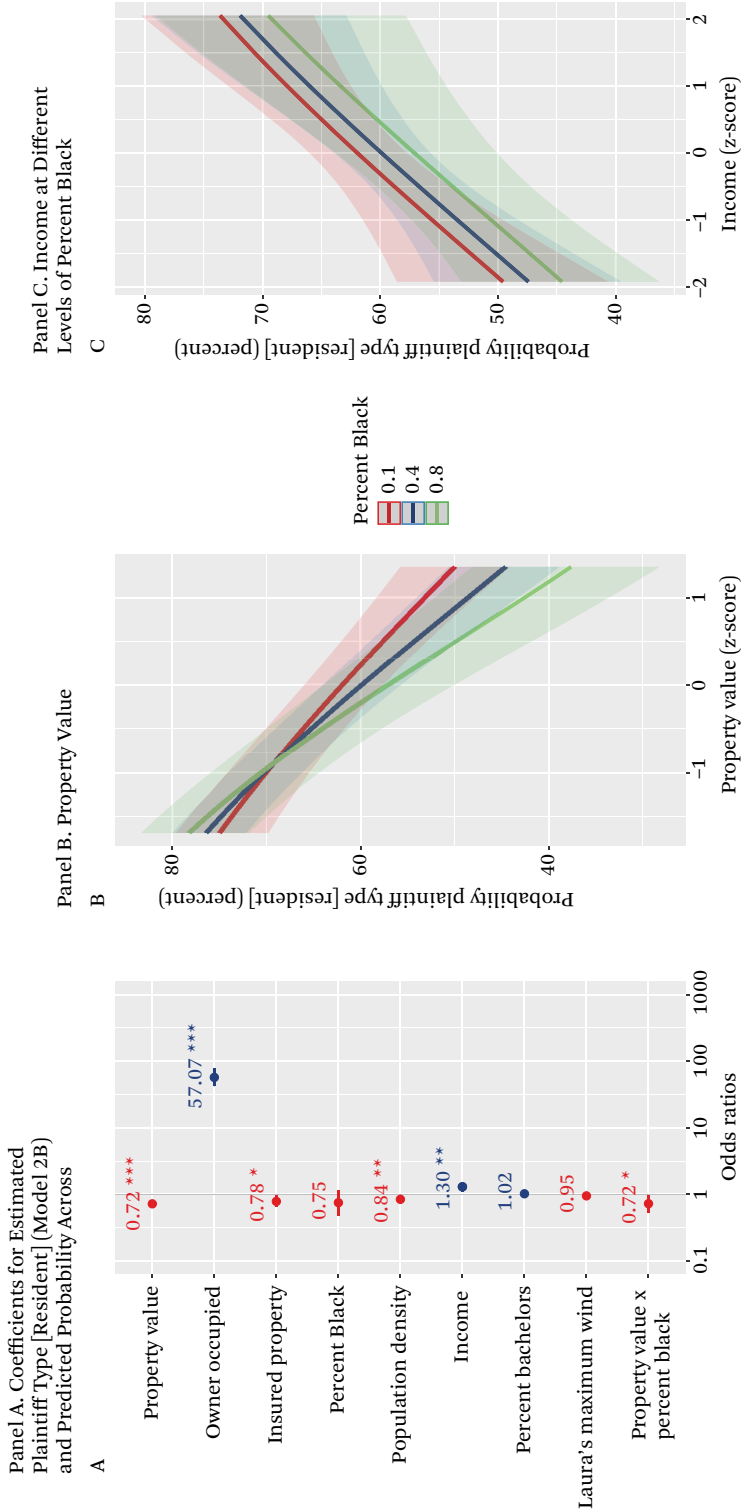
Panel B. Predicted Probability Across Property Value at Different Levels of Percent Black (Model 1B)



Source: Authors' calculations based on model estimates.

Note: $N = 94,820$

Figure 4. Sociodemographic and Property-Related Estimates and Predicted Probability of Plaintiff Type Residential



Source: Authors' calculations based on model estimates.

Note: $N = 5,476$. The optimal way to view this figure is in color. We refer readers of the print edition of this article to <https://www.rsjournal.org/content/12/4/178> to view the color version.

tors. In testing hypothesis 2, we find that plaintiffs in insurance litigation cases are more likely to be residents than nonresidents in socioeconomically privileged areas, but this effect is evident only through income, not race or ethnicity.

The insured indicator is estimated as a negative and significant predictor of residential plaintiffs, potentially due to underestimates of insured properties. The percent Black population is a negative and insignificant predictor of resident plaintiffs. Additionally, population density is a negative and weakly significant predictor of resident plaintiffs, suggesting that more rural areas are more likely to contain resident plaintiffs than nonresidential plaintiffs (figure A.1). Findings for estimating plaintiff type also remain consistent across the four robustness checks (table A.8).

Estimates of Case Filing Date

Model results predicting when lawsuits were filed suggest that owner-occupied properties result in later filing dates by 2 percent, and for insured properties, time to case filing decreases by 5 percent (table A.5). While both are significant, these effects are small. Tract-level variables show little and insignificant variation. Robustness checks suggest these patterns remain stable for the baseline model (table A.9). Predominantly Black areas saw earlier filings overall (11 percent), but this trend reversed for resident plaintiffs, who filed 17 percent later than nonresident plaintiffs (model 3D). This suggests that nonresidential plaintiffs, such as commercial businesses or churches, are more likely to file lawsuits more quickly in majority-Black areas than individual residents are.

Figure A.7 validates these findings, where the mean filing date of residential plaintiffs is slightly higher than that of nonresidential plaintiffs, even though both groups exhibited a common peak in filings at the twenty-four-month mark. However, nonresidents tended to file under the earlier twelve-month deadline, whereas residents filed under the twenty-four-month deadline. Again, these differences are relative given the significantly larger number of resident plaintiffs (4,496) compared to nonresidential plaintiffs (980). These model estimates suggest that hypothesis 3 is unsupported in that insur-

ance litigation cases are filed at relatively the same point in time following Hurricane Laura, regardless of sociodemographics.

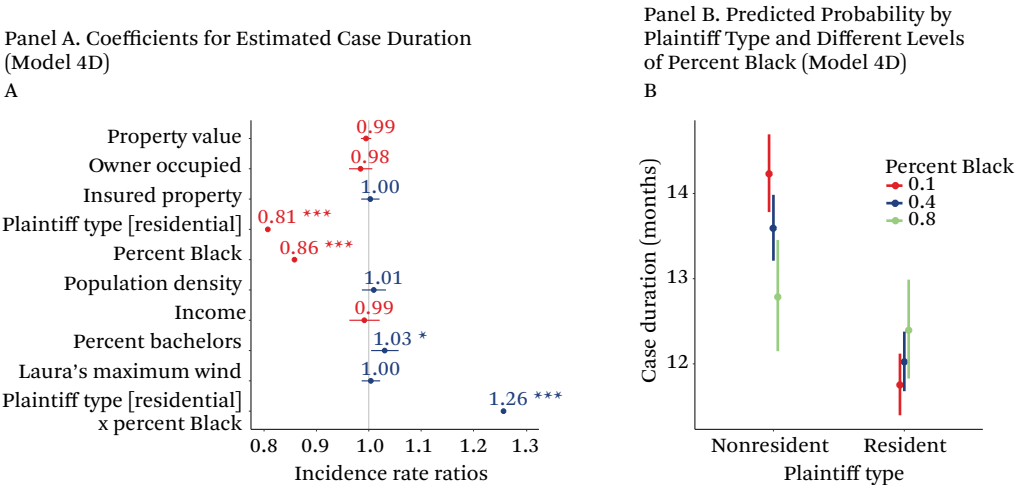
Estimates of Case Duration

Estimates of case duration suggest case duration is 8 percent shorter for owner-occupied properties in closed cases (4,776 of the total 5,476) (see figure 5, panel A; table A.6). Given the relationship between owner-occupied properties and the plaintiff type, resident plaintiffs' cases are 14 percent shorter than nonresident cases (model 4D). Areas with higher percentages of bachelor's degrees had a modestly significant increase in case duration (3 percent). The interaction between property value and the percent Black population suggests a significant 6 percent increase in case duration (model 4B). Robustness checks suggest these patterns remain stable for the baseline model (table A.10). Model 4D reveals that resident plaintiffs and those living in predominantly Black areas experience shorter case durations but also see that the percent Black populations lead to a 26 percent increase in case duration for resident plaintiffs when accounting for plaintiff type (figure 5, panel B). This suggests that while cases in Black-majority areas tend to resolve faster overall, resident plaintiffs in these areas face longer case durations. We conclude that hypothesis 4 is supported in that the duration of litigation is less in socio-economically privileged areas by race and ethnicity when controlling for plaintiff type.

DISCUSSION

Systemic racial and class variation explain differential treatment in property insurance claims handling (Lin et al. 2022; Peacock and Girard 1997), the administration and delivery of government assistance post-disaster (Emrich et al. 2022), and recovery outcomes (Muñoz and Tate 2016). The impacts of differential administration in aid and quality of insurance are long-lasting and can be detrimental to aspects that extend beyond household finance, including wealth generation (Howell and Elliot 2019), residential mobility (Rhodes and Besbris 2022), and displacement (Fussell and Harris 2014). To further describe how inequality is perpetuated in disasters, this analysis makes a first foray into describing socioeconomic trends in legal

Figure 5. Sociodemographic and Property-Related Estimates and Predicted Probability of Case Duration



Source: Authors' calculations.
Note: $N = 4,776$

claims against private insurers that are made in post-disaster settings. Our findings echo the evidence of socioeconomic disparities documented in other research on post-disaster recovery. In doing so, this work contributes to the growing empirical efforts to document outcomes stemming from potentially procedural inequalities in disaster-impacted communities (Raker 2023).

These findings clarify the who, where, and when of insurance litigation in the case of Southwest Louisiana following Hurricanes Laura and Delta, suggesting both race and class disparities exist in explaining who brings litigation against insurers. Notably, counter to prevailing expectations of who may be best situated to bring lawsuits, litigation is more likely in higher percent Black residential areas, adding nuance to existing qualitative work finding that minority populations are often disincentivized from participating in legal recourse for harms, particularly in post-disaster recovery contexts (Nalla et al. 2021; Simington 2023). This finding also empirically advances understanding of the socioeconomic gaps in accessing justice through civil litigation procedures (Legal Services Corporation 2022).

Importantly, we do not control for direct property damage, and we lack data on which

properties were associated with property insurance claims that closed without litigation, or any individual- or group-level measure of willingness to litigate. Without controlling for these, we are unable to draw any causal linkages between blatant, systematic, race- and class-based discriminatory practices by insurance companies in adjusting claims, which may explain the patterns of higher litigation evident in the findings. Instead, our results only provide evidence of patterns of socioeconomic differences in litigation participation, and do not discern instances in which litigation was unnecessary or pursued due to unknown constraints. As such, our findings in estimating litigation represent just the tip of the grievance-claims-disputes pyramid that Richard E. Miller and Austin Sarat (1981) present as a logic for explaining why not all harms eventually make their way to formal legal claims or disputes. In other words, the absence of litigation may not reflect fair claims handling but rather cases in which individuals were not empowered to sue their insurer or were resource-constrained for various financial or immaterial reasons. In these instances, the need for immediate cash relief to start repairs or hire a contractor outweighed the potentially long and uncertain path of engaging in litigation. While measuring these initial differences in

claims handling is not possible with the available data, our analytical design provides evidence of these differences in participation. Further ongoing work by the lead author uses qualitative interviews with residents to understand individuals' motivations for participating in litigation, illuminating whether and to what extent social and economic factors influence one's proclivity or ability to engage in litigation following Hurricanes Laura and Delta.

Our findings on socioeconomic differences in the case filing and case duration also reveal unique patterns of the temporality of litigation, further enhancing our understanding of the procedural character of litigation. Our findings that nonresident plaintiffs file cases earlier than residents may suggest that commercial plaintiffs get their foot in the door with court proceedings earlier than residents do, and that businesses may be more legally savvy than residents. Moreover, our finding that case duration is longer in higher percent Black areas may indicate systemic delays for individual homeowners compared to businesses in majority-Black areas. Ongoing research by the lead author to further clarify the mechanisms that drive individuals to engage in litigation against their insurer and survey the array of experiences with litigation to explore how litigation enables recovery aims to elucidate these trends further.

The highly significant spatial clustering observed across all outcome variables suggests that litigation incidence, litigant characteristics, and temporal patterns explored in this analysis exhibit strong spatial dependence. This phenomenon of litigation clustering may be explained by socialized knowledge transfer, as found in other studies to drive awareness of legal remedies (Sandefur 2012), such that residents learn about litigation from neighbors and nearby residents. This spreading of information is consistent with other studies of information spread and knowledge transfer in post-disaster contexts (Aldrich 2014) and the efficacy of shared narratives from collective experiences (Chamlee-Wright and Storr 2011).

These findings are instructive for several possible extensions that could refine the characterization of disparities in insurance litigation. Given that homeowner's insurance is regulated by states in the US, laws regarding grounds for

litigation against insurers post-disaster, including the maximum allowed penalties, the prescriptive period for bringing a suit, and entities exempt from liability for property insurance claims, vary across states. The recent state legislative changes in Florida and Louisiana to deter litigation show how the legal environment and conditions vary across jurisdictional and temporal contexts. Similarly, third-party mediation programs may alleviate the need for formal litigation. Moreover, further analysis can be done to evaluate the degree to which losses incurred following a disaster correlate with litigation rates. Highly spatially correlated claims may exacerbate the need for homeowners to pursue litigation. These variations provide fertile ground for comparative statistical analyses to examine how litigation rates and sociodemographics vary across geographic, legal, and disaster-impact settings. For future survey-based work to extend these findings to other case studies, the results could inform sampling using modeled characteristics of populations likely to engage in litigation, as well as survey-based post-stratification weighting using socioeconomic trends.

The two main limitations of our approach are variable measurement and geographic scale. Regarding variable measurement, we include a robustness check that excludes the proxy for insured properties. Evidence from estimating plaintiff type also suggests possible undermeasurement of insurance, indicating that this proxy is an imperfect measure of properties with homeowners' insurance. While litigation is predicated on a property being insured, a more precise measure of insurance coverage, along with measures of owner occupation, may help illuminate circumstances in which litigation pertains to residential but non-owner-occupied housing. In this analysis, the zero indicator for non-occupied properties includes rental properties but also applies to nonresidential properties. Given the overwhelming emphasis on researching owner-occupied housing, leaving post-disaster dynamics for renters relatively opaque (Lee and Van Zandt 2019), this analysis further reinforces this focus on owner dynamics, which primarily concern owner-occupied residents; there are possible extensions to clarify how litigation impacts rental property and

tenants. To do so, the names of plaintiff types could be further examined to separately classify rental properties from non-rental properties, as well as other commercial or organization-owned properties. Moreover, this would also have to be done with the full parcel sample. Additional data on rental properties or large-scale survey work would need to be undertaken to capture this dynamic, especially how litigation concerning rental properties relates to any disparate impact of displacing tenants while repairs remain partially or wholly unaddressed.

Additionally, omitted variables may influence variable measurement and model specification. Calcasieu Parish residents' prior experiences with hurricane-related property damage, particularly Hurricane Rita in 2005, may affect their expectations and familiarity with navigating property insurance claims for hurricane losses. Law clinics have been proven essential sources of education and legal aid for residents, particularly low-income residents who may have the financial resources to hire a lawyer but need assistance with insurance claims adjustments and other legal needs that arise post-disaster (Finger 2015). The degree or character of these interventions' influence on residents' litigation participation cannot be discerned from the data available for this analysis. Relatedly, the extent to which fraudulent lawyering biases the measurement of litigation participation is beyond the scope of this study. However, we remove all McClenny Moseley & Associates cases, which represent the bulk of reported fraudulent lawyering.

The second major limitation is the scale of the estimates and predictors. Who these litigants are in terms of sociodemographics says a lot about the geography of litigation, given how segregated the Parish is racially and economically, except for tracts located centrally in Lake Charles. Importantly, though, we caution against drawing ecological inference in assuming that all Black residents in relatively high Black percent population block groups litigate or that only residents living in those tracts are Black. Moreover, given the spatial scale of the socioeconomic data, we are limited in drawing strong conclusions about the geographic pattern of litigation, as it maps to areas with diverse racial and economic residential makeup. For

example, in tracts with a relatively balanced mixed proportion of Black and White residents in central Lake Charles, there is a high rate of litigation, obscuring precise estimates of litigants' socioeconomic characteristics. While there are methods for imputing race at the individual level (see Hepburn et al. 2020), we chose not to do so, given both empirical and ethical concerns about the validity of the estimates. Further work to refine the racial estimates also risks overfitting the model and hindering generalization to other contexts. While we chose not to pursue individual race imputation given these justifications, we can only conclude neighborhood sociodemographic variations in who brings suits, when they file, and how long their cases last at the block-group and tract levels.

CONCLUSION

While the decision to litigate ultimately hinges on the insured picking up the phone to call a lawyer, this act of turning to the law to resolve unmet damages is prompted by a series of decisions, actors, and social encounters, each shaping one's conceptualization of the worth of litigation and ultimately implicating them to pragmatically act in mobilizing the law (Blomley 2014). This complex landscape of litigants and experience mirrors what Kate Booth and Bruce Trantor (2017) describe as "temporarily shifting and heterogeneous spaces of trust appear to embody significant and differentiated power relations, especially when it comes to the relationship between households and insurance companies." In individual insurance cases, the legal claims signal not only alleged misconduct by their insurer but also a decision made at some point in time to bring a lawsuit.

This study documents and analyzes the socioeconomic and housing characteristics of recorded litigation cases. Existing summaries of insurance litigation provide non-specific descriptions of litigation proceedings and parties involved, masking *who* brings suits against insurers. This risks assumptions about the role litigation plays in recovery, given procedural disparities in how different groups navigate and what they potentially gain or lose from insurance litigation. Here, we present a novel undertaking to collate court records on insurance litigation, geolocated to the property level, to

infer the spatial disparities in legal claim-making in post-disaster contexts, a significantly understudied phenomenon. Evaluation of this dataset with sociodemographic estimates within Calcasieu Parish yields insights that, in this case setting, Black residents litigate at a higher rate than White residents, with property value acting as a key determinant of litigation. While our approach precludes assessing the mechanisms of litigation and potentially race- or class-based discrimination in claims handling, it offers an empirical approach to expose patterns of litigation, which are fruitful points of departure to funnel empirical attention to the particular social, economic, and policy contexts that necessitate litigation and implications of state reforms to clamp down on litigation.

This article interrogates and argues that insurance litigation is yet another facet through which procedural vulnerability is used to understand the institutions, actors, and systems that (re)produce, distribute, contest, and sustain risk and alternative futures (Marino and Faas 2020). As disasters become more frequent and severe, this work joins debates on how individuals navigate everyday risks and procedural challenges through insurance and litigation.

REFERENCES

- Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey M. Wooldridge. 2023. "When Should You Adjust Standard Errors for Clustering?" *Quarterly Journal of Economics* 138(1): 1–35. <https://doi.org/10.1093/qje/qjac038>.
- Aldrich, Daniel P., and Michelle A. Meyer. 2014. "Social Capital and Community Resilience." *American Behavioral Scientist* 59(2): 254–69. <https://doi.org/10.1177/0002764214550299>.
- Anselin, Luc. 2003. "Spatial Econometrics." In *A Companion to Theoretical Econometrics*, edited by Badi H. Baltagi. Blackwell Publishing Ltd.
- Baker, Tom, and Karen McElrath. 1996. "Whose Safety Net? Home Insurance and Inequality." *Law & Social Inquiry* 21(2): 229–64. <https://doi.org/10.1111/j.1747-4469.1996.tb00080.x>.
- Bakkensen, Laura A., and William Larson. 2014. "Population Matters When Modeling Hurricane Fatalities." *Proceedings of the National Academy of Sciences* 111(50): e5331–e5332. <https://doi.org/10.1073/pnas.1417030111>.
- Ballard, Jordan, Julia Howard-Gibbon, Branda Muñoz Furnish, and Aaron Scheinwald. 2013. "Natural Disasters, Access to Justice, and Legal Services." *City University of New York Law Review* 17(1). <https://doi.org/10.31641/clr170101>.
- Bates, Douglas, Martin Mächler, Ben Bolker, and Steve Walker. 2015. "Fitting Linear Mixed-Effects Models Using lme4." *Journal of Statistical Software* 67(1): 1–48. <https://doi.org/10.18637/jss.v067.i01>.
- Blomley, Nicholas. 2014. "Learning from Larry: Pragmatism and the Habits of Legal Space." In *The Expanding Spaces of Law: A Timely Legal Geography*, edited by Iru Braverman, Nicholas Blomley, David Delaney, and Alexandre Kedar. Stanford University Press.
- Bolin, Robert C., and Patricia A. Bolton. 1986. "Race, Religion, and Ethnicity in Disaster Recovery." Institute of Behavioral Science, University of Colorado. January. https://scholarcommons.usf.edu/fmhi_pub/88.
- Booth, Kate, and Bruce Tranter. 2017. "When Disaster Strikes: Under-Insurance in Australian Households." *Urban Studies* 55(14): 3135–50. <https://doi.org/10.1177/0042098017736257>.
- Cangialosi, John P., and Robbie Berg. 2021. *Hurricane Delta (AL262020): Tropical Cyclone Report*. National Hurricane Center. National Oceanic and Atmospheric Administration. April 19. https://www.nhc.noaa.gov/data/tcr/AL262020_Delta.pdf.
- Chamlee-Wright, Emily, and Virgil Henry Storr. 2011. "Social Capital as Collective Narratives and Post-Disaster Community Recovery." *Sociological Review* 59(2): 266–82. <https://doi.org/10.1111/j.1467-954X.2011.02008.x>.
- Community Foundation of Southwest Louisiana. 2020. "Hurricanes Laura & Delta Recovery." Community Foundation of Southwest Louisiana. November. https://static1.squarespace.com/static/5b6c60224611a06e12b5da29/t/600f4c5cd52c160bdea1a735/1611615327310/202011%2BHurricane%2BLaura%2BDelta%2BRecovery_vFINAL.pdf.
- Cornelissen, Sharon, Douglas Heller, and Michael DeLong. 2024. *Exposed: A Report on 1.6 Trillion Dollars of Uninsured American Homes*. Consumer Federation of America. March 12. <https://consumerfed.org/wp-content/uploads/2024/03/Exposed-UninsuredHomes-1.pdf>.
- Dulin, Kelsey D. 2008. "The Disaster After the Disaster: Insurance Companies' Post-Catastrophe

- Claims Handling Practices." *Oklahoma Law Review* 61(1): 189.
- Emrich, Christopher T., Sanam K. Aksha, and Yao Zhou. 2022. "Assessing Distributive Inequities in FEMA's Disaster Recovery Assistance Fund Allocation." *International Journal of Disaster Risk Reduction* 74: 102855. <https://doi.org/10.1016/j.ijdr.2022.102855>.
- Ewick, Patricia, and Susan S. Silbey. 1998. *The Common Place of Law: Stories from Everyday Life*. University of Chicago Press.
- Feinman, Jay M. 2010. *Delay, Deny, Defend: Why Insurance Companies Don't Pay Claims and What You Can Do About It*. Delden Press.
- Finch II, Michael. 2022. "Here Are the Louisiana Insurers That Have Gone Broke or Left the State amid Deepening Crisis." Nola.com, September 27. https://www.nola.com/news/business/here-are-the-louisiana-insurers-that-have-gone-broke-or-left-the-state-amid-deepening/article_c7f077b4-3e98-11ed-86c9-f7f11037202f.html.
- Finger, Davida. 2015. "Post-Disaster Housing Through the Lens of Litigation: The Katrina Housing Justice Docket." *Loyola Law Review* 61: 591-621.
- Finger, Davida. 2022. "50 Years After the 'War on Poverty': Evaluating the Justice Gap in the Post-Disaster Context." *Boston College Journal of Law & Social Justice* 34(2): 267-82.
- Flitter, Emily. 2022. "New Suit Uses Data to Back Racial Bias Claims Against State Farm." *New York Times*, December 14. <https://www.nytimes.com/2022/12/14/business/state-farm-racial-bias-lawsuit.html>.
- Fox, John David. 2020. *Regression Diagnostics: An Introduction*, 2nd ed. SAGE Publications, Inc. <https://doi.org/10.4135/9781071878651>.
- Friedman, Lawrence M. 1975. *The Legal System: A Social Science Perspective*. Russell Sage Foundation.
- Fussell, Elizabeth. 2015. "The Long-Term Recovery of New Orleans' Population After Hurricane Katrina." *American Behavioral Scientist* 59(10): 1231-45. <https://doi.org/10.1177/0002764215591181>.
- Fussell, Elizabeth, and Elizabeth Harris. 2014. "Homeownership and Housing Displacement After Hurricane Katrina Among Low-Income African-American Mothers in New Orleans." *Social Science Quarterly* 95(4): 1086-100.
- Greene, Sara Sternberg. 2015. "Race, Class, and Access to Civil Justice." *Iowa Law Review* 101(4): 1263-322.
- Hepburn, Peter, Renee Louis, and Matthew Desmond. 2020. "Racial and Gender Disparities Among Evicted Americans." *Sociological Science* 7(27): 649-62. <https://doi.org/10.15195/v7.a27>.
- Howell, Junia, and James R. Elliott. 2019. "Damages Done: The Longitudinal Impacts of Natural Hazards on Wealth Inequality in the United States." *Social Problems* 66(3): 448-67. <https://doi.org/10.1093/socpro/spy016>.
- Hsu, Minna, Richard Howitt, and Fiona Miller. 2015. "Procedural Vulnerability and Institutional Capacity Deficits in Post-Disaster Recovery and Reconstruction: Insights from Wutai Rukai Experiences of Typhoon Morakot." *Human Organization* 74(4): 308-18.
- Jefferson, Elana Ashanti. 2024. "Triple-I CEO Links Catastrophe Costs to Legal System Abuse." *PropertyCasualty360*, July 11. <https://www.propertycasualty360.com/2024/07/11/triple-i-ceo-links-catastrophe-costs-to-legal-system-abuse/>.
- Johnson, Leigh. 2015. "Catastrophic Fixes: Cyclical Devaluation and Accumulation Through Climate Change Impacts." *Environment and Planning A: Economy and Space* 47(12): 2503-21. <https://doi.org/10.1177/0308518x15594800>.
- Jurjevich, Jason R. 2019. "Confronting Statistical Uncertainty in Rural America: Toward More Certain Data-Driven Policymaking Using American Community Survey (ACS) Data." In *Population, Place, and Spatial Interaction*, edited by Rachel S. Franklin. *New Frontiers in Regional Science: Asian Perspectives*, vol. 40. Springer Nature Singapore.
- Kane, Christy, Stephanie Beaugh, and Gerren Sias. 2019. "Addressing Heirs' Property in Louisiana: Lessons Learned, Post-Disaster." In *Heirs' Property and Land Fractionation: Fostering Stable Ownership to Prevent Land Loss and Abandonment*, edited by Cassandra J. Gaither, Ann Carpenter, Tracy Lloyd McCurdy, and Sara Toering. US Department of Agriculture Forest Service, Southern Research Station.
- Keys, Benjamin J, and Philip Mulder. 2024. "Property Insurance and Disaster Risk: New Evidence from Mortgage Escrow Data." NBER Working Paper 32579. National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w32579/w32579.pdf.

- Klein, Ken. 2022. "Unpacking 'Social Inflation.'" NAIC Consumer Liaison Committee, NAIC Summer 2022 National Meeting. August 12. https://content.naic.org/sites/default/files/national_meeting/AttmtFive_Consumer_Social%20Inflation_kenklein.pdf.
- Kousky, Carolyn. 2019. "The Role of Natural Disaster Insurance in Recovery and Risk Reduction." *Annual Review of Resource Economics* 11(1): 399–418. <https://doi.org/10.1146/annurev-resource-100518-094028>.
- Kousky, Carolyn, and Karina French. 2023. *Inclusive Insurance for Climate-Related Disasters: A Roadmap for the United States*. January 24. Ceres. <https://www.ceres.org/resources/reports/inclusive-insurance-roadmap>.
- Landry, Jeff. 2024. "The Fight for Common Sense in Our Insurance Crisis." August 1. Office of the Governor. <https://gov.louisiana.gov/index.cfm/newsroom/detail/4594>.
- Lee, Jee Young, and Shannon Van Zandt. 2019. "Housing Tenure and Social Vulnerability to Disasters: A Review of the Evidence." *Journal of Planning Literature* 34(2): 156–70. <https://doi.org/10.1177/0885412218812080>.
- Legal Services Corporation. 2022. *The Justice Gap: The Unmet Civil Legal Needs of Low-Income Americans*. April. Legal Services Corporation. <https://lsc-live.app.box.com/s/xl2v2uraioitbbzrhwtjlgioemp3myz1>.
- Li, Yueqi, Lauren Clay, Haley Murphy, Hao-Che Wu, and Alex Greer. 2024. "When Do Households Evacuate? Hurricane Evacuation Timing During the COVID-19 Pandemic." *Environmental Hazards* 23(5): 506–526. <https://doi.org/10.1080/17477891.2024.2333739>.
- Lin, Xiao, Mark J. Browne, and Annette Hofmann. 2022. "Race Discrimination in the Adjudication of Claims: Evidence from Earthquake Insurance." *Journal of Risk and Insurance* 89(3): 553–80. <https://doi.org/10.1111/jori.12386>.
- Louisiana Department of Insurance. 2021. *Commissioner Donelon Updates 2020 Hurricane Data Through Sept. 30, 2021*. Louisiana Department of Insurance.
- Louisiana Legislative Auditor. 2022. *Residential Property Insurance Complaint Statistics*. Louisiana Department of Insurance. [https://app.lila.state.la.us/publicreports.nsf/0/a78b15fc0c7658d386258845007cb63c/\\$file/00026be3a.pdf](https://app.lila.state.la.us/publicreports.nsf/0/a78b15fc0c7658d386258845007cb63c/$file/00026be3a.pdf)
- Marino, Elizabeth K., and Alexander J. Faas. 2020. "Is Vulnerability an Outdated Concept? After Subjects and Spaces." *Annals of Anthropological Practice* 44(1): 33–46. <https://doi.org/10.1111/napa.12132>.
- Maschke, Alena. 2024. "Four Years after Hurricane Laura Lake Charles Has Recovered but Many Are Left Behind." *Acadiana Advocate*, August 31. https://www.theadvocate.com/acadiana/news/four-years-after-hurricane-laura-lake-charles-has-recovered-but-many-are-left-behind/article_4d591620-6711-11ef-a321-4b1cbfe951d5.html.
- Miller, Richard E., and Austin Sarat. 1981. "Grievances, Claims, and Disputes: Assessing the Adversary Culture." *Law & Society Review* 15(3–4): 525–66. <https://doi.org/10.2307/3053502>.
- Mower, Lawrence. 2023. "Florida Leaders Blame Insurance Crisis on Lawsuits, but Evidence Is Thin." *Tampa Bay Times*, October 19. <https://www.tampabay.com/news/florida-politics/2023/10/19/florida-leaders-blame-insurance-crisis-lawsuits-evidence-is-thin/>.
- Muñoz, Cristina E., and Eric Tate. 2016. "Unequal Recovery? Federal Resource Distribution After a Midwest Flood Disaster." *International Journal of Environmental Research and Public Health* 13(5): 507. <https://doi.org/10.3390/ijerph13050507>.
- Myrick, Amy, Robert L. Nelson, and Laura Beth Nielson. 2012. "Race and Representation: Racial Disparities in Legal Representation for Employment Civil Rights Plaintiffs." *NYU Journal of Legislation and Public Policy* 15: 705.
- Nalla, Vineetha, Nihal Ranjit, and Garima Jain. 2021. "Representations of Disaster Recovery Needs: A Study of Legal Frameworks and Litigation in Odisha." *International Journal of Disaster Risk Reduction* 57: 102163. <https://doi.org/10.1016/j.ijdr.2021.102163>.
- National Institute of Standards and Technology and Applied Research Associates (NIST/ARA). 2020. *NIST/ARA Hurricane Laura Rapid Response Windfield Estimate: Notes for Preliminary Windfield Release 3*. September 4. Design Safe. <https://www.designsafe-ci.org/data/browser/tapis/designsafe.storage.community/%2FRecon%20Portal%2F2020%20Hurricane%20Laura%20Cameron%20Louisiana%20USA%2FNIST%20ARA%20Rapid%20Reponse%20Windfield%20Estimate>.
- Pasch, Richard, Robbie Berg, David Roberts, and Philippe Papin. 2021. *Hurricane Laura*

- (AL132020): *National Hurricane Center Tropical Cyclone Report*. May 26. National Oceanic and Atmospheric Administration. https://www.nhc.noaa.gov/data/tcr/AL132020_Laura.pdf.
- Peacock, Walter Gillis, Betty Hearn Morrow, and Hugh Gladwin. 1997. *Hurricane Andrew: Ethnicity, Gender, and the Sociology of Disasters*. Routledge.
- Peacock, Walter Gillis, Shannon Van Zandt, Yang Zhang, and Wesley E. Highfield. 2014. "Inequities in Long-Term Housing Recovery After Disasters." *Journal of the American Planning Association* 80(4): 356–71. <https://doi.org/10.1080/01944363.2014.980440>.
- Raker, Ethan J. 2023. "Stratifying Disaster: State Aid, Institutional Processes, and Inequality in American Communities." *Social Forces* 102(2): 430–53. <https://doi.org/10.1093/sf/soad050>.
- Rhodes, Anna, and Max Besbris. 2022. *Soaking the Middle Class: Suburban Inequality and Recovery from Disaster*. Russell Sage Foundation.
- Rivera, Danielle Zoe, Bradleigh Jenkins, and Rebecca Randolph. 2022. "Procedural Vulnerability and Its Effects on Equitable Post-Disaster Recovery in Low-Income Communities." *Journal of the American Planning Association* 88(2): 220–31. <https://doi.org/10.1080/01944363.2021.1929417>.
- Sandefur, Rebecca L. 2008. "Access to Civil Justice and Race, Class, and Gender Inequality." *Annual Review of Sociology* 34: 339–58.
- Sandefur, Rebecca L. 2012. "Money Isn't Everything: Understanding Moderate Income Households' Use of Lawyers' Services." In *Middle Income Access to Justice*, edited by M. Trebilcock, Anthony Duggan, and Lorne Sossin. University of Toronto Press.
- Sandefur, Rebecca L. 2014. *Accessing Justice in the Contemporary USA: Findings from the Community Needs and Services Study*. August 8. American Bar Foundation. https://www.americanbarfoundation.org/wp-content/uploads/2023/04/sandefur_accessing_justice_in_the_contemporary_usa_aug_2014.pdf.
- Sandefur, Rebecca L. 2019. "Access to What?" *Daedalus* 148(1): 49–55. https://doi.org/10.1162/daed_a_00534.
- Schwarcz, Daniel. 2008. "Redesigning Consumer Dispute Resolution: A Case Study of the British and American Approaches to Insurance Claims Conflict." *Tulane Law Review* 83(3): 735.
- Schwarcz, Daniel. 2019. "Towards a Civil Rights Approach to Insurance Anti-Discrimination Law." *DePaul Law Review* 69(2): 657–98.
- Silbey, Susan S., Patricia Ewick, Elizabeth Schuster, and Lisa Kaunelis. 1993. *Differential Use of Courts by Minority and Non-Minority Populations in New Jersey*. November. New Jersey Judiciary, Supreme Court Task Force on Minority Concerns. <https://www.ojp.gov/pdffiles1/Digitization/149226NCJRS.pdf>.
- Simington, Jasmine. 2023. "Displaced Trust: Disrupting Legal Estrangement During Disaster Recovery." *Social Forces* 102(2): 771–89. <https://doi.org/10.1093/sf/soad026>.
- Squires, Gregory D. 2003. "Racial Profiling, Insurance Style: Insurance Redlining and the Uneven Development of Metropolitan Areas." *Journal of Urban Affairs* 25(4): 391–410. <https://doi.org/10.1111/1467-9906.t01-1-00168>.
- Squires, Gregory D., Sally O'Connor, and Josh Silver. 2001. "The Unavailability of Information on Insurance Unavailability: Insurance Redlining and the Absence of Geocoded Disclosure Data." *Housing Policy Debate* 12(2): 347–72. <https://doi.org/10.1080/10511482.2001.9521409>.
- Sterett, Susan M., and Laura K. Mateczun. 2020. "Displacement, Legal Mobilization, and Disasters: Trial Courts and Legal Process." *Risk, Hazards & Crisis in Public Policy* 11(4): 348–76. <https://doi.org/10.1002/rhc.3.12199>.
- Sterett, Susan M., and Laura K. Mateczun. 2022. "Legal Claims and Compensation in Climate-Related Disasters." *Political Science Quarterly* 137(2): 293–330. <https://doi.org/10.1002/polq.13320>.
- Tierney, Kathleen. 2012. "Disaster Governance: Social, Political, and Economic Dimensions." *Annual Review of Environment and Resources* 37(1): 341–63. <https://doi.org/10.1146/annurev-environ-020911-095618>.
- Transactional Records Access Clearinghouse (TRAC). 2021. *One Year After Hurricane Laura, Louisiana Plaintiffs Rush to Meet One-Year Insurance Filing Deadline in Federal Court*. September 17. Transactional Records Access Clearinghouse. <https://tracreports.org/tracreports/civil/661/>.
- Transactional Records Access Clearinghouse (TRAC). 2022. *Insurance Lawsuits Skyrocket in Communities Hit Hard by Extreme Weather Events*. October 19. Transactional Records Access Clearinghouse. <https://tracreports.org/whatsnew/email.221019.html>.

- US Census Bureau. 2024. *Methodology for the United States Population Estimates: Vintage 2024*. December. US Census Bureau. <https://www2.census.gov/programs-surveys/popest/technical-documentation/methodology/2020-2024/methods-statement-v2024.pdf>.
- Veland, Siri, Richard Howitt, Dale Dominey-Howes, Frank Thomalla, and Donna Houston. 2013. "Procedural Vulnerability: Understanding Environmental Change in a Remote Indigenous Community." *Global Environmental Change* 23(1): 314–26. <https://doi.org/10.1016/j.gloenvcha.2012.10.009>.
- Western District of Louisiana. 2023. *Case Management Order No. 1*. Western District of Louisiana. https://www.lawd.uscourts.gov/sites/lawd/files/UPLOADS/Laura%20Delta%20-%20CMO_0.pdf.
- You, Xuesong, and Carolyn Kousky. 2024. "Improving Household and Community Disaster Recovery: Evidence on the Role of Insurance." *Journal of Risk and Insurance* 91(2): 299–338.
- Zink, Kathleen A. 2014. "Should Neither Wind nor Rain nor Hurricane Keep Victims from Recovery?: Examining the Tort and Insurance Systems' Ability to Compensate Hurricane Victims." *Fordham Law Review* 83(3): 1621–67.



Politics, Politicians, and Organizations

Growing Adaptability Among Undocumented Communities During Climate-Induced Disasters: An Analysis of the Role of Migrant-Serving Organizations



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This research explores the conditions and contexts that make undocumented communities uniquely vulnerable to climate-induced disasters, as well as the role of migrant-serving organizations (MSOs) in supporting them throughout these events. We apply the framework of adaptive governance to examine how climate change has forced MSOs, including those without previous disaster-related experience, to become disaster experts, advocates, and direct aid providers. Using participant observation at two California-wide disaster policy workshops and interviews with MSO practitioners, we identify five factors that explain how these organizations cope and why they have had to adapt their operations to develop innovative disaster aid practices. We also discuss the organizational challenges that arise, including the mental health implications of these added responsibilities on staff. Policy recommendations follow, to help inform more equitable disaster policies for undocumented migrant communities and to support MSO practitioners working with limited organizational capacities and experiencing secondary trauma.

Keywords: adaptive governance, climate change, undocumented immigrants, secondary trauma, nonprofits

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Throughout the United States, climate change is damaging infrastructure and ecosystems, disrupting food systems, reducing employment opportunities, and exacerbating health disparities (Jay et al. 2023). This is particularly true in California, where a series of climate-induced disasters, including extreme heatwaves, wildfires, droughts, and storms (Bedsworth et al. 2018; Brown et al. 2023; Pastor et al. 2024) have displaced thousands of households and negatively affected the health and economic well-being of many communities over the last several years (Rosenthal et al. 2021). For low-income individuals and people of color, long-standing structural inequities in policy, practice, and funding have increased vulnerability to and prolonged recovery from climate-induced disasters (Méndez 2020; Smith et al. 2022). Undocumented Latino/a and Indigenous migrants are particularly susceptible, first, because many work outdoors. During a statewide series of wildfire events in 2017, farmworkers had to endure extreme heat and toxic smoke to harvest crops—even in mandatory evacuation zones that were deemed hazardous to the general population. Despite official recommendations against working or exercising outdoors during the fires, agricultural companies prioritized harvesting crops over the health of their employees (Chunga Pizarro et al. 2024; Méndez et al. 2020).

Undocumented migrants also face significant barriers in accessing resources for disaster preparedness and recovery. Research has found that access is largely a function of income (including the ability to afford infrastructure insurance) and discrimination (particularly on the basis of race and ethnicity) (Shonkoff et al. 2011); migrants are often further excluded by US citizenship requirements (Dorazio 2022; Fothergill and Peek 2004; Medwinter 2023; Méndez 2022; Stough et al. 2010). Immigration status also determines who can shape laws, regulations, and plans that distribute environmental burdens and benefits (Chu et al. 2017; Méndez-Barrientos et al. 2023). These combined factors intensify the vulnerability of undocumented households to climate-induced disasters (Zuñiga and Méndez 2023).

This is an especially important issue for Cal-

ifornia, with its estimated 2.7 million unauthorized residents. Approximately 1.7 million are undocumented workers (representing nearly 6 percent of the state's workforce) who in 2022 contributed more than \$8.4 billion in taxes (Migration Policy Institute n.d.; Davis et al. 2024). Among these workers are more than 170,000 Indigenous migrants from Latin America, including Mixtec, Zapotec, Maya, Triqui, and Purépecha people facing unique challenges such as communication barriers; many of them speak only Indigenous languages and some are illiterate; their cultural practices and beliefs can also lead to social isolation and discrimination from Latino/a and non-Latino/a populations (MICOP 2024). California is often considered more inclusive than other states because of legislation like the California Values Act of 2017 (State of California 2017), which limits local enforcement cooperation with federal immigration authorities, providing a relatively secure environment for undocumented migrants. However, the state's vulnerability to climate-induced disasters exacerbates long-standing inequities for these workers, who often lack access to disaster aid and safe working conditions (Méndez et al. 2020) and are excluded from unemployment and health-care benefits.

Preexisting inequities affect undocumented people's capacity to prepare for and recover from climate-induced disasters (Padilla-Frausto et al. 2023; The Children's Partnership 2022). For instance, in California, 73 percent of migrants have unmet mental health care needs and 20 percent of undocumented children live in poverty. This complex reality underscores the importance of understanding how MSOs adapt to fill systemic gaps and support undocumented individuals during a crisis, particularly when community needs far exceed their resources. Prior to the 2017 wildfires, none of the MSOs in our study offered disaster-relief services. Since then, they have promoted access to emergency information in languages including Indigenous dialects, advocated for labor protections for farmworkers threatened by extreme conditions, and established a disaster-relief fund for migrants ineligible for federal aid. Many undocumented individuals have historically avoided seeking such resources for fear of retaliation or deportation.

MSOs have thus been forced to fill a gap in government, mainstream mutual aid, and philanthropic programs by advocating for and distributing resources to a group ignored or rendered invisible during times of crisis (Chunga Pizarro et al. 2024). Michael Méndez and colleagues (2020, 51) have shown that this invisibility is often caused by systemic racism and cultural norms regarding US citizenship and who is deemed a “worthy disaster victim.” Society routinely treats undocumented migrants—as well as other stigmatized groups, such as LGBTQ+ and homeless people—as less than human and disposable (Vickery 2018; Goldsmith et al. 2022). These forms of exclusion directly shape disaster planning and response (Lerner 2010).

While the focus of this article is California, similar impacts are felt throughout the country. For example, following Hurricane Helene in 2024, several news outlets described MSOs’ assistance to undocumented households ignored by the government in North Carolina. Experts observed that nationally, MSOs and foundations have set up parallel channels for disaster assistance that would otherwise be provided by the Federal Emergency Management Agency (FEMA) or the Red Cross (Rivero 2024; Perez 2024, 2025; Sledge 2024).

MSOs will face new challenges as climate change increases the frequency and intensity of disasters (Jay et al. 2023). This article uses an adaptive governance framework to explore how MSOs have dealt with these events and related inequities. On the frontlines, they have developed innovative disaster preparedness, aid, and recovery practices—becoming experts, advocates, and direct service providers. At the same time, MSOs’ growing workload has taken a personal and mental toll on staff. Using interviews with practitioners across California, our research asks two questions: First, how are MSOs responding to the needs of their undocumented communities as they become more exposed to the effects of climate change? Second, how have leaders and practitioners coped and adapted in the process? Understanding these issues can

help governments create more equitable strategies for disaster relief and recovery.

The next section discusses adaptive governance as a framework for examining how organizations respond to climate change and the needs of undocumented migrants. Study methods and research findings follow. The latter indicates that five factors drove organizational changes: conditions shaping vulnerability of undocumented immigrants, evolving role of migrant-serving organizations, immediate response and advocacy, structural challenges and local context, and collaboration and social learning. These organizations are not equipped to provide the mental health services that their communities need, while their staff often struggle to cope with the secondary trauma¹ that can accompany their role as informal first responders. We conclude with recommendations to inform more equitable disaster policies and support MSO practitioners in these conditions.

THEORETICAL FRAMEWORK

Adaptive Governance in Changing Environments

Research on MSOs during disasters has shown that these groups often fill the gaps left by government agencies by providing and distributing aid, offering translation services, and advocating on behalf of immigrant and Indigenous communities (Vilá et al. 2023; Méndez 2022; Roth and Grace 2018; Guhlincozzi 2023). While this work demonstrates that MSOs are critical to disaster response and recovery, it rarely examines how these organizations govern themselves or how they adapt their roles within broader systems of governance shaped by immigration policy and climate change. Few scholars have analyzed how MSOs make decisions, learn from collaboration, or restructure their missions when disasters expose systemic inequities (Cravero et al. 2024; Wurtz et al. 2024; Hobbs et al. 2024; Cuervo et al. 2017). This article addresses these gaps by applying an adaptive governance framework to analyze how MSOs in

1. Secondary trauma refers to the mental and physical exhaustion felt by practitioners helping other people. This trauma may be caused by exposure to a single event or by residual emotion that builds over time (University of Kentucky College of Social Work 2021). While an indirect exposure, secondary trauma can develop into post-traumatic stress disorder (PTSD) or other trauma-related disorders (Rynfield and Turner 2024).

California have evolved in response to climate-induced disasters and how their work has expanded from service provision to community-based forms of governance for undocumented migrants. Adaptive governance has emerged as an alternative to top-down, traditional governance, which often fails to address the complexity of socio-environmental issues—problems arising from the dynamic interaction of individuals, social elements, institutional processes, and nature (McGinnis and Ostrom 2014; Nikkanen et al. 2024; Palmer 2022). As rapid environmental and social shifts, like those presented by climate change, place new demands on governance systems, polycentric and flexible models—involving collaboration among actors at various levels to achieve a common goal—are more successful (Stephan et al. 2019). In this sense, we use a conventional definition of adaptive governance: “the evolution of the rules and norms that promote the satisfaction of underlying human needs and preferences given changes in understanding, objectives, and the social, economic and environmental context” (Hatfield-Dodds et al. 2007, 4).² Attention to justice and inequality has increased support for more flexible approaches to disaster governance that incorporate the lived experiences of diverse stakeholders (Parthasarathy 2018).

Disasters introduce new sources of stress, adding to the uncertainty and vulnerability of susceptible groups like undocumented migrants (Parthasarathy 2018). In adaptive governance, collaboration and networking are key to diversifying knowledge, reducing risks, and promoting innovation; knowledge generation evolves dynamically as new actors become involved (Berkes 2009; Pahl-Wostl and Hare 2004). A study of Finland’s disaster management protocol, for instance, highlights collaboration’s role in helping municipal authorities create plans and response templates for different scenarios (Nikkanen et al. 2024). Since a broad spectrum of actors (including community groups and civil society organizations) participated in these ex-

ercises, practitioners gained a more comprehensive understanding of regional preparedness. The resulting networks encouraged nestedness and polycentricity by fostering cross-sector collaboration at multiple levels. Draft disaster preparedness plans were then tailored to local needs and various crises (Djalante et al. 2011; Pahl-Wostl and Hare 2004; Termeer et al. 2010).

Other aspects of adaptive governance promote more inventive and equitable results (Parthasarathy 2018). Among them is the willingness to experiment with policy approaches, embrace flexible outcomes, and adjust plans in light of unforeseen challenges (Huiteima et al. 2009; Lach et al. 2005; Pahl-Wostl et al. 2007). For example, during the 2011 Great East Japan Earthquake and Tsunami, municipal officials exemplified adaptability by mobilizing volunteer and non-governmental workers from different parts of the country to remedy area staff shortages. Through arrangements with stakeholders including nonprofits and businesses, the government used strategies like tailored matching, which deployed personnel in response to demand for certain skills and adjusted as needed. Responsibilities were shifted to other actors in the nonprofit and private sectors if they were able to complete tasks more quickly than the central government (Aoki 2016).

These approaches are not limited to formal governing institutions (Folke et al. 2005) but can occur within nonprofits aiming to enhance their capacities, anticipate varying pressures, and empower efforts to adapt to changing environments (Cutter 2016; van Assche et al. 2021). Literature has shown that prior to disasters, MSOs serve as mediating structures (particularly during heightened anti-immigrant sentiments), offering specialized resources that critically support migrants’ social and economic integration (Martinez-Damilia et al. 2024). Mediating structures “provide unique contexts” that can shape “how individuals engage with social problems, and often serve as the practi-

2. Adaptive governance focuses on the institutional and political contexts for managing complex systems, whereas adaptive management is a systematic process for improving a specific policy or issue (Hasselman 2017). We use the adaptive governance framework in this article because of its recognition that governance emerges from many actors as they interact and learn, in response to complex systems and rigid institutions (Folke et al. 2005).

cal bridges between individuals and society” (Todd and Allen 2010, 222). When state-led responses to disasters fail to support the most vulnerable, nonstate actors like these move swiftly to provide relief (Méndez 2022). Their ability to garner resources, creatively distribute aid, and adjust plans warrants analysis. A better understanding is needed of the factors that drive MSOs to adapt their missions and the services they provide to local communities (Parthasarathy 2015).

Previous research has found that the circumstances around disasters push nonprofits—including those whose missions do not involve disaster management—into response and recovery work (Flatt and Stys 2013; Simo and Bies 2007; Mathias et al. 2022). For example, a study on direct service providers in South Carolina identified structural barriers that limited migrants’ access to these organizations’ resources, which ranged from cash assistance to legal services (Roth and Grace 2018). Their top challenge was in-person engagement, since migrants lived outside their geographic service areas. They exhibited adaptive behavior by recognizing this limitation and making the collective decision to offer mobile services. Further, by consistently communicating a commitment to the well-being of Latino/a immigrants, these service providers established rapport and trust (Roth and Grace 2018).

Another study on community-based organizations in Chicago determined that lack of transportation, absence of childcare, and inflexible work schedules reduced Latina migrants’ access to health care, particularly during the COVID-19 pandemic (Guhlincozzi 2023). These organizations adapted by tailoring services to address these barriers and pandemic-related considerations in mind. Organizations distributing supplies adopted linguistically and culturally appropriate outreach strategies as well as a drive-thru model to avoid in-person contact. They also switched to telehealth (video conferencing) or phone appointments to answer questions about the virus and other medical concerns, successfully disseminating information and directing migrants to services for which they were eligible (Guhlincozzi 2023).

Similarly, the MSOs in our study are complex

actors that evolve to support their communities, particularly in the wake of climate-induced disasters, even when this work was outside their missions’ scope. By situating this research in California, which has the largest undocumented migrant population in the United States, we can extensively examine the disparate impacts of climate-induced disasters, the importance of MSOs, and the ongoing gaps in protecting these vulnerable communities (Méndez et al. 2020; Passel and Krogstad 2024).

METHODS

We used participant observation from two disaster policy workshops and semi-structured interviews with MSO practitioners to understand the unique vulnerability of undocumented communities to climate-induced disasters. These methods, complemented by a survey distributed to the MSOs, also provided insight into how these organizations support these communities throughout these events.

Background: The California UndocuFund Summit

On September 18, 2022, thirty-two MSOs attended the California UndocuFund Summit (the Summit). The first convening of its kind in the nation, the Summit outlined the experiences of undocumented Californians during disasters and an advocacy path forward (Sanchez De Alba 2022; Deutschman 2023). Its purpose was to boost capacity to meet disaster-related needs, mutually support MSOs’ efforts, and expand their influence on state policy. Participants discussed the political and public policy landscapes, programs to support disaster mitigation and recovery efforts, and ways to collaborate. The attending MSOs—including the Central Coast Alliance United for a Sustainable Economy (Ventura County), North Bay Jobs with Justice (Sonoma County), and Comunidades Indígenas en Liderazgo (Los Angeles County)—are trusted in their respective communities. Their services and advocacy have been crucial during the COVID-19 pandemic and recent wildfires, drought, heatwaves, and extreme storms.

Taken together, the attending MSOs are national leaders in adapting to support undocumented migrants affected by climate-induced

disasters (Deutschman 2023; Kime et al. 2024). Between 2017 and 2022, after the Northern California Tubbs and Nuns fires, nonprofits in the affected region provided services for over 60,000 people and distributed nearly \$114 million in direct financial aid, including for COVID-19 assistance (Deutschman 2023). These MSOs were also critical in advocating for expanded safety-net programs throughout California. Such programs would provide state unemployment benefits and medical services to undocumented workers and families ineligible for federal unemployment insurance or state-sponsored low-income health care (Kuang and Foy 2023; Vargas Bustamante et al. 2023). The Summit provided a space to congregate, celebrate accomplishments, and coordinate new policy strategies.

Participant Observation and Semi-Structured Interviews

The research presented in this article forms part of a case study of the grassroots MSOs that attended the Summit. Our team served as academic advisors and breakout-group facilitators during the event. We supported organizers by helping them prepare presentation materials and administering online surveys before and after, to quantify these nonprofits' collective impact. Attending the event allowed research team members to establish working relationships with practitioners and build mutual trust, reciprocity, and greater study access (Christopher et al. 2008).

The data were collected from twenty-one semi-structured interviews with practitioners from twenty MSOs, supplemented by participant observation at the Summit and pre-Summit surveys. Online appendix tables A.1 and A.2 summarize the characteristics of each nonprofit and list a sample of the open-ended questions asked in the pre-Summit survey, the results of which informed our interview guide.³ To ensure interviewees' anonymity, specifics are concealed. The MSOs studied vary in size, location, and focus area; all had been involved in disaster preparedness and recovery for undocumented migrants since 2017.

MSO practitioners were contacted by email

to request participation; interviews were conducted between October 2022 and February 2023. The video conference platform Zoom was used for twenty of the interviews, and one was conducted over the phone. Interview length ranged from thirty to ninety minutes. The bilingual research team conducted interviews primarily in English, with some alternating between English and Spanish and one interview conducted entirely in Spanish.

The interview guide included nine open-ended questions regarding the organization's and practitioner's backgrounds, how the organization had responded to climate-induced disasters, and how the practitioner had seen climate change affecting undocumented migrants. The guide also included questions about "secondary trauma," alternatively called compassion fatigue. Interview data were supplemented by detailed notes taken by the research team during Summit breakout groups. Attendees were placed in these groups to discuss topics including the political landscape, legislation and policies, and opportunities for collaboration. Groups summarized their responses on notepads and shared them with everyone at the Summit. The research team collected these responses and took notes when groups shared perspectives. These data provided insights into the adaptations and innovations MSOs have developed to support undocumented communities during climate-related crises.

To ensure technical accuracy, the authors convened a disaster policy workshop in May 2024 that brought together nearly fifty stakeholders (five of whom were interviewed for this study) from community-based organizations, philanthropic foundations, academic institutions, and federal, state, and local policymaking entities (Kime et al. 2024). Held at the Beckman Center of the National Academy of Sciences, Engineering, and Medicine, the workshop provided an opportunity to refine our data and obtain feedback on study findings.

Data Analysis

This study follows an inductive qualitative design that draws from grounded theory princi-

3. The online appendix can be found at <https://www.rsfjournal.org/content/11/4/206/tab-supplemental>.

ples. Rather than beginning with preset hypotheses, we allowed patterns and themes to emerge directly from the interview transcripts and participant observation notes through review and comparison (Glaser and Strauss 1999; Suddaby 2006). This approach is appropriate given how each motivating factor to engage in disaster management is tied to a particular context, including the unique experiences and observations of each practitioner and their respective organization that inform the decision to expand their operations. There is currently limited research studying how MSOs respond to the overlapping pressures of climate change and immigration. By grounding our analysis in the lived experiences of practitioners, we aimed to generate new theoretical insights about how these organizations govern and adapt during disasters. All interviews were transcribed and coded using NVivo Qualitative Data Analysis Software.

The first author of this article developed a preliminary codebook with themes derived from the first interview set. As other research team members reviewed the data, this codebook was adjusted to increase coding consistency. During the process, we began identifying connections and differences among the data to elucidate challenges and opportunities encountered by stakeholders. Inter-rater reliability was established throughout via comparison across each researcher's interpretation. Differences were discussed and redressed, with no major conflicts emerging (Armstrong et al. 1997; Saldaña 2014).

Through the practitioner interviews, we also sought to understand how their perceptions, biases, and experiences of disaster management for undocumented migrants translated into actions to improve outcomes. This approach is supported by social science literature focused on feedback between social groups, governments, and the landscape to better inform inclusive strategies for reducing vulnerability to disasters (Yanow and Schwartz-Shea 2014). Furthermore, the data helped us gain insights into the lived experiences and intersectional identities of undocumented migrants and MSO practitioners, and how these influenced outcomes in times of disaster (Carroll et al. 2006; Paveglio et al. 2018; Crenshaw 1989). These findings are particularly important since few studies have

analyzed these groups' perspectives in this context.

RESULTS

Many interviewees highlighted how their organizations were expanding and altering services in response to the disproportionate impacts of climate change on the undocumented communities they serve. The following sections explore five factors uncovered by our research that explain and exemplify this adaptive governance behavior. We then discuss how the issue of mental health reveals the limits of adaptation in two ways—MSOs lack the resources to provide needed mental health services to their communities, and their own staff can be affected by secondary trauma while responding to disasters.

Conditions Shaping Vulnerability of Undocumented Immigrants

Undocumented migrants are uniquely vulnerable to disasters given overlapping sources of risk produced by environmental, economic, and political factors. Disasters also intersect with issues related to legality, housing precarity, and labor exploitation that further produce conditions that make preparation, response, and recovery especially difficult for this population. Climate-induced disasters have forced MSOs to address the intersecting effects of climate change on the populations they serve (Méndez et al. 2024). Participants at the Summit argued that health conditions were exacerbated by a surge in labor violations during disasters, further exploiting undocumented workers. During extreme wildfires compounded with heatwaves, undocumented workers were often denied water, rest breaks, and protective equipment while harvesting crops or cleaning up toxic debris. Workers hesitated to report violations because of their limited job opportunities, the immediate need to support their families, and fear of retaliation or deportation (Flynn et al. 2015; Méndez et al. 2024).

Overlapping with these events in 2020 and 2021, the COVID-19 pandemic increased concerns about unsafe working and living conditions. Many undocumented people reside in overcrowded, substandard housing, making the risk of contagion high. One participant shared: "For example, with COVID-19, farmworkers had

to get out to harvest crops but then come back home—knowing that they have elders in their family or children who are not eligible for the vaccine and just living with that stress of, “Where do I go to make sure that I keep them safe?” I have to work” (Respondent 11). Climate change decreases housing access by displacing people, destroying homes, and prompting surges in rent (DeGenaro 2015; Fan et al. 2018; Nanda 2024). Many undocumented people found themselves relocating in search of more affordable housing options, lengthening their commutes.

Continuous disasters also disrupt the public transportation networks on which many undocumented workers rely. Severed roads made cities like Santa Barbara, which provide tourism jobs, difficult to reach after the Thomas fire. Many employment hubs were damaged and closed. These cascading impacts reveal the precarity of housing and employment for undocumented migrants. As one practitioner stated, it is common to compartmentalize, but the “reality is that addressing one issue requires considering its relationship with others” (Respondent 15). For MSOs, recognizing that interconnectedness is imperative because of the multifaceted impacts of climate change. In response to these intersecting issues, MSOs became increasingly involved in discussions around housing security and eviction protections during wildfires and floods. With longer commutes and related costs for workers, MSOs also had to address affordable transportation access—an acknowledgment of the correlations among housing, infrastructure, and climate change (Méndez et al. 2020).

Other intersectional approaches that are starting to be acknowledged by MSOs involve the heightened vulnerability of Indigenous and women migrants during disasters, due to inequities that shape their socioeconomic status and autonomy. Research shows that during disasters, women face increased economic hardship, barriers to sexual and reproductive health care, and greater childcare responsibilities (Crenshaw 1989; Trentin et al. 2023). Gender-based violence also tends to rise during and after disasters. Yet, because of limited capacity and resources, MSOs have not fully developed methods to address these issues (Kime et al. 2024; FEMA 2024).

The US legal system’s lack of a clear pathway to citizenship prevents undocumented migrants from accessing post-disaster aid and resources, perpetuating their marginalized status (Horton 2012; Méndez 2022). As Respondent 13 mentions, “Immigrant workers, through a cruel and inhumane immigration system that labels people undocumented [or illegal], are expected to continue working, often without protection or care for their safety. If they choose not to work, they have no safety net to protect their families.” Mainstream disaster relief agencies, such as the American Red Cross, largely lacked a strategy to serve special-needs and hard-to-reach populations, such as undocumented migrants. For example, the Northern California chapter had no Latino/a and Spanish-speaking outreach coordinator until 2017. A year later, the national Red Cross developed the first draft of its Latino Engagement Program (Rivera 2020). According to Respondent 16, while the Red Cross has increased its presence in their local area, “it has a major capacity issue, and they have had difficulty in attracting and retaining bilingual, Spanish-speaking staff.” Respondent 9 also stated that during the 2017 fires in Ventura and Santa Barbara Counties, the Red Cross was visible at evacuation shelters but relied on MSOs for Spanish interpretation, further straining their limited resources.

At the federal level, disaster-aid programs are administered within departments historically distrusted by undocumented migrants. This is particularly true for households whose members have different immigration statuses in which at least one, but not all, of the members has legal status. These households can access certain types of disaster aid from FEMA, but many refuse assistance because FEMA and Immigration and Customs Enforcement (ICE) are both part of the Department of Homeland Security (DHS) and may share information across agencies (US Department of Homeland Security 2017; US Immigration and Customs Enforcement 2016; US Immigration and Customs Enforcement 2022; Kime et al. 2024; Elkin 2022). Respondents further stated that during mandatory evacuations from areas threatened by wildfire in 2017, many undocumented migrants stayed home for fear of immigration checks at emergency shelters, despite county direction

barring federal immigration officials from these locations. Due to this confusion and “to escape raging fires, and choking smoke, hundreds of migrants decided to shelter for days at local beaches” (Respondents 15 and 16). These fears continue today, as immigration agents have ramped up targeted enforcement arrests at work-sites, gas stations, and traffic stops throughout California (Franco and Huh 2025). These repeated experiences of fear, avoidance, and exclusion from official aid create patterns of exclusion, where undocumented and mixed-status households are systematically left out of formal disaster systems and forced to depend on informal or unsafe options. In this context, exclusion is not only about lack of access to resources but also about being positioned outside the boundaries of who is seen as a legitimate disaster survivor. Labor insecurity reinforces these dynamics, as undocumented migrants continue working through disasters to avoid income loss, often at personal risk.

Our study’s MSOs also expressed the need for unemployment insurance, hazard pay, disaster assistance for lost belongings, health care, financial support for funerals, and housing to protect undocumented migrants’ health and well-being (Rivera-Batiz 1999; Smith et al. 2003). Undocumented migrants cannot forgo employment because many live paycheck to paycheck. Respondent 3 recalled a story from the 2019 Kincaid Fire: “I remember two gentlemen shared that they were going to jump onto a bus to go back to the vineyard to continue picking grapes in mandatory evacuation zones because their boss had come and said: ‘There’s a fire and you need to finish picking before it’s all lost.’ For these individuals, you can talk about having a choice, but at the same time, it’s like you don’t really have one, right?” This interview underscores why a social safety net is needed to help migrants withstand and recover from disasters. Another respondent noted that they keenly understood the economic links between completing the harvest and wineries’ ability to stay in business and pay salaries. At the same time, they stressed that wildfire creates dangerous conditions in which profits are prioritized over the lives of farmworkers. For Respondent 21, it is important to acknowledge that migrants “deserve basic human rights and [more] protec-

tions,” as their labor sustains certain industries at the cost of their health.

In pushing for more labor protections during extreme weather events, MSOs have similarly supported jobs in the informal economy. Respondent 14, whose organization advocates for street vendors, commented on inconsistent policies regarding access to shade structures (including tree canopies) and vendor sites. These policies are also often inconsistently enforced, making it difficult for vendors to comply with regulations and protect themselves from the elements in intensifying heatwaves and storms (Rosales 2020). MSOs have campaigned to challenge existing laws and create resources that safeguard the well-being of undocumented workers.

In response to socioeconomic structures that limit access to aid and expose migrants to dangerous working conditions, nonprofits have been found to adopt the role of mutual-aid provider (Vilá et al. 2023). MSOs in this study exhibited similar behavior by distributing cash after disasters, regardless of recipients’ legal status. Recognizing that undocumented migrants are reluctant to share personal details, MSOs avoided the extensive questionnaires that are often involved in disaster assistance. They also distributed funds directly, capitalizing on established trust and the knowledge that the people they served felt most comfortable collecting aid at their offices. Taken together, these findings reveal how climate exposure, labor exploitation, and exclusion from aid systems intersect to create chronic vulnerability for undocumented migrants. The overlapping pressures of work insecurity, housing instability, and fear of enforcement make disasters not isolated events but extensions of everyday hardship. These conditions, in turn, compelled MSOs to expand their missions and take on new responsibilities to protect their communities.

The Evolving Role of Migrant-Serving Organizations

Many interviewees’ organizations had not initially focused on disaster response but were compelled to expand their roles as their communities faced the multifaceted impacts of climate-induced disasters. For instance, an MSO that primarily worked on labor rights, advocat-

ing for wage protection and workplace safety, found itself petitioning for hazard pay and enforcing protection against employer retaliation during wildfire evacuations. Similarly, groups dedicated to Indigenous language justice, which had historically provided interpretation services in legal and medical settings, began translating emergency warnings and evacuation orders to ensure language accessibility for Indigenous migrants. Over time, these adaptations reshaped the missions of MSOs, expanding their advocacy to include climate-related policy interventions. These shifts reflect adaptive governance, as MSOs not only responded to immediate crises but also reconfigured their long-term strategies to meet the evolving needs of their communities.

Immediate Response and Advocacy

Building on this evolving role, MSOs demonstrate their commitment to meeting the urgent needs of undocumented migrants through providing accessible information, supplies, and shelter, in addition to direct cash relief, and by advocating for policy changes. For instance, in 2020, during the wildfires and pandemic, MSOs provided culturally specific food and translation services: “lentils, rice [food that] our community members eat but were not able to get from anywhere, and we were the ones translating [county] documents so that they could have information in [their respective languages]” (Respondent 10). They also disseminated information using trusted social media, radio, text messaging platforms, and community-driven networks (Guberek et al. 2018). As Respondent 1 mentioned, “During the last phase, we had a full outreach team going directly to where the people were, instead of waiting for people to come to us or waiting for people to call us.” One respondent further shared that their organization serves a community that is often excluded from government assistance due to immigration status, which forces them to constantly seek alternative funding sources and create new outreach models. “It’s tough. The individuals we support are often viewed as less deserving of help during crises, making it harder to secure funding for our communities,” they explained. Through these on-the-ground experiences, our interviewees have developed valuable skills in

innovation and adaptability to provide immediate support.

MSOs, thus, are often quickest to respond to climate-induced disasters, largely because of the lack of government services for their constituents. Nonetheless, they are unambiguous in affirming the government’s obligation to protect these communities: “I would like to change things from the top so that nonprofit [MSO] leaders or volunteers don’t have to exist. They are always so resilient, trying to make up for what the people with more power and resources are responsible for” (Respondent 11). Other respondents echoed that until those in power enact changes, MSOs will be obliged to adapt to support vulnerable and stigmatized communities. This type of mutual aid, however, can face the challenge of neoliberal co-optation. Scholars have argued that neoliberalism erodes public infrastructure and services, advocating for privatization and emphasizing voluntary efforts instead. According to legal scholar Dean Spade (2020, 142), government social safety nets are often replaced by mainstream faith-based organizations and philanthropy as a result. Spade (2020) argues that in this way, nonprofit actors seeking policy changes are forced to invent new ways to manage crises and social problems that should be the responsibility of governments. Many interviewees described taking a “bottom-up” approach to combat these dynamics and hold government accountable, engaging in activities and policy issues that reflected the priorities and needs of community members. In many instances, MSOs created leadership opportunities enabling community members to develop advocacy skills and guide the organization in seeking systemic changes to disaster policies. This approach allowed organizations to garner trust and build on community knowledge to spread the word about the inequitable effects of disasters and opportunities to increase political influence.

Between 2017 and 2024, MSOs helped undocumented migrants present their experiences and data on these issues to the news media and policymakers at the United Nations and US federal and state agencies. As a result, in 2019 the Office of California Governor Gavin Newsom allocated \$50 million in state disaster grants for vulnerable communities, provided \$75 million

in cash assistance to undocumented migrants during the COVID-19 pandemic, and adopted an emergency state regulation to protect outdoor workers from wildfire smoke. In 2023, Sonoma County's Board of Supervisors set aside \$1 million in their annual budget for disaster assistance to farmworkers, and migrants collaborating with MSOs obtained labor concessions from E. & J. Gallo Winery and Eco Terrano Vineyards (one of the state's largest wineries and regenerative vineyards, respectively), guaranteeing hazard pay whenever air quality is deemed unhealthy for the general population because of wildfire smoke (Chunga Pizarro et al. 2024; Pastor et al. 2024; Mendez et al. Zucker 2020). Several respondents contended that these projects can cultivate resistance (Spade 2020) to the government's abandonment of the social safety net (these state and local outcomes were also supported by research and data generated by the author team). These outcomes demonstrate that MSOs not only filled immediate response gaps but also shaped policy environments through advocacy and collective organizing.

Structural Challenges and Local Context

Geography, local politics, and the historical disinvestment in migrant communities profoundly influence organizations' decisions to adapt. For example, Respondent 13 represents an organization on the Central Coast, a relatively rural and politically conservative area. They discussed how their nonprofit has had to engage issues beyond its mission and fill gaps in essential services for undocumented migrants because of its isolation. In cities, where nonprofits tend to be concentrated, they can specialize, disperse tasks, and delegate responsibilities, enhancing their influence on particular issues and enabling them to coordinate in support of or opposition to policy. In contrast, Respondent 13's organization has limited capacity to confront powerful regional interests such as agriculture, real estate, oil, and gas—and thus less power in policymaking. This variability underscores the importance of tailoring disaster aid strategies to local conditions.

Other participants noted that local, state, and federal policy responses to climate change are typically standardized, regardless of context

(Brunner and Lynch 2010). Some MSOs have turned their attention to this issue, seeking ways to make climate policy more adaptive to the needs of their communities. One respondent mentioned gray infrastructure like seawalls to protect against sea-level rise, and cooling centers to provide heatwave relief. They argue that such science-driven projects should be supplemented with community input about social infrastructure to strengthen local economies and prepare residents for employment in industries less vulnerable to climate change. Respondent 15's organization, for instance, helps migrants start businesses aligned with sustainable sectors like electrification, solar energy, and fire mitigation—a focus on climate change that was new to their project portfolio. Respondent 20 further suggested allocating resources to train undocumented migrants to lead community-focused policy initiatives, including climate action and land use planning (Zuñiga and Méndez 2023).

While migrants historically have struggled in advocating for improved infrastructure in their communities, they serve a critical role in the disaster rebuilding process throughout the US by alleviating labor shortages. After Hurricane Harvey in 2017, over 50 percent of construction workers involved in reconstruction were migrants, and thousands were undocumented. Many worked long hours without adequate protection from toxic debris, and some experienced wage theft (Krauze 2025). It is anticipated that migrants will also play a key role in recovery after 2025's extreme wildfire events in Los Angeles and Ventura Counties. According to a report by the American Immigration Council (n.d.), 43 percent of construction workers in California are migrants, a majority of them of Mexican origin. Nonprofit and businesses leaders assert that without migrant labor, these counties would not be able to rebuild all the homes and infrastructure that were lost in the fires (Krauze 2025). These place-based variations illustrate that while MSOs' capacities differ, they consistently adapt to ensure undocumented migrants are not left behind in disaster recovery.

Collaboration and Social Learning

Collaboration and continuous learning emerged as central strategies in how MSOs strengthened

their capacity to act. The evolving nature of MSOs can be attributed to learning from their collaborations—a key feature of adaptive governance (Pahl-Wostl and Hare 2004). Through these engagements, MSOs identified internal gaps and adapted to develop new services, expertise, and political strategies. They also recognized their strengths and how to use them to support allies. Respondents 1 and 2 recalled instances during the COVID-19 pandemic and wildfires when their organizations—which had Spanish- and Mixteco-speaking staff—aided other nonprofits by translating information about financial and housing assistance. Unlike large national nonprofits, such as the Red Cross, MSOs are embedded within the communities they serve. This proximity enables them to build trust and address specific needs, uniquely positioning them as agile, contextual providers who fill systemic gaps left by larger, less flexible organizations. Engaging their diverse networks, moreover, expands MSOs' understanding of the intersecting implications of climate change for undocumented migrants (Crenshaw 1989; Trentin et al. 2023). The 805 UndocuFund provides an example: “We originally started as a collaborative between three organizations that have worked in our region for almost thirty years with immigrant communities and advocacy. It’s just interesting because these three organizations are from the environmental justice, civic engagement, farmworker, and Indigenous perspectives,” one respondent stated. Collaboration is also needed to secure funding for disaster-related services. MSOs like the 805 UndocuFund rely on their partnerships with community groups and philanthropic organizations, further underscoring the importance of resource sharing and collective problem-solving.

MSOs leverage their deep-rooted community connections to effectively respond to disasters. Many MSOs employ staff who were raised in the community they serve and who often speak the same languages as other residents, for instance, Spanish, Mixtec, Chatino, and Maya. Drawing from experience, staff members offer valuable insights into organizing strategies and community needs. In contrast, government disaster-aid workers and mainstream mutual-aid providers often come from other regions or states, without an understanding of the local context or

cultural and linguistic competency. MSO staff with roots in affected areas show a deep sense of commitment and often hold themselves to a higher level of accountability to local residents. This can further propel an MSO to engage in adaptive governance during crises to maintain credibility and responsiveness to their communities, close friends, and family (Folke et al. 2003). Through direct engagement and local lived experience, moreover, MSOs have established trust: “When a disaster hits, we don’t always know who it’s going to affect [or] where the immediate impact [will be]. It’s essential for us to listen, to [create] those spaces and [understand] what is needed in terms of community resources and support” (Respondent 3). Through these collaborative processes, MSOs positioned themselves as adaptive institutions, capable of shaping more equitable disaster governance from the ground up.

Mental Health and the Limits of Adaptation

Adaptive governance and local collaborations enable MSOs to be trusted providers in communities that are frequently apprehensive and difficult to reach during disasters. This essential role brings an increased workload, including the delivery of mental health resources and assistance to undocumented communities—an area in which MSOs' capacities are often limited. In California, 73 percent of undocumented migrants have unmet mental health-care needs (Padilla-Frausto et al. 2023). During a policy workshop held by our author team in May 2024, psychologist Ángela Gutiérrez described a severe mental health crisis among undocumented migrants, amplified by rising anti-immigrant rhetoric and exacerbated by the COVID-19 pandemic and climate-induced disasters. Her research highlighted a 71 percent increase in severe psychological distress between 2015 and 2021. She called for expanding access to affordable, culturally and linguistically appropriate mental health care and leveraging the cultural wealth of communities to reduce associated barriers and social stigma (Kime et al. 2024; Padilla-Frausto et al. 2023).

The psychological impacts of climate change (Bourque and Cunsolo Willox 2014; Trombley et al. 2017) include distress, anxiety, depression, and an increased incidence of suicide, especially

among farming communities experiencing prolonged drought (Hanigan et al. 2012; Padhy et al. 2015). The San Joaquin Valley, with its widespread economic reliance on agriculture—increasingly affected by heat, flooding, and drought—has one of the highest rates of mental illness in California (Ganesh and Smith 2018). Migrant communities are exposed to these conditions on a regular basis, and research has shown that they also face higher rates of anxiety, depression, and PTSD after a disaster, compared to the general public (Dadson et al. 2025). Cultural factors likely contribute to these outcomes. For instance, Asian migrants’ underutilization of mental health care following the September 11 terrorist attacks in New York City was attributed to social stigmas around seeking psychological support and a tendency to convey psychological distress primarily through physical symptoms (Kung et al. 2018). Migrants may forgo government assistance for mental health issues due to uncertainty regarding their eligibility or apprehension about the potential consequences of stringent immigration policies. This situation was exacerbated by the Trump administration’s “public charge” rule. It instilled fears that using public benefits could endanger migrants’ applications for green cards and citizenship, or worse, make them targets for deportation (Calvo and Waters 2023). All these compounding challenges place additional stressors on MSOs, especially staff working on the frontlines of disasters—a situation that is largely unexamined within disaster studies. To our knowledge, research on mental health implications has primarily addressed direct traumas affecting individuals and communities (Chen et al. 2020). Our findings diversify this research by spotlighting MSO practitioners.

Social and Health Impacts for MSO Practitioners

While community-based disaster relief work can be rewarding, it can also inflict secondary trauma, a familiar challenge in fields such as social work and health care (Holmes et al. 2021; Tullberg and Boothe 2019; Cocker and Joss 2016). Our interviewees unanimously acknowledged the profound impact of internalizing harrowing stories and events. When asked how they recognized secondary trauma, practitioners cited stress, anxiety, exhaustion, fear, depression,

bodily discomfort, restlessness, insomnia, and a pervasive sense of powerlessness (Chen et al. 2020). During interviews, many gave emotional accounts of their experiences. Respondent 21 tearfully recalled supporting families as they evacuated their homes, became displaced, and returned to find their belongings destroyed by wildfire. Throughout our interviews, a distinction emerged in the severity of mental health impacts, according to organizational roles: directors and managers experienced secondary trauma less intensely than frontline staff.

We found that directors and managers recognized this difference and worked to minimize their staff’s exposure. Indeed, research has highlighted the importance of interventions that promote resilience and help practitioners return to high-functioning behaviors (Cocker and Joss 2016; Holmes et al. 2021; Miller et al. 2022). A supportive work environment is consequential for the well-being of practitioners repeatedly exposed to stressful or traumatic events (Headley et al. 2023). Addressing secondary trauma is also a critical component of adaptive governance. Adopting trauma-informed practices helps MSOs maintain their capacity to respond effectively to their communities’ needs by protecting staff and sustaining organizational effectiveness during disasters. Respondent 12’s organization rotates frontline staff throughout the disaster and recovery stages. Other MSOs provide time off, hold debriefing sessions, or offer recreational classes like yoga. Practitioners recognize the importance of protecting their well-being, as noted by Respondent 3: “The need and the stories I see and hear have a huge impact on me, and it is crucial I take care of myself to sustain this work long-term. Sometimes I need to pause and take myself to the coast, [to be in nature] to continue doing this work.”

Some MSO practitioners’ work led them to feel pessimistic and burned out. One participant (Respondent 4) had considered leaving the sector in frustration over the lack of progress in disaster recovery and building resiliency for undocumented migrants: “I think that policymakers and even the best [ones] say that there isn’t a lot of change happening, certainly not quickly enough. There is high resistance to taking action to address the climate change issues that we’re facing. It’s not being connected to the cri-

sis of people, climate refugees, the crisis of labor and [occupational health, and] migration.” Respondent 11 more optimistically noted that secondary trauma can serve as motivation: “It’s important that we don’t stop feeling because vicarious trauma⁴ is a real thing and compassion fatigue is a real thing, but also it’s important that we feel these emotions because if we don’t, then we don’t attack the root cause of the issue and we repeat the cycle of power by adopting Band-Aid solutions.” Despite these challenges, practitioners developed deliberate strategies to sustain themselves and their coworkers through repeated crises.

Coping Mechanisms and Source of Strength

To navigate the challenges of disaster management, practitioners have embraced various coping mechanisms. For one, coping manifested through a proactive “trauma response mode” (Schuster 2023).⁵ They recalled evacuating people from a wildfire and then immediately organizing a donation bank and community support via social media platforms. Several others mentioned recognizing the limitations of their capacity to help others. For Respondent 3, cultivating this awareness resulted in personal growth and professional efficiency: “I am one individual, and I can only do so much. [That] gives me a little bit of peace, as does having skills and tools to take care of me. To be able to continue to do this work. It’s taken me a while to get to that point.” Another participant used reflective practices (Méndez 2022) to become more selective regarding the tasks they attend to. Many practitioners engaged in self-care through nature walks, gardening, exercising, journaling, meditating, listening to music, attending therapy, and dedicating quality time to loved ones and pets. However, when the wildfires overlapped with the pandemic, practitioners struggled to maintain boundaries between their professional and personal lives.

Participants also found solace in their colleagues, whom some consider extended family

members, thanks to close bonds forged through shared experiences. They noted the therapeutic value of mental health briefings (or peer-to-peer counseling) conducted among staff members and managers, which provided space to unpack collective trauma. One practitioner recollected how cooking with other staff on a work trip prepared them for challenging fieldwork and facilitated a sense of security and camaraderie at the end of the day. Other sources of strength included participants’ dedication to their communities and aspirations to cultivate a society that treats undocumented migrants with dignity and respect. Many had familial ties to undocumented individuals, which personalized their advocacy. Others grew up in the communities they now serve. Several had been undocumented at some point and felt that their work supported their present communities as well as their past selves. Many drew inspiration from the resilience demonstrated by their communities, as encapsulated by Respondent 6: “Some of my husband’s siblings were born here in the United States, but my in-laws weren’t. I’ve always been drawn to their story of coming here, and how they’ve built their lives, and it’s inspirational to me. I feel like it’s what motivates me to continue to do this [work] and is the reason I agreed to an interview [for this study].” Taken together, these experiences highlight both the emotional cost and the moral drive that define MSO practitioners’ work. Their strategies for care, reflection, and mutual support demonstrate that adaptive governance depends not only on institutional flexibility but also on the well-being of the individuals who sustain it.

DISCUSSION

Our research provided a platform for participants to reflect on the ways their organizations have supported undocumented communities in recent disasters, which in turn helped us learn why they are having to adapt. These findings further expand existing literature by demonstrating how the inequities of climate-induced

4. Although often used interchangeably with the concept of secondary trauma, vicarious trauma refers to the shift in someone’s worldviews after witnessing trauma experienced by others (Rynfield and Turner 2024).

5. “Trauma response mode” is a self-defense mechanism triggered by stressful or traumatic situations. Responses like proactive engagement can help people manage various stressors or stay safe in a dangerous situation, but they can also have negative physical and mental health consequences (Schuster 2023).

disasters intersect with indigeneity, labor, race, gender, and immigration status (Elliott et al. 2023; Walker et al. 2021), as well as the need for multifaceted responses. Notably, while gender and gender-based violence (GBV) largely did not emerge as a standalone topic, they became more salient in advocacy and policy arenas after our interviews (Trentin et al., 2023; Kime et al. 2024). This shift aligns with findings from FEMA's National Advisory Council, which has recommended integrating GBV considerations into disaster planning and response frameworks (FEMA National Advisory Council 2024). Fact-finding reports by FEMA (2024) have also highlighted the need for policies that address the disproportionate risks faced by migrant women and LGBTQ+ people of color in post-disaster settings, including heightened vulnerabilities to exploitation and lack of access to gender-responsive resources (Geiger et al. 2023).

In assisting undocumented migrants during climate crises, MSOs learned from their collaborators and communities (Pahl-Wostl and Hare 2004). As they learned, they shifted their operations to meet emerging needs and respond to changes in their environments, including the political landscape (Gooding 2012). Engaging in adaptive governance has granted these nonprofits the flexibility to respond to climate change and support their communities accordingly (Moore 2000).

When the MSOs in our study responded to disasters or offered mutual-aid services, they engaged in issues beyond their core missions—a phenomenon known as “mission creep,” or “mission drift.” In the field of organizational theory, mission creep is understood to result from nonprofits’ efforts to enhance their image (Foster and Meinhard 2002); to accommodate external pressures, like changes to government programs and regulations (Frumkin and Galaskiewicz 2004); to respond to political and philanthropic shifts (Gooding 2012); or, most commonly, to access additional resources and funding opportunities (Jonker and Meehan III 2008; Milliken 1990; Mitchell 2014). Our findings show that intersectionality, inequitable structures, urgent needs, historical disinvestment, collaboration, and exclusionary practices can also motivate organizations to shift the focus of their activities.

This expansion of responsibilities is not just a by-product of external pressures or opportunities—it is also a strategic response to systemic gaps in disaster governance. As MSOs took on new roles, they navigated the broader political and institutional landscape in ways that reinforced their credibility and influence. Organizational theory further shows how MSOs conform to societal expectations to maintain legitimacy (DiMaggio and Powell 1983). By filling gaps left by government agencies, MSOs not only adapt to but reshape disaster-response discourse and policies according to practitioners’ lived experiences (Méndez 2022). Zayda Sorrell-Medina (2023) further found that MSOs often formed in response to anti-immigrant sentiment, policies excluding asylum seekers from services or resources, or governmental failures to provide essential support. Our study’s MSOs exhibited similar behavior: expanding missions to deliver services to undocumented migrants suffering from climate-induced disasters.

The emotional and psychological effects of climate change on individuals are amply documented elsewhere, and evident in our research. Existing literature on mental health has largely focused on the individual or on populations with legal immigration status. These studies have identified a range of ways in which living through a disaster affects mental health, with depression and PTSD being the most common (Lowe et al. 2019; Silveira et al. 2021). Climatic events have also been found to disproportionately impact the mental health of socially vulnerable populations (Singh et al. 2014). Agricultural communities in poor rural areas have greater difficulty adjusting psychologically following a drought, heatwave, or severe storm (Vins et al. 2015). Factors like age, gender, immigration status, race, and ethnicity have also been found to heighten the risk of psychological distress (Chen et al. 2020). Vulnerability to mental health issues increases with socioeconomic disadvantage, and can be compounded by inadequate access to appropriate services as well as cultural stigma, especially among men and uninsured populations (Trombley et al. 2017).

Studies have also explored how the health-care industry is preparing for the mental health

effects of climate-induced disasters on the general population (Trombley et al. 2017). Our work makes a significant contribution by examining the psychological stress experienced by frontline practitioners who aid undocumented migrants throughout the entire disaster management cycle. Lynn Weber and DeAnne K. Hilfinger Messias's (2012) examination of comparable experiences in the wake of Hurricane Katrina is among the few studies highlighting the mental health implications of disasters for nonprofit personnel. Our findings underscore a crucial need for mental health resources to support both undocumented migrants and frontline workers (Méndez et al. 2024; Kime et al. 2024).

Our research approach does have certain limitations. First, the MSOs examined are exclusively from California, which complicates the generalization of the findings across the United States. California's government may be perceived as more "welcoming" than other states', indicating the need for future comparative studies in different regions. Second, our data collection relied primarily on in-depth interviews with MSO personnel, which may not adequately capture the experiences of undocumented migrants. To partially mitigate this concern, alternative methods such as policy workshops, participant observations of community and government meetings, and analysis of laws, policies, and gray literature were utilized.

POLICY RECOMMENDATIONS

Climate-induced disasters exacerbate systemic inequities, particularly for undocumented migrants, one of the most marginalized and stigmatized populations in the United States (Méndez et al. 2024). The MSOs in our study recognized that structural changes must be made to all socioeconomic institutions if we are to get to the core of the intersecting issues affecting migrant communities. This finding aligns with the work of Erica Kohl-Arenas (2015) and Fayola Jacobs (2019, 2), which addresses how the structural roots of poverty and racial inequality are exacerbated during and after disasters. Reactive measures like distributing face masks during wildfires and advocating for safer working conditions are necessary but offer only temporary relief, rather than building the systemic

resilience needed to mitigate the intensifying impacts of climate change. For these MSOs, policy measures like a social safety net or a pathway to citizenship would go far in addressing underlying problems. Their limited legislative experience, resources, and political influence have hampered their engagement with policy-making. But collaborating across networks (Lu 2018; Wilson et al. 2022) and a sense of belonging to a larger cause (Fyall and McGuire 2015; Verba et al. 1995) have strengthened their engagement in this arena. Some challenges that MSOs face can only be met through political processes and are beyond our study's scope. We focus instead on three key issues that can be addressed through broader access to resources, data, technical assistance, and training.

These pragmatic recommendations were developed with the current federal context in mind, which has intensified immigration enforcement activities across multiple states. Since early 2025, new DHS directives have expanded worksite raids and targeted enforcement near schools and transportation hubs (US Department of Homeland Security 2025; Blume and Sanchez 2025). There have also been numerous reports of roving patrols of immigration agents targeting individuals on the basis of factors including appearance and the language a person speaks (Ibarra 2025). Testimonies describing individuals being detained in public areas like gas stations and leaving behind loved ones and belongings are increasingly common (Marcus 2025). These incidents have deepened fear and instability in immigrant communities and have further strained the capacity of MSOs as they have assumed additional responsibilities of monitoring their communities for immigration enforcement activities, advocating against these arrests, and collecting funds and donated items to support community members who live in fear because of these raids (Garcia 2025). We argue that the lessons from this study are more urgent given the current national climate. The adaptive approaches developed by MSOs can serve as a model for organizations in other states that are also being pushed to respond to changing federal policy that heightens the vulnerability of immigrant communities to a variety of issues, including climate change.

Include MSOs in Disaster Planning at Local and State Levels

While FEMA's local hazard mitigation guide requires engagement with communities and stakeholders, local agencies often purposely exclude migrants, and federal agencies explicitly omit undocumented households from their programs. Due to the shifting nature of national emergency management, local emergency managers should ensure substantive engagement with MSOs before a disaster strikes (Mathias et al. 2022). California MSOs have successfully worked with decision-makers to pass inclusive disaster-related policies, a recent example being Senate Bill 1105 (Office of Senator Steve Padilla 2024), which requires employers to allow agricultural workers to utilize their sick days when local or state authorities have declared an emergency due to smoke, extreme heat, or flooding. This legislation was partially informed by the author team's previously published research. This law will enable farmworkers to remain indoors, safeguarding their health during adverse conditions, and will protect them from retaliation. Similarly, hazard pay could be provided to farmworkers laboring in dangerous climatic conditions. Governments at all levels should also provide appropriate funding to MSOs for community training, disaster response drills, early warning systems, and community-based vulnerability mapping projects (Gero et al. 2011).

Provide Mental-Health Resources to Nonprofit Practitioners and Migrant Communities

Responding to climate-induced disasters exacts a toll on practitioners' mental health, reducing their capacity to adapt and support migrant communities (Norris et al. 2002). Mental health and post-traumatic resources, such as those provided by Assembly Bill 1116 (State of California 2019)—including peer counseling support for emergency personnel—should be extended to these practitioners (California Professional Firefighters 2019). The impetus for AB 1116 was a survey conducted by the California Professional Firefighters Association and NBC Bay Area News, which revealed that almost one in six firefighters has contemplated suicide. Our research shows that MSO practitioners may experience

similar mental stress or trauma (Marchand 2019, 6). We further recommend that MSOs partner with the Green Cross Academy of Traumatology (GCAT) to receive support from licensed mental health professionals trained to help victims and responders following traumatic events (Green Cross Academy of Traumatology 2024). Similar resources should be provided to migrants; for instance, expanding access to affordable, culturally and linguistically appropriate mental health services (including programs to address GBV); and leveraging community-based and cultural approaches to break down the associated barriers and stigma (Kime et al. 2024).

Require UndocuAlly Training for Emergency Responders

State and local government emergency agencies should be required to receive linguistic and cultural competency training to inform their interactions with undocumented communities. This program could be modeled after UndocuAlly trainings, which are primarily conducted in higher education to increase awareness, competency, and self-efficacy among university personnel (Southern 2016). These trainings are demonstrably effective for teaching the unique challenges faced by undocumented students (Jach and Carvajal 2023). Government agencies should collaborate with MSOs to develop similar modules for emergency managers and staff.

CONCLUSION

This study examines how MSOs navigate climate-induced disasters and adapt to address the needs of undocumented communities. With MSO support, undocumented communities gain access to aid otherwise withheld from them—particularly by government agencies. Practitioners in these organizations are de facto first responders as well as experts on how undocumented status contributes to disparate disaster outcomes. Responding to disasters has serious mental health implications; despite exposure to secondary trauma and limited access to mental health resources, many practitioners maintain a deep commitment to the people they serve. Our research indicates the need for structural changes that grant both migrant-serving practitioners and undocumented migrants the means to cope and thrive. Increased resources,

funding, and more inclusive government strategies to reduce vulnerability would ensure that MSOs no longer constitute the main source of aid to communities historically excluded and rendered invisible by disaster policies.

REFERENCES

- American Immigration Council. n.d. "Immigrants in California." American Immigration Council. Accessed January 4, 2025. <https://map.americanimmigrationcouncil.org/locations/california/>.
- Aoki, Naomi. 2016. "Adaptive Governance for Resilience in the Wake of the 2011 Great East Japan Earthquake and Tsunami." *Habitat International* 52: 20–25. <https://doi.org/10.1016/j.habitatint.2015.08.025>.
- Armstrong, David, Ann Gosling, John Weinman, and Theresa Marteau. 1997. "The Place of Inter-Rater Reliability in Qualitative Research: An Empirical Study." *Sociology* 31(3): 597–606. <https://doi.org/10.1177/0038038597031003015>.
- Bedsworth, Louise, Dan Cayan, Guido Franco, Leah Fisher, and Sonya Ziaja. 2018. "California's Fourth Climate Change Assessment: Statewide Summary Report." Governor's Office of Planning and Research. August. https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf.
- Berkes, Fikret. 2009. "Evolution of Co-Management: Role of Knowledge Generation, Bridging Organizations and Social Learning." *Journal of Environmental Management* 90(5): 1692–702. <https://doi.org/10.1016/j.jenvman.2008.12.001>.
- Blume, Howard, and Olivia Sanchez. 2025. "'I Don't Feel Safe Anywhere.' California Moves to Aid Undocumented Students as Fears Surge." *Los Angeles Times*, January 7, 2025. <https://www.latimes.com/california/story/2025-01-07/california-schools-plan-to-support-undocumented-amid-trump-deportation-vows>.
- Bourque, François, and Ashlee Cunsolo Willox. 2014. "Climate Change: The Next Challenge for Public Mental Health?" *International Review of Psychiatry* 26(4): 415–22. <https://doi.org/10.3109/09540261.2014.925851>.
- Brown, Patrick T., Holt Hanley, Ankur Mahesh, et al. 2023. "Climate Warming Increases Extreme Daily Wildfire Growth Risk in California." *Nature* 621: 760–66. <https://doi.org/10.1038/s41586-023-06444-3>.
- Brunner, Ronald D., and Amanda H. Lynch. 2010. *Adaptive Governance and Climate Change*. American Meteorological Society.
- California Professional Firefighters. 2019. "Governor Signs Historic CPF-Sponsored Bills." California Professional Firefighters, October 2. <https://www.cpf.org/news/news-updates/governor-signs-historic-cpf-sponsored-bills>.
- Calvo, Rocío, and Mary C. Waters. 2023. "The Impact of the COVID-19 Pandemic on Older Latino Immigrants." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 9(3): 60–76. <https://doi.org/10.7758/RSF.2023.9.3.03>.
- Carroll, Matthew S., Lorie L. Higgins, Patricia J. Cohn, and James Burchfield. 2006. "Community Wildfire Events as a Source of Social Conflict." *Rural Sociology* 71(2): 261–80. <https://doi.org/10.1526/00360110677789701>.
- Chen, Shuquan, Rohini Bagrodia, Charlotte C. Pfeiffer, Laura Meli, and George A. Bonanno. 2020. "Anxiety and Resilience in the Face of Natural Disasters Associated with Climate Change: A Review and Methodological Critique." *Journal of Anxiety Disorders* 76: 102297. <https://doi.org/10.1016/j.janxdis.2020.102297>.
- Christopher, Suzanne, Vanessa Watts, Alma Knows His Gun McCormick, and Sara Young. 2008. "Building and Maintaining Trust in a Community-Based Participatory Research Partnership." *American Journal of Public Health* 98(8): 1398–1406. <https://doi.org/10.2105/AJPH.2007.125757>.
- Chu, Eric, Isabelle Anguelovski, and Debra Roberts. 2017. "Climate Adaptation as Strategic Urbanism: Assessing Opportunities and Uncertainties for Equity and Inclusive Development in Cities." *Cities* 60: 378–87. <https://doi.org/10.1016/j.cities.2016.10.016>.
- Chunga Pizarro, Carlo A., Rebecca R. Buchholz, Rebecca S. Hornbrook, Kevin Christensen, and Michael Méndez. 2024. "Air Quality Monitoring and the Safety of Farmworkers in Wildfire Mandatory Evacuation Zones." *GeoHealth* 8(7): e2024GH001033. <https://doi.org/10.1029/2024GH001033>.
- Cocker, Fiona, and Nerida Joss. 2016. "Compassion Fatigue Among Healthcare, Emergency and Community Service Workers: A Systematic Review." *International Journal of Environmental Research and Public Health* 13(6): 618. <https://doi.org/10.3390/ijerph13060618>.
- Cravero, Kathleen, L. Ansley Hobbs, Elisabeth Manipoud Figueroa, and Diana Romero. 2024. "Sup-

- porting Organizations to Improve Migrants' Access to Health Services in New York City." *Journal of Migration and Health* 10: 100249. <https://doi.org/10.1016/j.jmh.2024.100249>.
- Crenshaw, Kimberlé. 1989. "Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics." *University of Chicago Legal Forum* 1989(1): 8. <https://chicago.unbound.uchicago.edu/uclf/vol1989/iss1/8>.
- Cuervo, Isabel, Les Leopold, and Sherry Baron. 2017. "Promoting Community Preparedness and Resilience: A Latino Immigrant Community-Driven Project Following Hurricane Sandy." *American Journal of Public Health* 107(sup2): S161–S164.
- Cutter, Susan L. 2016. "Resilience to What? Resilience for Whom?" *Geographical Journal* 182(2): 110–13. <https://doi.org/10.1111/geoj.12174>.
- Dadson, Yvonne Appiah, DeeDee M. Bennett-Gayle, Victoria Ramenzoni, and Elisabeth A. Gilmore. 2025. "Experiences of Immigrants During Disasters in the US: A Systematic Literature Review." *Journal of Immigrant and Minority Health* 27(1): 134–48. <https://doi.org/10.1007/s10903-024-01649-8>.
- Davis, Carl, Marco Guzman, and Emma Sifre. 2024. *Tax Payments by Undocumented Immigrants*. Institute on Taxation and Economic Policy. July 30. <https://itep.org/undocumented-immigrants-taxes-2024/>.
- DeGenaro, Carey. 2015. "Looking Inward: Domestic Policy for Climate Change Refugees in the United States and Beyond." *University of Colorado Law Review* 86(3): 991–1048. <https://scholar.law.colorado.edu/lawreview/vol86/iss3/5>.
- Deutschman, Katie. 2023. *Growing Resilience: California Immigrant Organizations Advocating for and Serving Immigrants in Disaster*. UndocuFund and 805 UndocuFund. November 15. <https://undocufund.org/2023/11/15/california-immigrant-organizations-advocating-for-and-serving-immigrants-in-disaster/>.
- DiMaggio, Paul J., and Walter W. Powell. 1983. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields." *American Sociological Review* 48(2): 147–60. <https://doi.org/10.2307/2095101>.
- Djalante, Riyanti, Cameron Holley, and Frank Thomalla. 2011. "Adaptive Governance and Managing Resilience to Natural Hazards." *International Journal of Disaster Risk Science* 2(4): 1–14. <https://doi.org/10.1007/s13753-011-0015-6>.
- Dorazio, Justin. 2022. *How FEMA Can Prioritize Equity in Disaster Recovery Assistance*. Center for American Progress. July 19. <https://www.americanprogress.org/article/how-fema-can-prioritize-equity-in-disaster-recovery-assistance/>.
- Elkin, Jacob. 2022. "The Climate Justice Implications of Co-Locating FEMA and ICE within DHS." *Environmental Claims Journal* 34(4): 281–99. <https://doi.org/10.1080/104060a26.2021.2010892>.
- Elliott, Tina M., Maureen G. Reed, and Amber J. Fletcher. 2023. "Learning from Wildfire: Co-Creating Knowledge Using an Intersectional Feminist Standpoint Methodology." *Frontiers in Environmental Science* 11: 1249598. <https://doi.org/10.3389/fenvs.2023.1249598>.
- Fan, Qin, Karen Fisher-Vanden, and H. Allen Klaiber. 2018. "Climate Change, Migration, and Regional Economic Impacts in the United States." *Journal of the Association of Environmental and Resource Economists* 5(3): 643–71. <https://doi.org/10.1086/697168>.
- Federal Emergency Management Agency (FEMA). 2024. *Planning Considerations: Putting People First*. December.
- Federal Emergency Management Agency (FEMA). National Advisory Council. 2024. *Annual Report*. November. https://eelp.law.harvard.edu/wp-content/uploads/2024/01/fema_nac_report_112024.pdf.
- Flatt, Victor Byers, and Jeffrey Stys. 2013. "Long Term Recovery in Disaster Response and the Role of Non-Profits." *Oñati Socio-Legal Series* 3(2): 364–81. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2119879.
- Flynn, Michael A., Donald E. Eggerth, and Jeffrey Jacobson Jr. 2015. "Undocumented Status as a Social Determinant of Occupational Safety and Health: The Workers' Perspective." *American Journal of Industrial Medicine* 58(11): 1127–37. <https://doi.org/10.1002/ajim.22531>.
- Folke, Carl, Johan Colding, and Fikret Berkes. 2003. "Synthesis: Building Resilience and Adaptive Capacity in Social-Ecological Systems." In *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, edited by Fikret Berkes, Johan Colding, and Carl Folke. Cambridge University Press.

- Folke, Carl, Thomas Hahn, Per Olsson, and Jon Norberg. 2005. "Adaptive Governance of Social-Ecological Systems." *Annual Review of Environment and Resources* 30(1): 441–73. <https://doi.org/10.1146/annurev.energy.30.050504.144511>.
- Foster, Mary K., and Agnes G. Meinhard. 2002. "A Contingency View of the Responses of Voluntary Social Service Organizations in Ontario to Government Cutbacks." *Canadian Journal of Administrative Sciences / Revue canadienne des Sciences de l'administration* 19(1): 27–41. <https://doi.org/10.1111/j.1936-4490.2002.tb00667.x>.
- Fothergill, Alice, and Lori A. Peek. 2004. "Poverty and Disasters in the United States: A Review of Recent Sociological Findings." *Natural Hazards* 32(1): 89–110. <https://doi.org/10.1023/B:NHAZ.0000026792.76181.d9>.
- Franco, Jose, and Jenny Huh. 2025. "Immigration Enforcement Operations Taking Place in Bakersfield Area, Local Officials Say." *KGET*. January 7. <https://www.kget.com/news/local-news/immigration-enforcement-operations-taking-place-in-bakersfield-area-local-officials-say/>.
- Frumkin, Peter, and Joseph Galaskiewicz. 2004. "Institutional Isomorphism and Public Sector Organizations." *Journal of Public Administration Research and Theory: J-PART* 14(3): 283–307. <http://www.jstor.org/stable/3525838>.
- Fyall, Rachel, and Michael McGuire. 2015. "Advocating for Policy Change in Nonprofit Coalitions." *Nonprofit and Voluntary Sector Quarterly* 44(6): 1274–91. <https://doi.org/10.1177/0899764014558931>.
- Ganesh, Chandrakala, and Jason A. Smith. 2018. "Climate Change, Public Health, and Policy: A California Case Study." *American Journal of Public Health* 108(sup2): S114–S119. <https://doi.org/10.2105/AJPH.2017.304047>.
- Garcia, Karen. 2025. "Immigration Raids Have Shaken Communities Across Los Angeles County. How Can You Help?" *Los Angeles Times*, June 11. <https://www.latimes.com/california/story/2025-06-11/immigration-raids-have-shaken-communities-across-los-angeles-county-how-can-you-help>.
- Geiger, Jessica, Leo Goldsmith, and Michael Méndez. 2023. *Amplified Harm: LGBTQ+ Disaster Displacement*. December. Claremont Graduate University; Yale University; and University of California, Irvine. https://socialecology.uci.edu/sites/default/files/users/mkcruz/amplified_harm_-_lgbtq_disaster_displacement_12.7.23.pdf.
- Gero, Anna, Kirstie Méheux, and Dale Dominey-Howes. 2011. "Integrating Community Based Disaster Risk Reduction and Climate Change Adaptation: Examples from the Pacific." *Natural Hazards and Earth System Sciences* 11(1): 101–13. <https://doi.org/10.5194/nhess-11-101-2011>.
- Glaser, Barney, and Anselm Strauss. 1999. *Discovery of Grounded Theory: Strategies for Qualitative Research*. Routledge.
- Goldsmith, Leo, Vanessa Raditz, and Michael Méndez. 2022. "Queer and Present Danger: Understanding the Disparate Impacts of Disasters on LGBTQ+ Communities." *Disasters* 46(4): 946–73. <https://doi.org/10.1111/disa.12509>.
- Gooding, Claude Ivan. 2012. "Organizational Mission and the Phenomenon of Mission Drift/Creep: A Perspective from the Nonprofit Sector." PhD diss., University of Maryland Global Campus.
- Green Cross Academy of Traumatology. 2024. "What Is the Green Cross?" Accessed July 7, 2024. <https://greencross.org/about-gc/>.
- Guberek, Tamy, Allison McDonald, Sylvia Simioni, Abraham H. Mhaidli, Kentaro Toyama, and Florian Schaub. 2018. "Keeping a Low Profile? Technology, Risk and Privacy Among Undocumented Immigrants." In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery. <https://dl.acm.org/doi/10.1145/3173574.3173688>.
- Guhlincozzi, Aída R. 2023. "'It's Better If You Have More Hands!': Latina Healthcare Access Barriers and Community Organization Interventions in Chicago Suburbs." *Geoforum* 146: 103863. <https://doi.org/10.1016/j.geoforum.2023.103863>.
- Hanigan, Ivan C., Colin D. Butler, Philip N. Kokic, and Michael F. Hutchinson. 2012. "Suicide and Drought in New South Wales, Australia, 1970–2007." *Proceedings of the National Academy of Sciences* 109(35): 13950–55. <https://doi.org/10.1073/pnas.1112965109>.
- Hasselman, Lyndal. 2017. "Adaptive Management; Adaptive Co-Management; Adaptive Governance: What's the Difference?" *Australasian Journal of Environmental Management* 24(1): 31–46. <https://doi.org/10.1080/14486563.2016.1251857>.
- Hatfield-Dodds, Steve, Rohan Nelson, and David C. Cook. 2007. "Adaptive Governance: An Introduction and Implications for Public Policy." Paper presented at the 51st Annual Conference of the

- Australian Agricultural and Resource Economics Society, Queenstown, New Zealand, February 13–16. <https://doi.org/10.22004/ag.econ.10440>.
- Headley, Andrea M., Kaila Witkowski, Christa Remington, N. Emel Ganapati, and Santina L. Contreiras. 2023. "Trauma-Informed Organizational Climate and Its Impact on First Responder Burnout During COVID-19." *Public Administration Review* 85(1): 144–64. <https://doi.org/10.1111/puar.13764>.
- Hobbs, L. Ansley, Dima Masoud, Kathleen Cravero, Elisabeth Manipoud Figueroa, and Diana Romero. 2024. "'The Perfect Storm': Community Worker Perspectives on the Impact of COVID-19 on New York City Immigrants and Migrant-Serving Organizations." *Frontiers in Public Health* 12: 1387182. <https://doi.org/10.3389/fpubh.2024.1387182>.
- Holmes, Megan R., C. Robin Rentrop, Amy Korsch-Williams, and Jennifer A. King. 2021. "Impact of COVID-19 Pandemic on Posttraumatic Stress, Grief, Burnout, and Secondary Trauma of Social Workers in the United States." *Clinical Social Work Journal* 49(4): 495–504. <https://doi.org/10.1007/s10615-021-00795-y>.
- Horton, Laura. 2012. "Nowhere to Turn: Obstacles for Immigrants Seeking Government Disaster Assistance." *National Lawyers Guild Review* 69(3): 140–59.
- Huitema, Dave, Erik Mostert, Wouter Egas, Sabine Moellenkamp, Claudia Pahl-Wostl, and Resul Yalcin. 2009. "Adaptive Water Governance: Assessing the Institutional Prescriptions of Adaptive (Co-)Management from a Governance Perspective and Defining a Research Agenda." *Ecology and Society* 14(1). <https://www.jstor.org/stable/26268026>.
- Ibarra, Ana B. 2025. "'Can I Just Be a Kid?' Students Shaken by Immigration Raids Seek Help from School Counselors." *CalMatters*, October 3. <https://calmatters.org/health/mental-health/2025/10/immigration-raids-kids-mental-health/>.
- Jach, Elizabeth A., and Cynthia N. Carvajal. 2023. "Evaluating the Effectiveness of UndocuAlly Trainings: A Case Example in the State of New York." *New Directions for Higher Education* 2023(203): 109–23. <https://doi.org/10.1002/he.20477>.
- Jacobs, Fayola. 2019. "Black Feminism and Radical Planning: New Directions for Disaster Planning Research." *Planning Theory* 18(1): 24–39. <https://doi.org/10.1177/1473095218763221>.
- Jay, Alexa K., Allison R. Crimmins, Christopher W. Avery, et al. 2023. "Overview: Understanding Risks, Impacts, and Responses." In *Fifth National Climate Assessment*, edited by Allison R. Crimmins, Christopher W. Avery, David R. Easterling, Kenneth E. Kunkel, Brooke C. Stewart, and Thomas K. Maycock. U.S. Global Change Research Program. https://secasc.ncsu.edu/wp-content/uploads/sites/178/2025/07/NCA5_Ch1_Overview.pdf.
- Jonker, Kim, and William F. Meehan III. 2008. "Curb-ing Mission Creep." *Stanford Social Innovation Review* 6(1): 60–65. <https://doi.org/10.48558/75BE-MA15>.
- Kime, Sage, Michael Méndez, and Belinda Campos. 2024. *Addressing Disaster Disparities in Migrant Communities: Spring 2024 Workshop*. University of California, Irvine; UCLA Latino Policy and Politics Institute. <https://latino.ucla.edu/wp-content/uploads/2024/03/Undoc-Migrant-Wildfire-and-Disasters-Workshop-proceedings-report-2024.pdf>.
- Kohl-Arenas, Erica. 2015. *The Self-Help Myth: How Philanthropy Fails to Alleviate Poverty*. University of California Press.
- Krauze, León. 2025. "Who Will Rebuild Los Angeles? Immigrants." *Washington Post*, January 9. <https://www.washingtonpost.com/opinions/2025/01/09/los-angeles-reconstruction-immigrants-deportation/>.
- Kuang, Jeanne, and Nicole Foy. 2023. "California Built a Safety Net for Undocumented Immigrants. Now Deficits Could Leave Some Behind." *CalMatters*, July 11. <http://calmatters.org/california-divide/2023/07/undocumented-immigrants-california/>.
- Kung, Winnie W., Xinhua Liu, Emily Goldmann, et al. 2018. "Posttraumatic Stress Disorder in the Short and Medium Term Following the World Trade Center Attack Among Asian Americans." *Journal of Community Psychology* 46(8): 1075–91. <https://doi.org/10.1002/jcop.22092>.
- Lach, Denise, Steve Rayner, and Helen Ingram. 2005. "Taming the Waters: Strategies to Domesticate the Wicked Problems of Water Resource Management." *International Journal of Water* 3(1): 1–17. <https://doi.org/10.1504/IJW.2005.007156>.
- Lerner, Steve. 2010. *Sacrifice Zones: The Front Lines*

- of *Toxic Chemical Exposure in the United States*. MIT Press.
- Lowe, Sarah R., Jessica L. Bonumwezi, Zerbrina Valdespino-Hayden, and Sandro Galea. 2019. "Posttraumatic Stress and Depression in the Aftermath of Environmental Disasters: A Review of Quantitative Studies Published in 2018." *Current Environmental Health Reports* 6(4): 344–60. <https://doi.org/10.1007/s40572-019-00245-5>.
- Lu, Jiahuan. 2018. "Organizational Antecedents of Nonprofit Engagement in Policy Advocacy: A Meta-Analytical Review." *Nonprofit and Voluntary Sector Quarterly* 47(sup4): S177–S203. <https://doi.org/10.1177/0899764018769169>.
- Marchand, Vincent D. 2019. "Firefighters: Peer Support." Office of Senate Floor Analyses. Senate Rules Committee for the California State Senate.
- Marcus, Josh. 2025. "ICE Arrests California Father and Leaves His Children Behind in Car: Witness." *Independent*, May 15. <https://www.the-independent.com/news/world/americas/ice-oxnard-california-gas-station-b2748547.html>.
- Martinez-Damia, Sara, Daniela Marzana, Virginia Paloma, and Elena Marta. 2024. "The Mediating Role of Migrant Community-Based Organizations: Challenges and Coping Strategies." *Voluntas: International Journal of Voluntary and Nonprofit Organizations* 35(1): 85–96. <https://doi.org/10.1007/s11266-023-00572-0>.
- Mathias, John, Desirée D. Burns, Ellen Piekalkiewicz, Juyeong Choi, and Giselle Feliciano. 2022. "Roles of Nonprofits in Disaster Response and Recovery: Adaptations to Shifting Disaster Patterns in the Context of Climate Change." *Natural Hazards Review* 23(3): 04022011. [https://doi.org/10.1061/\(ASCE\)NH.1527-6996.0000559](https://doi.org/10.1061/(ASCE)NH.1527-6996.0000559).
- McGinnis, Michael D., and Elinor Ostrom. 2014. "Social-Ecological System Framework: Initial Changes and Continuing Challenges." *Ecology and Society* 19(2): 30. <https://doi.org/10.5751/ES-06387-190230>.
- Medwinter, Sancha Doxilly. 2023. *Ecologies of Inequality: How Disaster Response Reconstitutes Race and Class Inequality*. University of Georgia Press.
- Méndez, Michael. 2020. *Climate Change from the Streets: How Conflict and Collaboration Strengthen the Environmental Justice Movement*. Yale University Press.
- Méndez, Michael. 2022. "The Reflective Practitioner in the Context of Racial and Environmental Justice." *Planning Theory & Practice* 23(3): 425–58. <https://doi.org/10.1080/14649357.2022.2082710>.
- Méndez, Michael, Genevieve Flores-Haro, and Lucas Zucker. 2020. "The (In)Visible Victims of Disaster: Understanding the Vulnerability of Undocumented Latino/a and Indigenous Immigrants." *Geoforum* 116: 50–62. <https://doi.org/10.1016/j.geoforum.2020.07.007>.
- Méndez, Michael, Manuel Pastor, and Angelu C. Lesaca. 2024. "Climate Change, Migration, and Health Disparities at and Beyond the US-Mexico Border." *JAMA* 331(8): 696–97. <https://doi.org/10.1001/jama.2024.0228>.
- Méndez-Barrientos, Linda E., Amanda L. Fencel, Cassandra L. Workman, and Sameer H. Shah. 2023. "Race, Citizenship, and Belonging in the Pursuit of Water and Climate Justice in California." *Environment and Planning E: Nature and Space* 6(3): 1614–35. <https://doi.org/10.1177/25148486221133282>.
- Migration Policy Institute. n.d. "Profile of the Unauthorized Population: California." Migration Policy Institute. Accessed January 7, 2025. <https://www.migrationpolicy.org/data/unauthorized-immigrant-population/state/CA>.
- Miller, Annie, Maren B. Trochmann, and Ida Drury. 2022. "Trauma-Informed Public Management: A Step Toward Addressing Hidden Inequalities and Improving Employee Wellbeing." *Public Administration Quarterly* 46(3): 238–57. <https://doi.org/10.37808/paq.46.3.3>.
- Milliken, Frances J. 1990. "Perceiving and Interpreting Environmental Change: An Examination of College Administrators' Interpretation of Changing Demographics." *Academy of Management Journal* 33(1): 42–63.
- Mitchell, George E. 2014. "Strategic Responses to Resource Dependence Among Transnational NGOs Registered in the United States." *Voluntas: International Journal of Voluntary and Nonprofit Organizations* 25(1): 67–91. <https://doi.org/10.1007/s11266-012-9329-2>.
- Mixteco Indígena Community Organizing Project (MICOP). 2024. "Who Is California's Indigenous Migrant Community?" Mixteco Indígena Community Organizing Project. Accessed June 12, 2024. <https://mixteco.org/mixtec/>.
- Moore, Mark H. 2000. "Managing for Value: Organizational Strategy in for-Profit, Nonprofit, and Governmental Organizations." *Nonprofit and Vol-*

- untary Sector Quarterly 29(sup1): 183–204.
<https://doi.org/10.1177/0899764000291S009>.
- Nanda, Anupam. 2024. “Climate Change and Housing.” In *The Routledge Handbook of Housing Economics*, edited by Kenneth Gibb, Chris Leishman, Alex Marsh, Geoffrey Meen, Rachel Ong ViforJ, and Craig Watkins. Routledge.
- Nikkanen, Maija, Aleks Räsänen, and Sirkku Juhola. 2024. “Adaptive Governance of Disaster Preparedness? The Case of Regional Networks in Finland.” *International Journal of Disaster Risk Reduction* 108: 104549. <https://doi.org/10.1016/j.ijdr.2024.104549>.
- Norris, Fran H., Matthew J. Friedman, Patricia J. Watson, Christopher M. Byrne, Eolia Diaz, and Krzysztof Kaniasty. 2002. “60,000 Disaster Victims Speak: Part I. An Empirical Review of the Empirical Literature, 1981–2001.” *Psychiatry* 65(3): 207–39. <https://doi.org/10.1521/psyc.65.3.207.20173>.
- Office of Senator Steve Padilla. 2024. “Governor Newsom Signs Senator Padilla’s Farmworker Protection Legislation Expanding Sick Leave for Climate-Fueled Hazardous Environmental Conditions.” Senate District 18. September 24. <https://sd18.senate.ca.gov/news/governor-newsom-signs-senator-padillas-farmworker-protection-legislation-expanding-sick-leave>.
- Padhy, Susanta Kumar, Sidharth Sarkar, Mahima Panigrahi, and Surender Paul. 2015. “Mental Health Effects of Climate Change.” *Indian Journal of Occupational and Environmental Medicine* 19(1): 3–7.
- Padilla-Frausto, Imelda, Nicole Pereira, Ángela Gutiérrez, and Sean Tan. 2023. “Immigrants in California Have Increased Psychological Distress and High Rates of Unmet Need for Mental Health Care.” December 18. UCLA Center for Health Policy Research. <https://healthpolicy.ucla.edu/our-work/publications/immigrants-california-have-increased-psychological-distress-and-high-rates-unmet-need-mental-health>.
- Pahl-Wostl, Claudia, Marc Craps, Art Dewulf, Erik Mostert, David Tabara, and Tharsi Taillieu. 2007. “Social Learning and Water Resources Management.” *Ecology and Society* 12(2): 5. <https://doi.org/10.5751/ES-02037-120205>.
- Pahl-Wostl, Claudia, and Matt Hare. 2004. “Processes of Social Learning in Integrated Resources Management.” *Journal of Community & Applied Social Psychology* 14(3): 193–206. <https://doi.org/10.1002/casp.774>.
- Palmer, Margaret A. 2022. “What Is a Socio-Environmental System?” National Socio-Environmental Synthesis Center. July 8. <https://www.sesync.org/resources/what-socio-environmental-system>.
- Parthasarathy, Devanathan. 2015. “Informality, Resilience, and the Political Implications of Disaster Governance.” *Pacific Affairs* 88(3): 551–75. <https://doi.org/10.5509/2015883551>.
- Parthasarathy, Devanathan. 2018. “Inequality, Uncertainty, and Vulnerability: Rethinking Governance from a Disaster Justice Perspective.” *Environment and Planning E: Nature and Space* 1(3): 422–42. <https://doi.org/10.1177/2514848618802554>.
- Passel, Jeffrey S., and Jens Manuel Krogstad. 2024. “What We Know About Unauthorized Immigrants Living in the U.S.” Pew Research Center. July 22. <https://www.pewresearch.org/short-reads/2024/07/22/what-we-know-about-unauthorized-immigrants-living-in-the-us/>.
- Pastor, Manuel, J. Mijin Cha, Michael Méndez, and Rachel Morello-Frosch. 2024. “California Dreaming: Why Environmental Justice Is Integral to the Success of Climate Change Policy.” *Proceedings of the National Academy of Sciences* 121(32): e2310073121. <https://doi.org/10.1073/pnas.2310073121>.
- Paveglio, Travis B., Matthew S. Carroll, Amanda M. Stasiewicz, Daniel R. Williams, and Dennis R. Becker. 2018. “Incorporating Social Diversity into Wildfire Management: Proposing ‘Pathways’ for Fire Adaptation.” *Forest Science* 64(5): 515–32. <https://doi.org/10.1093/forsci/fxy005>.
- Perez, Nate. 2024. “Undocumented People Are Among Most Vulnerable to Climate-Fueled Disasters.” NPR. December 23. <https://www.npr.org/2024/12/23/nx-s1-5172489/hurricanes-climate-change-undocumented-extreme-weather>.
- Perez, Nate. 2025. “Farmworkers Feed the Country, but Who Protects Them from Wildfire Smoke?” NPR. February 3. <https://www.npr.org/2025/01/31/nx-s1-5276397/wildfires-and-outdoor-workers>.
- Rivera, Roberto. n.d. *It Takes a Village – Introducing the Latino Engagement Team*. American Red Cross. Accessed January 5, 2025. <https://redcrossblognccr.org/wp-content/uploads/2020/09/it-takes-a-village.pdf>.

- Rivera-Batz, Francisco L. 1999. "Undocumented Workers in the Labor Market: An Analysis of the Earnings of Legal and Illegal Mexican Immigrants in the United States." *Journal of Population Economics* 12(1): 91–116. <https://doi.org/10.1007/s001480050092>.
- Rivero, Nicolás. 2024. "For These North Carolina Families, Disaster Aid May Never Come." *Washington Post*, October 17. <https://www.washingtonpost.com/climate-environment/2024/10/17/hurricane-helene-latinos-north-carolina/>.
- Rosales, Rocio. 2020. *Fruteros: Street Vending, Illegality, and Ethnic Community in Los Angeles*. University of California Press.
- Rosenthal, Annie, Eric Stover, and Rohini J. Haar. 2021. "Health and Social Impacts of California Wildfires and the Deficiencies in Current Recovery Resources: An Exploratory Qualitative Study of Systems-Level Issues." *PLOS One* 16(3): e0248617. <https://doi.org/10.1371/journal.pone.0248617>.
- Roth, Benjamin J., and Breanne Grace. 2018. "Structural Barriers to Inclusion in a Latino Immigrant New Destination: Exploring the Adaptive Strategies of Social Service Organizations in South Carolina." *Journal of International Migration and Integration* 19(4): 1075–93. <https://doi.org/10.1007/s12134-018-0587-8>.
- Sabino Recovery. 2023. "What Is the Difference Between Vicarious Trauma and Secondary Trauma?" Sabino Recovery. July 13. <https://www.sabinorecovery.com/what-is-the-difference-between-vicarious-trauma-and-secondary-trauma/>.
- Saldaña, Johnny. 2014. "Coding and Analysis Strategies." In *The Oxford Handbook of Qualitative Research*, edited by Patricia Leavy. Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199811755.013.001>.
- Sanchez De Alba, Victoria. 2022. "The First-Ever UndocuFund Summit Hosted by 805 UndocuFund, UndocuFund, and Latino Community Foundation, Calling for Equitable Disaster Relief." *Business Wire*. September 16, 2022. <https://www.businesswire.com/news/home/20220916005016/en/The-First-Ever-UndocuFund-Summit-hosted-by-805-UndocuFund-UndocuFund-and-Latino-Community-Foundation-Calling-for-Equitable-Disaster-Relief>.
- Schuster, Sarah. 2023. "The 4 Trauma Responses: Fight, Flight, Freeze, and Fawn." *Health*, October 17.
- Shonkoff, Seth B., Rachel Morello-Frosch, Manuel Pastor, and James Sadd. 2011. "The Climate Gap: Environmental Health and Equity Implications of Climate Change and Mitigation Policies in California—a Review of the Literature." *Climatic Change* 109(1): 485–503. <https://doi.org/10.1007/s10584-011-0310-7>.
- Silveira, Sarita, Mariah Kornbluh, Mathew C. Withers, Gillian Grennan, Veerabhadran Ramanathan, and Jyoti Mishra. 2021. "Chronic Mental Health Sequelae of Climate Change Extremes: A Case Study of the Deadliest Californian Wildfire." *International Journal of Environmental Research and Public Health* 18(4): 1487. <https://doi.org/10.3390/ijerph18041487>.
- Simo, Gloria, and Angela L. Bies. 2007. "The Role of Nonprofits in Disaster Response: An Expanded Model of Cross-Sector Collaboration." *Public Administration Review* 67(sup1): 125–42. <https://doi.org/10.1111/j.1540-6210.2007.00821.x>.
- Singh, Sapam Ranabir, Mohammad Reza Eghdami, and Sarbjeet Singh. 2014. "The Concept of Social Vulnerability: A Review from Disasters Perspectives." *International Journal of Interdisciplinary and Multidisciplinary Studies* 1(6): 71–82.
- Sledge, Matt. 2024. "Advocates for Immigrants Ask: What FEMA Cash?!" *Intercept*. October 9. <https://theintercept.com/2024/10/09/hurricane-milton-immigrants-fema/>.
- Smith, Genee S., Erica Anjum, Chantel Francis, Lauren Deanes, and Charisma Acey. 2022. "Climate Change, Environmental Disasters, and Health Inequities: The Underlying Role of Structural Inequalities." *Current Environmental Health Reports* 9(1): 80–89. <https://doi.org/10.1007/s40572-022-00336-w>.
- Smith, Rebecca, Amy Sugimori, and Luna Yasui. 2003. "Low Pay, High Risk: State Models for Advancing Immigrant Workers' Rights Colloquium: The Border Crossed US: Current Issues in Immigrant Labor." *NYU Review of Law & Social Change* 28(3–4): 597–654.
- Sorrell-Medina, Zayda. 2023. "Citizenry Exclusion Theory: Understanding Why Immigrant-Serving Nonprofits Emerge." *Ethnic and Racial Studies* 47(10): 2174–95. <https://doi.org/10.1080/01419870.2023.2259448>.
- Southern, Kyle G. 2016. "Institutionalizing Support Services for Undocumented Students at Four-

- Year Colleges and Universities." *Journal of Student Affairs Research and Practice* 53(3): 305–18. <https://doi.org/10.1080/19496591.2016.1143832>.
- Spade, Dean. 2020. "Solidarity Not Charity: Mutual Aid for Mobilization and Survival." *Social Text* 38(1): 131–51. <https://doi.org/10.1215/01642472-7971139>.
- State of California. 2017. *California Values Act* (Senate Bill 54), Chapter 495, Statutes of 2017. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB54.
- State of California. 2019. *California Firefighter Peer Support and Crisis Referral Services Act* (Assembly Bill 1116), Chapter 424, Statutes of 2019. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201920200AB1116.
- Stephan, Mark, Graham Marshall, and Michael McGinnis. 2019. "An Introduction to Polycentricity and Governance." In *Governing Complexity: Analyzing and Applying Polycentricity*, edited by Andreas Thiel, William A. Blomquist, and Dustin E. Garrick. Cambridge University Press.
- Stough, Laura M., Edgar Villarreal, and Linda G. Castillo. 2010. "Disaster and Social Vulnerability: The Case of Undocumented Mexican Migrant Workers." In *How Ethnically Marginalized Americans Cope with Catastrophic Disasters. Studies in Suffering and Resiliency*, edited by Jason D. Rivera and Demond S. Miller. Edwin Mellen Press.
- Suddaby, Roy. 2006. "From the Editors: What Grounded Theory Is Not." *Academy of Management Journal* 49(4): 633–42. <https://doi.org/10.5465/amj.2006.22083020>.
- Termeer, Catrien J.A.M., Art Dewulf, and Maartje van Lieshout. 2010. "Disentangling Scale Approaches in Governance Research: Comparing Monocentric, Multilevel, and Adaptive Governance." *Ecology and Society* 15(4): 29. <https://www.jstor.org/stable/26268216>.
- The Children's Partnership. 2022. *A Child Is a Child: Children in Immigrant Families Health Fact Sheet*. June. The Children's Partnership. https://childrenspartnership.org/wp-content/uploads/2022/06/ACHildIsaChild_Children-in-Immigrant-Families-2022-FINAL.pdf.
- Todd, Nathan R., and Nicole E. Allen. 2011. "Religious Congregations as Mediating Structures for Social Justice: A Multilevel Examination." *American Journal of Community Psychology* 48(3–4): 222–37. <https://doi.org/10.1007/s10464-010-9388-8>.
- Trentin, Monica, Elena Rubini, Awsan Bahattab, et al. 2023. "Vulnerability of Migrant Women During Disasters: A Scoping Review of the Literature." *International Journal for Equity in Health* 22(1): 135. <https://doi.org/10.1186/s12939-023-01951-1>.
- Trombley, Janna, Stephanie Chalupka, and Laura Anderko. 2017. "Climate Change and Mental Health." *American Journal of Nursing* 117(4): 44–52. <https://doi.org/10.1097/01.NAJ.0000515232.51795.fa>.
- Tullberg, Erika, and Georgia Boothe. 2019. "Taking an Organizational Approach to Addressing Secondary Trauma in Child Welfare Settings." *Journal of Public Child Welfare* 13(3): 345–67. <https://doi.org/10.1080/15548732.2019.1612498>.
- University of Kentucky College of Social Work. 2021. "Compassion Fatigue in Social Work: Causes, Prevention, and Treatment." Last modified November 12, 2021. University of Kansas College of Social Work. <https://socialworkonline.uky.edu/resources/article/compassion-fatigue-social-work/>.
- US Department of Homeland Security. 2017. "ICE Deploys Over 200 Personnel to Assist with Hurricane Harvey Rescue Efforts: Homeland Security." Last modified April 10, 2025. <https://www.dhs.gov/blog/2017/09/05/ice-deploys-over-200-personnel-assist-hurricane-harvey-rescue-efforts>.
- US Department of Homeland Security. 2025. "Statement from DHS Spokesperson on Directives Expanding Law Enforcement and Ending Abuse." January 21, 2025. <https://www.dhs.gov/news/2025/01/21/statement-dhs-spokesperson-directives-expanding-law-enforcement-and-ending-abuse>.
- US Immigration and Customs Enforcement. 2016. "ICE HSI Los Angeles Rapid Response Team Trains in Preparation for Danger." Last modified November 18, 2024. <https://www.ice.gov/news/releases/ice-hsi-los-angeles-rapid-response-team-trains-preparation-danger>.
- US Immigration and Customs Enforcement. 2022. "ICE Joins Rescue and Response Efforts for 3 Major Hurricanes." Last modified January 7, 2026. <https://www.ice.gov/features/hurricane-response>.
- van Assche, Kristof, Vladislav Valentinov, and Gert Verschraegen. 2021. "Adaptive Governance: Learning from What Organizations Do and Man-

- aging the Role They Play." *Kybernetes* 51(5): 1738–58. <https://doi.org/10.1108/K-11-2020-0759>.
- Vargus Bustamante, Arturo, Lucía Félix Beltrán, Nangha N. Cuadros, Xian Lun Zeng, and Silvia R. González. 2023. *Implementation Lessons from the 2022 Medi-Cal Expansion to Undocumented Adults Aged Fifty and Above*. July 13. UCLA Latino Policy & Politics Institute. <https://latino.ucla.edu/research/lessons-2022-adult-medical-expansion/>.
- Verba, Sidney, Kay Lehman Schlozman, and Henry E. Brady. 1995. *Voice and Equality: Civic Voluntarism in American Politics*. Harvard University Press.
- Vickery, Jamie. 2018. "Using an Intersectional Approach to Advance Understanding of Homeless Persons' Vulnerability to Disaster." *Environmental Sociology* 4(1): 136–47. <https://doi.org/10.1080/23251042.2017.1408549>.
- Vilá, Olivia, Bethany Cutts, Whitney Knollenberg, and Louie Rivers. 2023. "Environmental Justice in Disaster Recovery: Recognition of the Latinx Community by Nonprofit Leaders." *Climate Risk Management* 40: 100502. <https://doi.org/10.1016/j.crm.2023.100502>.
- Vins, Holly, Jesse Bell, Shubhayu Saha, and Jeremy J. Hess. 2015. "The Mental Health Outcomes of Drought: A Systematic Review and Causal Process Diagram." *International Journal of Environmental Research and Public Health* 12(10): 13251–75. <https://doi.org/10.3390/ijerph121013251>.
- Walker, Heidi M., Maureen G. Reed, and Amber J. Fletcher. 2021. "Applying Intersectionality to Climate Hazards: A Theoretically Informed Study of Wildfire in Northern Saskatchewan." *Climate Policy* 21(2): 171–85. <https://doi.org/10.1080/14693062.2020.1824892>.
- Weber, Lynn, and DeAnne K. Hilfinger Messias. 2012. "Mississippi Front-Line Recovery Work After Hurricane Katrina: An Analysis of the Intersections of Gender, Race, and Class in Advocacy, Power Relations, and Health." *Social Science & Medicine* 74(11): 1833–41. <https://doi.org/10.1016/j.socscimed.2011.08.034>.
- Wilson, Robyn S., Michael A. Méndez, Edward Maibach, and Gabrielle Wong-Parodi. 2022. *Engaging Socially Vulnerable Communities and Communicating About Climate Change-Related Risks and Hazards*. September. National Academies of Sciences, Engineering, and Medicine.
- Wurtz, Heather M., Tara F. Abularrage, Anna-Michelle Marie McSorley, Stephanie J. Rameau, and Goleen Samari. 2024. "'We've Reimagined the Way We Serve': Strategies of Community-Based Organizations in New York City to Support Immigrant Women During and After COVID-19." *Health Equity* 8(1): 96–104. <https://doi.org/10.1089/heq.2023.0178>.
- Yanow, Dvora, and Peregrine Schwartz-Shea. 2014. "Doing Social Science in a Humanistic Manner." In *Interpretation and Method: Empirical Research Methods and the Interpretive Turn*, 2nd ed., edited by Dvora Yanow, and Peregrine Schwartz-Shea. Routledge.
- Zuñiga, Michelle E., and Michael Méndez. 2023. "The Emergence of Environmental Justice in General Plans: Lessons from California's Senate Bill 1000." *Urban Affairs Review* 60(4): 1123–61. <https://doi.org/10.1177/10780874231175841>.

Navigating the Storm: Natural Disasters and the Policy Process



CADENCE WILLSE

Partisan divides in the legislature threaten efforts to combat climate change in the United States. Natural disasters, such as droughts, hurricanes, floods, and forest fires, may open a “window of opportunity” for elected representatives to take action on environmental legislation (Kingdon 1995). This article applies theories of the policy process to explore the effect of natural disasters on legislative behavior. I employ a panel event study to estimate the causal effect of a Federal Emergency Management Agency (FEMA) declared disaster on voting behavior in the House of Representatives. Major natural disasters change the legislative behavior of Democrats, increasing votes in favor of environmental policy. In contrast, major natural disasters push Republican legislators further to the right on environmental policy. Content analysis of congressional testimony illustrates how policymakers seize policy windows to champion policy and distribute blame. Polarization may lead to policy inaction, which harms vulnerable communities who suffer disproportionately from climate hazards.

Keywords: natural disasters, climate hazards, policy process, focusing events, partisanship, polarization

Natural disasters have increased by a factor of five in the past fifty years, driven in part by climate change (World Meteorological Organization 2021). Climate hazards compound structural inequalities in the United States: approximately one in five counties are both socially vulnerable and highly exposed to natural disasters (US Department of the Treasury 2023). Partisan polarization in the United States legislature has hindered efforts to fight climate change through policy (Aldrich 1995; Desilver

2022). Yet, the unique spatial and temporal challenges of climate change require that members of Congress work together to enact environmental legislation (Lazarus 2023). Natural disasters, such as droughts, hurricanes, floods, and forest fires, may serve as focusing events, opening a “window of opportunity” for legislators to take action on environmental legislation (Kingdon 1995). This article explores the effect of climate hazards on legislators’ environmental policy records: When do natural disasters translate

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into political action? Does partisan identity shape legislative behavior in the wake of a natural disaster?

I put these important questions to an empirical test, pairing quantitative and qualitative data to understand legislative response to disaster. I employ a novel dataset that merges the FEMA declared disaster database with congressional district boundaries and legislative voting records on environmental policy from the League of Conservation Voters National Environmental Scorecard from 2000–2022. Using a panel event study design, I estimate the causal effect of a FEMA-declared disaster in a congressional district on voting behavior in the House of Representatives. Next, I review speeches from the Congressional Record of the 117th Congress to understand how legislators discuss natural disasters and environmental policy on the floor of the House of Representatives. Pairing quasi-experimental and content analysis helps illustrate the impact of natural disasters on legislative behavior and the mechanisms by which legislators relate policy problems to their preferred policy solutions.

In the United States, elected representatives' voting records reflect deep partisan polarization on environmental legislation to address climate change (Bromley-Trujillo et al. 2019; Rode et al. 2021). When a congressional district experiences a large natural disaster, Democratic legislators may become more progressive on environmental policy issues. In contrast, Republican lawmakers are either unresponsive or grow more conservative after a natural disaster in their district. Content analysis of speeches on the floor of the House of Representatives demonstrates how legislators connect the problem of natural disasters to their preferred policy solutions. Democratic legislators often attribute natural disasters to climate change, pushing for pro-environmental legislation, ranging from land conservation, climate mitigation strategies, to green infrastructure. In contrast, many Republican legislators blame the bureaucracy, the legislative branch, or the executive branch for slowing down disaster recovery, arguing for less federal involvement. While natural disasters have the potential to generate consensus on environmental policy issues, members of Congress are sharply divided in their response.

A divided legislature is unable to tackle the climate crisis, and there is a high cost to policy inaction. Climate hazards amplify race- and income-based structural inequalities in the United States (Besbris et al. 2026, this issue). As articles in this issue detail, the social, political, and economic costs of climate hazards often accrue to the most vulnerable: children are negatively impacted by the effect of chronic school closures (McDaniel 2026, this issue), undocumented communities and the organizations that represent them increasingly focus on disaster aid (Valencia-Urbe et al. 2026, this issue), and Black and Latinx workers disproportionately suffer from harms to local economies (Francis and Horn 2026, this issue). While politicians may support targeted policies to help low-income residents (Mullin 2026, this issue), existing policies inequitably distribute costs and benefits (Hadden and Prakash 2024). Comprehensive, federal environmental policy is necessary to remedy the deep inequalities wrought by climate hazards.

FOCUSING EVENTS AND THE POLICY PROCESS

Thomas A. Birkland's (1997, 1998) work on focusing events provides an important theoretical frame to understand how natural disasters impact the policy process. Focusing events are "sudden, relatively rare," inflicting harms "... concentrated on a definable geographical area or community of interest, and that is known to policymakers and the public virtually simultaneously" (Birkland, 1997, 22). Focusing events "capture in a nutshell some sort of reality that people already sense in a vaguer, more diffuse way," (Kingdon 1995, 103) bringing attention to a policy problem. Existing research defines natural disasters as focusing events to understand their impact on policy (Arceneaux and Stein 2006; Birkland 1997, 1998; Birkland and Warne ment 2013; DeLeo et al. 2021; O'Donovan 2017; Zelin and Smith 2023). While scientists have noted that natural disasters are increasing as a result of climate change, natural disasters remain relatively rare. Harms from natural disasters generally accrue quickly to a specific geographic area or community, focusing public attention "suddenly and rapidly" (Birkland 1998, 54). Natural disasters are often described as "acts

of God,” creating a “causal story” that makes it difficult to blame a single political entity (Stone 2007).

The term “focusing event” first appears in John W. Kingdon’s *Agendas, Alternatives, and Public Policy* (1984; 1995) introducing the multiple streams approach. The three streams that lead to policy change include problems, policy, and politics. First, policy actors must recognize that there is an existing problem. Next, policy alternatives must be generated to address the problem, including input from a wide range of actors such as scientists, bureaucratic agencies, and elected representatives (Kingdon 1984, 200). The politics stream includes partisan composition of government, preferences of interest groups, and public opinion. Problems, policy and politics streams converge to form a “policy window,” or opportunity for policy change. Focusing events may bring the problems, policy, and politics streams together through “a crisis or disaster that comes along to call attention to the problem” (Kingdon 1984, 100). Policymakers have the opportunity to seize the policy window, leveraging attention to the problem and offering a policy solution. However, policymakers must remain attentive to the parties’ positions and the “mood” of their constituents (Cairney and Zahariadis 2016).¹

Climate hazards may create the conditions for political change (Pelling and Dill 2006). Damages in the wake of natural disasters provide a powerful symbol of the impact of climate hazards for members of Congress and their constituents (Weber 2016). Alternatively, disasters can mobilize the public by pushing “event-relevant issues to the top of the public agenda and provok[ing] shifts in public opinion” (Reny and Newman 2021, 1499). Constitu-

ents may pressure legislators to reflect their new positions (Barberá et al. 2019; Unsworth and Fielding 2014). Voters may hold elected leaders accountable for the aftermath of natural disasters (Albrecht 2017), especially if they believe that government is responsible for disaster preparation (Arceneaux and Stein 2006). Finally, disasters may shift the policy agenda (Sabatier and Weible 2014), pushing representatives to join pro-environmental advocacy coalitions.

Focusing events act as triggers for agenda setting, policy change, and issue entrepreneurship (Birkland 1998; Jones et al. 1993; Reny and Newman 2021). They also widen the scope of conflict (Schattschneider 1975), bringing new perspectives to the debate through agenda setting. This may occur through institutional avenues, such as congressional testimony (Birkland 1998) or media coverage (Best 2010). Such events can mobilize policy change through executive or legislative action (Godwin and Schroedel 2000; O’Donovan 2017; Pralle 2009). They may also uncover problems with existing policies, providing an opportunity for policymakers to mitigate risk or reduce inequities (Albright and Crow 2021; Birkland 2006; Heikkila and Gerlak 2013; O’Donovan 2017). Last, focusing events may bring attention to an issue but fail to make substantive policy change. The size and scope of a focusing event shape the policy window and the opportunity for political change.

This article is novel in its approach for several reasons. The dataset measures the impact of natural disasters on legislative voting records over a twenty-two year period. Studying long time periods ensures that broad trends in policymaking activity are considered (Sabatier and

1. Focusing events appear in other theories of the policy process. In punctuated equilibrium theory, Frank R. Baumgartner and Bryan D. Jones (2010) and Bryan D. Jones and colleagues (1993) advance a theory of stability and change in policymaking. Departing from Charles E. Lindblom’s (1959) theory that the policy process is marked by incremental policy change, Baumgartner and Jones note that there are also dramatic policy shifts. Critical junctures, or focusing events, may result in a radical change in policy and a new equilibrium. Focusing events redefine a policy issue, changing the attention the policy issue receives and the policy issue’s institutional venue (Baumgartner and Jones 2010). Focusing events also appear in the advocacy coalition framework, which posits that groups with shared core beliefs coordinate activity to seek policy change (Sabatier 1988). Coalitions engage in policy-oriented learning to adapt to changing political, economic, and social parameters and continue to advocate for their preferred policy goals. Focusing events can undermine coalitions, or provide an avenue for policy change for new coalitions (Cairney 2015).

Jenkins-Smith 1999) and that sufficient numbers of events are analyzed to perform meaningful statistical analyses.² Second, I argue that local focusing events—natural disasters in a congressional district—impact legislative voting records on national environmental policy issues. Existing research focuses on the effects of natural disasters on local policy outcomes (Arceneaux and Stein 2006; Zelin and Smith 2023), or the effects of natural disasters on the volume of green legislation and partisan differences in legislative response (Jud and Nguyen 2024). This article focuses on shifts in behavior among legislators. In an increasingly polarized Congress, small changes in individual legislators' policy positions may have reverberating effects for national policy. Focusing events can have deep impacts outside of their geographic area: local disasters shape legislative behavior, which in turn shapes federal policy. Environmental policy can mitigate or magnify structural inequalities in the United States.

Finally, qualitative data illustrates how legislators talk about natural disasters on the floor of the House. Natural disasters may spur legislators to engage in issue entrepreneurship and pursue policy change through congressional testimony (Birkland 1998). Alternatively, natural disasters may illustrate problems with existing policies (Albright and Crow 2021; Birkland 2006; Heikkilä and Gerlak 2013; O'Donovan 2017): climate hazards may offer an opportunity for members of Congress to link environmental policy to other policy problems, such as segregation and income inequality.

Hypotheses

This article tests four main hypotheses. First, partisanship matters: response to natural di-

sasters varies by party. Second, a major focusing event will result in a more dramatic change in legislative behavior than a minor focusing event. Third, I hypothesize that the window for a natural disaster to influence policy is small: legislators will increase pro-environmental behavior after the disaster, but the effect will fade over time. Finally, I examine speeches in the House of Representatives to illustrate how representatives propose policy solutions for the problem of climate hazards.

In the multiple streams framework, the politics stream includes partisan composition of the legislature and public opinion. Political parties influence legislative behavior and policy outcomes: competition between the parties has created highly polarized legislatures (Aldrich and Battista 2002). Legislative parties are unified by ideological consistency, discipline, and agenda control (Carey 2007). Ideological consistency has increased in the past several decades (Desilver 2022), creating cohesive parties where members have similar preferences. In addition, parties discipline legislators using incentives to reward party loyalty (Cox and McCubbins 2005). Finally, parties exert control over the legislative agenda (Cox et al. 2010). The legislative behavior of members of the House of Representatives is shaped, to a substantial degree, by their party affiliation (Aldrich and Rohde 2000). Republican legislators will not respond to focusing events by embracing environmental policy issues, as it would require deviating from the party platform and their constituents' preferences. However, focusing events may push Democratic legislators to vote in favor of environmental legislation. I hypothesize that Democratic legislators respond to a natural disaster by voting in favor of environ-

2. This article concentrates on an important mechanism for policy change: changes in legislative behavior on environmental policy. On the one hand, this is a limitation of the study. As Cairney and Jones (2016) note, policy windows may yield specific policy solutions or major reforms. I am limited to observing one type of policy solution to the problem of natural disasters—voting on federal environmental legislation. In addition, I focus on one arena of policymaking, the federal legislature, yet there are many other venues where specific policy solutions or major reforms may be proposed to build climate resiliency in affected communities. Federal legislative voting records on environmental policy issues are a “vague” policy solution to the problem of climate hazards, and focusing on federal policy may obscure other policy arenas. On the other hand, this is a critical venue for policy change: the challenges of climate hazards and resiliency are national in scope, and the federal legislature is the most important venue for environmental policy in the United States (Lazarus 2023).

mental policy issues, positively impacting their environmental scorecard.³

- Hypothesis 1, Partisanship: A natural disaster will increase pro-environmental votes if this behavior is consistent with the legislator's party platform.

Classic studies of focusing events argue the more unusual the event, the more power it has to shape policy (Birkland 1997). Kingdon (1995) and others argue that the aggregation of focusing events may also have notable public policy impacts. The process is cumulative: a natural disaster may “consolidate” and reinforce a policy issue that is already garnering attention (Jones et al. 1993; Wood 2006). Research suggests that rare focusing events and an “accumulation of experience” with minor focusing events both promote policy change (O'Donovan 2017, 205). I hypothesize that a catastrophic natural disaster resulting in multiple disaster declarations will have a greater impact on legislative behavior than a single disaster declaration.⁴

- Hypothesis 2, Major Events: A major natural disaster will have a larger impact on legislative behavior on environmental issues than a single disaster declaration.

Third, I examine the duration of the policy window after a focusing event. Kingdon (1995) argues that the “window of opportunity” for policy change closes quickly after a focusing event. Birkland (1996) concurs, suggesting that natural disasters have a brief window to influence policy: they are subject to media and voter attention in the aftermath of the event, but this attention slowly fades. A natural disaster may make the threats of climate change less abstract and more urgent (Weber 2016), forcing elected representatives to immediately respond. I examine a two-year time period before and after the event to understand the durability of changes in legislative behavior.

- Hypothesis 3, Policy Window: A natural disaster will have an immediate, brief impact on legislative behavior on environmental issues.

Parties exert control over the legislative agenda, shaping whether or not members of Congress have an opportunity to vote on environmental legislation (Cox et al. 2010; Aldrich and Rohde 2000). Qualitative data provide insight into how legislators discuss natural disasters in their district on the floor of the House, even if it does not translate into direct political action. Focusing events allow legislators to pursue issue entrepreneurship for their preferred policy solution. Preferred policies depend on their party, their own beliefs, and the “mood” of their constituents (Cairney and Zahariadis 2016). Members of Congress are motivated by reelection and constituency pressures, making them likely to react to focusing events (Birkland 1998; Mayhew 2004). Congressional testimony illustrates how policymakers seize policy windows to champion policy and distribute blame.

- Hypothesis 4, Policy Entrepreneurship: Members of Congress will talk about natural disasters in an entrepreneurial way—by coupling a problem with a solution. Democrats and Republicans will pursue different policy solutions.

In the online appendix, I present additional hypotheses, analyses, and robustness checks. For ideologically moderate partisans, I expect natural disasters to have a positive impact on pro-environmental voting behavior. I expect that members of Congress' response to climate disaster may be tempered by partisanship at the state level. Finally, I expect natural disasters that are more closely associated with climate change to have a greater impact on legislative behavior regarding environmental policy.

3. In the online appendix, the article presents additional analyses on factors that may moderate the influence of partisanship, such as a Representative's ideological position. The online appendix can be found at <https://www.rsfjournal.org/content/12/4/232/tab-supplemental>.

4. In the online appendix, I present additional analysis that examines congressional behavior in disaster-prone districts.

DATA

The article uses a novel dataset that merges the FEMA declared disaster database with legislative voting records from the League of Conservation Voters National Environmental Scorecard from 2000–2022 (Federal Emergency Management Agency 2023; League of Conservation Voters Scorecard 2023). Table 1 presents the data sources for all variables included in the analysis. The outcome of interest is the change in a member of the House of Representatives' legislative scorecard on environmental policy issues.⁵ The League of Conservation Voters and environmental policy experts from twenty organizations score roll-call votes on environmental issues in twelve categories, including air pollution, renewable energy, climate change, fossil fuels, drilling, private and public land conservation, ocean conservation, exposure to toxic chemicals, transportation, clean water and wildlife, and other. Members of Congress are awarded an annual legislative score calculated by dividing the number of “yay” votes for pro-environmental legislation by the total number of possible pro-environmental votes (excluding excused absences). Figure 1 shows the distribution of scores by party on a scale of 0 to 100, depicting wide variation in average legislative scores annually among Democratic and Republican members of the House of Representatives. The graph suggests a time trend across the sample: Democratic legislator scores increased

slightly, while Republican legislator scores decreased. To address this time trend, the model uses year fixed effects.

The independent variable measures whether a congressional district experienced a FEMA-declared disaster by year.⁶ The most common FEMA-declared disasters include fires, floods, hurricanes, severe storms, and ice and snowstorms.⁷ From 2000 to 2022, there were 35,894 county-declared disasters. Large natural disasters can yield numerous declarations: for example, Hurricane Sandy resulted in 559 county disaster declarations. The independent variable is a count of the total disaster declarations per congressional district year (ranging from 0–116, median = 0, $\mu = 1.69$). Most congressional districts experienced at least one disaster declaration during the twenty-two-year time period, and the median number of disaster declarations is 12. There is wide variation in districts' exposure to climate hazards: several districts in California, Illinois, Texas, and Washington had no disaster declarations, while 48 districts experienced over 100 disaster declarations from 2000 to 2022. There are limitations to using FEMA data: defining and measuring disasters are bureaucratic and political decisions.⁸ The executive branch is largely responsible for defining disasters to provide funding for protection, rescue, and recovery (Kousky et al. 2023). Existing research suggests that presidents use this discretionary power: a president facing reelection

5. Examining variation within-legislators' environmental policy voting provides a better test of the impact of focusing events, as it reflects a change in legislative behavior for members of the House of Representatives after a natural disaster. Election cycles and legislative turnover, paired with the rarity of natural disasters, significantly limit the sample size and make it difficult to examine variation within legislative behavior before and after a disaster. Focusing events may impact both within-legislator policy positions and within-district policy positions on environmental legislation. Within-district variation reflects changes in environmental legislative records of the representative(s) of the congressional district before and after a natural disaster. Changes within a congressional district may occur because of partisanship shifts in the electorate (Hunt 2021), redistricting (Mann and Cain 2008) or presidential elections (Golder 2006). Electoral turnover may lead to shifts in the agenda and legislative priorities, raising the status of some problems and solutions in Congress (Pralle 2009).

6. The FEMA Regional Office, in partnership with the federal, state, or tribal government, declares a disaster following an impact assessment for individuals and public facilities in the disaster area.

7. Excluded incidents: Toxic Substances, Terrorists, Other, Human Cause, Fishing Losses, Chemical, Biological.

8. Disaster declarations for climate hazards are a long, and imperfect, process. It starts with a state or tribal request once the disaster exceeds the state's or tribe's capacity to respond. The president must declare an emergency or major disaster in order for the state to qualify for personnel and funding to help impacted communities.

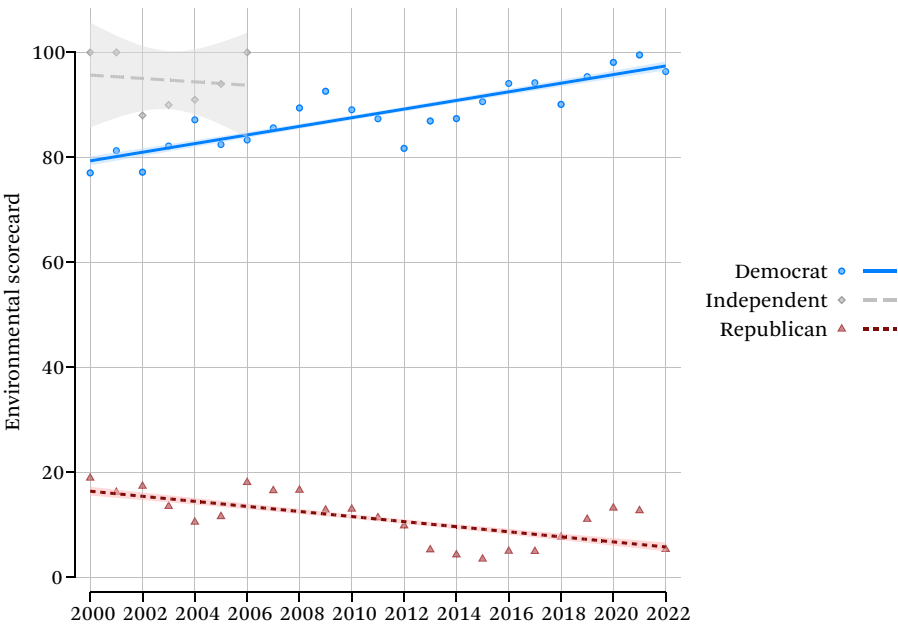
Table 1. Data Sources

Variable	Measurement Metrics	Data Source
FEMA declared disaster	0–111, median = 0, μ = 1.69	FEMA declared disaster database
Major FEMA declared disaster	0–1, median = 0, μ = 0.07	FEMA declared disaster database
Environmental scorecard	0–100, median = 43, μ = 49	The League of Conservation Voters
Partisanship, House of Representatives	D (48.9 percent), R (51.07 percent)	The League of Conservation Voters
Voter partisanship, by district	–44–34, median 0, μ = –1.27	Cook Partisan Index
Presidential administration	Bush, Obama, Trump, Biden	

Source: Data compiled from the Federal Emergency Management Agency Disaster Declarations, the League of Conservation Voters Congressional Scorecard, and The Cook Partisan Voting Index (Federal Emergency Management Agency 2023; The League of Conservation Voters 2023; The Cook Political Report 2023).

Note: D = Democrat. R = Republican.

Figure 1. Distribution of Environmental Scorecard by Party, 2000–2022



Source: Data compiled from the Federal Emergency Management Agency Disaster Declarations, the League of Conservation Voters Congressional Scorecard, and The Cook Partisan Voting Index (Federal Emergency Management Agency 2023; The League of Conservation Voters 2023; The Cook Political Report 2023).

is more likely to grant a disaster declaration, and Democratic presidents award more disaster aid than Republican presidents (Husted and Nickerson 2014). To address this concern, the model includes year fixed-effects and dummy

variables for presidential administrations during the time period.

Shifts in voter partisanship may impact legislative behavior: members of the House of Representatives are responsive to the policy priori-

ties of their constituents (Barberá et al. 2019). I use the Cook Partisan Voting Index to measure congressional district partisanship from 2000 to 2022 (Cook Political Report 2023). This comparative measure examines how strongly a congressional district leans toward the Democratic or Republican Party. One challenge in linking natural disasters to legislative behavior is a mismatch in the unit of analysis: FEMA declares natural disasters by county-year, and counties often overlap congressional district boundaries. To address this issue, I employ Andreas Ferrara and colleagues' (2021) population-based geographic crosswalks for counties and congressional districts from 1990 to 2020.⁹

EMPIRICAL STRATEGY

This article utilizes a mixed-methods empirical strategy to understand legislative behavior after a natural disaster. The quantitative analysis illustrates the effect of a natural disaster on legislative behavior, or policy outcomes. Parties exert control over the legislative agenda, shaping whether or not members of the House have an opportunity to vote on environmental legislation (Cox et al. 2010; Aldrich and Rohde 2000); and the qualitative analysis examines whether legislators couple policy problems (natural disasters) with policy solutions.

Quantitative Analysis

I estimate the causal effect (β) of FEMA-declared disasters on members of the House of Representatives' environmental policy scorecard dur-

ing each legislative year y_{it} . I use linear panel data, where i indexes congressional districts and t indexes years. The outcome y_{it} is the annual environmental score assigned to each member of the House of Representatives by the League for Conservation Voters. The independent variable is either a count variable for the number of FEMA-declared disasters in a congressional district, or a 0/1 binary variable noting a major FEMA-declared disaster in a congressional district.¹⁰ The unit of analysis is within-legislator, or legislator-years: the analysis is restricted to members of the House of Representatives who were in office before, during, and after the natural disaster. The panel method helps to isolate the exogenous impact of FEMA disaster declaration, accounting for time-varying unobservable variables that may be correlated with both the independent and dependent variables.

In implementing an empirical strategy that examines differences before and after an event, the first assumption is that there are two discrete time periods in the sample (Angrist and Pischke 2009; Roth et al. 2023). In this case, the sample is divided into congressional districts before and after FEMA disaster declarations. However, there is heterogeneity in the occurrence of natural disasters—congressional districts experience natural disasters at different points in time. Many congressional districts do not experience any natural disasters during this time period. This article uses a heterogeneity-robust estimator for staggered event time to es-

9. The crosswalk contains weights for mapping counties to the congressional district level using a population model, which uses built-up property counts from Stefan Leyk and colleagues (2020). Andreas Ferrara and colleagues (2021) develop an approach to geographic matching using relative population, accounting for heterogeneities in urbanization within counties. This crosswalk matches counties to congressional districts according to the distribution of the population. Congressional district boundaries change during the time period; therefore, disaster declarations in 2000–2002 are matched to the 1990 congressional district boundaries, 2003–2012 are matched to the 2000 congressional district boundaries, and 2013–2022 are matched to the 2010 congressional district boundaries.

10. While five disaster declarations represent a cutoff in the data for a rare event (only 10 percent of congressional districts experience five or more disaster declarations annually), it is an imperfect measure. Rerunning the analysis at different cutoffs (for example, 1.7 disaster declarations, or 20 percent of the sample) yields very similar results. FEMA aid funding could also serve as a proxy for disaster size, but existing scholarship demonstrates clear issues with this measure. For example, Thomas A. Garrett and Russell S. Sobel (2003) find that disaster relief funding is motivated by politics (congressional representation on the FEMA oversight committee, election year, and partisanship) rather than need. Additional studies highlight racial inequities in FEMA fund distribution (Emrich et al. 2022).

timate causal impacts when the timing of natural disasters varies (Freyaldenhoven et al. 2019; Roth et al. 2023).

The second assumption is that the average outcome among the treatment and comparison groups follows a parallel trend in the absence of the event (Angrist and Pischke 2009; Roth et al. 2023). This assumption requires that members of the House of Representatives express ideological consistency in environmental policy positions, absent experiencing a natural disaster in their district. Empirical research in political science reports ideological consistency among members of Congress (Poole 2007): voting behavior of members of Congress is remarkably stable over time (Lott Jr. and Brotners 1993). Parties exert control over House of Representatives voting records, enforcing ideological consistency (Hager and Talbert 2000). Primary challengers present an exception: incumbents who face extreme ideological primary challengers may adopt more conservative or progressive policy positions (Jewitt and Treul 2019). Absent a natural disaster, existing research suggests that members of the House follow parallel trends in environmental legislative activity.

A third key assumption is that the event has no causal effect before it occurs. Pre-event trends provide evidence against the strict exogeneity of the event in a panel event study (Freyaldenhoven et al. 2019). Natural disasters are often described as “acts of God,” making it unlikely that members of the House of Representatives are anticipating a disaster (Stone 1989; Birkland 1998). The analysis will test for pre-trends to understand whether members of the House of Representatives are changing their voting behavior in anticipation of natural disasters in their congressional district.

Using a panel event study, I compare changes in a member of the House of Representatives voting behavior after experiencing a natural disaster. I estimate the effect of natural disasters on members’ of the House of Representatives

voting behavior during each legislative session, using the *xtevent* Stata package (Freyaldenhoven et al. 2022), where:

$$y_{it} = \alpha_i + \lambda_t + \sum_{k=-2, k \neq -1}^2 \beta_k R_{it}^k + \beta_{-3+} \bar{R}_{it}^{-3+} + \beta_{3+} \bar{R}_{it}^{3+} + \text{PVI}_{it} + \text{PresAdmin}_{it} + \varepsilon_{it}$$

y_{it} represents legislators’ scorecard on environmental policy, at time t in congressional district i . Coefficients α_i and λ_t represent legislator fixed effects and time fixed effects, respectively. The covariates R_{it}^k for $k = -3, \dots, 3$ represent event time dummies that are k years away from a disaster declaration in member’s congressional district i . $\bar{R}_{it}^{-3+}$ and $\bar{R}_{it}^{3+}$ represent that the disaster declaration is at least three years in the future and the past, respectively. The coefficients of interest are β_k , which measures the deviation in the outcome variable k years before and after the natural disaster impacted their congressional district. The k refers to the window around the event to estimate a dynamic effect on the outcome. I use a window of two years, as recovery from natural disasters is often a long process, and congressional districts are likely still implementing recovery plans for years after a natural disaster (Cook et al. 2008).¹¹ Members of the House of Representatives also serve two-year terms. The visualization depicts the six coefficients in the window $(-2, 0, 1, 2)$ and two endpoints $(-3+, 3+)$. The year a disaster strikes is referred to as $k = 0$, and $k = -1$ is the reference period prior to the disaster declaration. The model controls for variation in constituent partisanship by congressional district-year (PVI), and includes dummy variables for presidential administration.

Qualitative Analysis

To illustrate how legislators connect natural disasters to policy, the article analyzes speeches on the floor of the House of Representatives during the 117th congressional session.¹² How do legislators seize policy windows and connect them to their preferred solutions? The research

11. Major disaster recovery rates vary. One of the fastest completion rates for a major disaster was about 3.5 years for Hurricane Sandy, while Hurricanes Ike and Gustav took almost 6 years to recover (Emrich et al. 2022).

12. This sampling framework has advantages and disadvantages. Because the data utilized are discussions on the floor of the House of Representatives, the sample of primary material includes a novel overview of language and policy discussion among members of Congress. Focusing on discussion in Congress allows for rich descrip-

questions drive the data sources consulted and collected (VanGronigen and Meyers 2019): to understand how legislators translate natural disasters into policy problems that require action and resolution, we examine how they frame and discuss disasters on the floor. We focus on congressional records that mention natural disasters in the House of Representatives. This includes records that mention either a natural disaster or a specific weather event ($n = 1,245$).¹³ The unit of analysis is individual speeches or time yielded to a member of Congress. The analysis is limited due to intense polarization in the time period: rhetoric around climate hazards in the 117th Congress will differ starkly from discussions in the House of Representatives a decade earlier. However, analysis of the 117th Congress illustrates how lawmakers translate climate hazards into policy in the current political environment, which is important for scholars, policymakers, and the public advocating for climate hazard mediation policy at the national level.

To summarize vast quantities of text, the article employs content analysis categorization drawn from existing research on focusing events, issue entrepreneurship, and the policy process (Glaser and Laudel 2019). Borrowing from Kingdon's framework (1984; 1995), we reviewed the speeches for two key parts of the policy process: problem definition and policy solutions. Speeches that identified a policy problem mentioned natural disasters in a legislator's district. A key part of problem definition is framing: legislators may discuss natural disasters in the context of climate change, environmental policy, or an alternative policy area. Another important part of problem definition is blame. For example, many legislators blame climate change, while others blame the executive branch for disaster management.

Speeches that mentioned a policy alternative or solution connected the disaster to an action, such as sponsoring a new policy or revising existing legislation. We captured details on the

policy solution, grouping proposed solutions into several categories: sponsoring new policy, advocating for new policy, revising legislation, repealing legislation, appealing to the executive branch, and recognizing the costs of natural disasters. The indicators for problem definition and policy solution were conceptualized as present or not present in a binary variable: for example, if the legislator mentioned a disaster in their legislative district and connected it to legislation on climate change, they received a one for the "problem" indicator and a one for the "policy solution" indicator. The analysis illustrates how members of Congress discuss natural disasters in their district on the floor of the House of Representatives, even if it does not translate into direct political action. Climate hazards allow legislators to pursue issue entrepreneurship, define the problem, and offer their preferred policy solution.

RESULTS

The results for the quantitative analysis are presented graphically. Each event study plots the legislative scorecard on environmental policy on the y-axis, and the time before and after a disaster declaration on the x-axis. The plotted coefficients depict the estimated effect of a single disaster declaration on environmental scorecards, relative to the year before the natural disaster occurs. The bands around each coefficient depict a 95 percent confidence interval. The figures report pre-trend and leveling-off p -values. The pre-trend p -value assesses parallel trends in legislative behavior before a disaster declaration, and the leveling-off p -value assesses whether the estimation window is sufficiently long to capture the dynamic effect of disasters on legislative behavior.

The analysis demonstrates wide variation in Representatives' legislative behavior on environmental policy issues by party. Democrats exhibit legislative behavior that is more "pro"-environment after a natural disaster. In figure 2, panel A, the plotted coefficients can

tion of policy dialogue among elected representatives, or elites. However, we do not observe how members of Congress describe policy to their constituents, or how natural disasters are framed for a larger political audience.

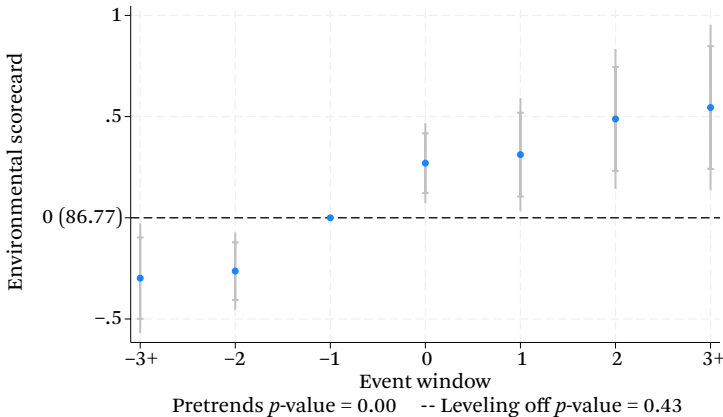
13. Our search parameters include the following keywords: natural disaster, hurricane, fire, flood, ice storm, coastal storm, drought, earthquake, severe ice storm, snowstorm, severe storm, tornado, tsunami, typhoon.

be interpreted as estimated effects for a one-unit change in the disaster declaration variable. For Democrats, time “zero”—the year the disaster strikes—represents a statistically significant increase in pro-environmental legislative behavior from the year prior. Specifically, every FEMA disaster declaration within the congressional district corresponds with a 0.27-point increase in the legislator’s environmental pol-

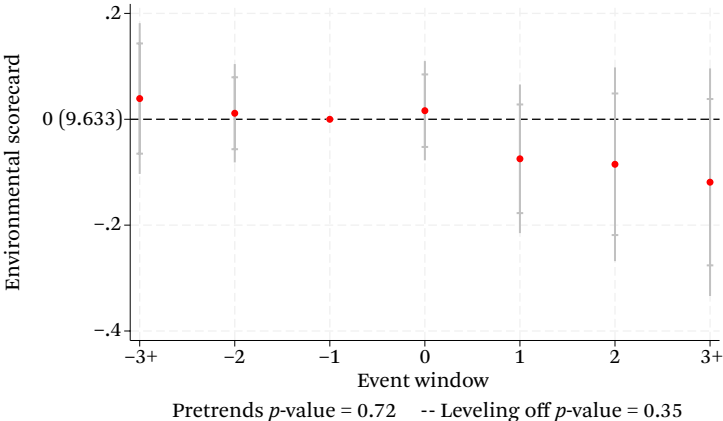
icy score. The effect grows over time, in the years after the event: in year two, members’ score increases by 0.49 points per disaster, and in the years following the disaster members’ score increases by 0.54 points per disaster relative to the year before the disaster. In sum, Democratic members of the House receive higher environmental scores in the period following the event. In contrast, Republican mem-

Figure 2. Results for Panel Event Study Testing Hypothesis 1: Partisanship

Panel A. Environmental Scorecard, Democratic Legislators



Panel B. Environmental Scorecard, Republican Legislators



Source: Data compiled from the Federal Emergency Management Agency Disaster Declarations, the League of Conservation Voters Congressional Scorecard, and The Cook Partisan Voting Index (Federal Emergency Management Agency 2023; The League of Conservation Voters 2023; The Cook Political Report 2023). Author utilized Freyaldenhoven et al. (2022) *xtevent* Stata package for panel event study estimation.

Note: Top panel: Pretrends p -value = 0.00. Leveling off p -value = 0.43. Bottom panel: Pretrends p -value = 0.72. Leveling off p -value = 0.35.

bers of the House engage in anti-environmental legislative behavior after a natural disaster declaration, although the effect is not statistically significant.

Next, I test the hypothesis that major natural disasters impact legislative behavior on environmental issues. I categorize congressional districts as experiencing a major natural disaster if FEMA declared five or more disasters that year (occurring in only 10 percent of the sample). For example, New Orleans was gravely impacted by Hurricane Katrina and Hurricane Rita in 2005, resulting in many declared disasters in Louisiana's Second District. I expect a major FEMA-declared disaster to have a greater impact on legislative behavior for Democratic legislators than a single FEMA-declared disaster. Figure 3 shows the plotted coefficients by party.

Democratic legislators' scores shift after a natural disaster, and the effect grows substantively over time: in the year of the event, Democratic lawmakers' environmental policy scores are 2.5 percentage points higher than their pre-disaster scores, holding all else constant. Major natural disasters substantially impact Republican lawmakers' environmental policy record, as well. In the post-disaster period, Republican legislators receive lower environmental scores (see figure 3, panel B). Again, this effect increases over time: in the year after a disaster, Republican legislators' scores drop by 2.7 percentage points relative to the year prior to the disaster. Three years after the event, Republican lawmakers' environmental policy scores are 4 percentage points lower than their pre-disaster scores, all else equal. Republicans react to major natural disasters by adopting anti-environmental positions.

The third hypothesis examines the policy window created by natural disasters. In interpreting the causal effect of a panel event study, the plot helps to visualize the initial impact of the event, or a jump at time zero when disaster strikes. It can also help visualize the long-term impact of the event on the outcome of interest. I hypothesized that a natural disaster has an immediate, brief window of impact on legislative behavior on environmental issues. Figure 3 presents a different narrative: natural disasters have long-lasting impacts on legislative behav-

ior for both Republican and Democratic lawmakers.

Each model controls for presidential era, to indicate the complicated process of FEMA disaster declarations and the role of the executive branch in agenda-setting. The results indicate polarization between the branches of government: during the Barack Obama administration, Republicans have lower environmental scorecards than during the George W. Bush administration, all else equal (table 2). During the Donald Trump administration, conversely, Republicans have higher environmental scorecards compared to the Bush administration, all else equal. This may reflect policy positions unique to the Trump administration: for example, Trump's decision to withdraw from the Paris climate agreement was met with disapproval across the aisle (Tollefson 2017).

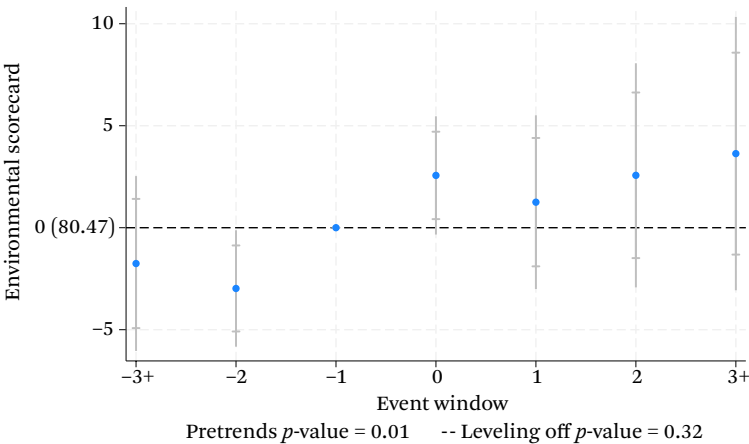
Voter partisanship is an important control variable that may impact legislative behavior. However, the Cook Partisan Voter Index variable is not statistically significant. Controlling for congressional district and year fixed effects likely accounts for time-varying changes in constituent partisanship.

The pre-trend p -value tests the joint significance of the coefficients in the pre-disaster period relative to the baseline year. For Democratic lawmakers, the pre-trend test yields a p -value of 0.00 (model 1) and 0.01 (model 3), which indicates statistically significant differences in trends prior to disaster declarations. We need to use caution when making a causal link between disasters and changes in environmental scorecards for Democratic lawmakers. For Republican lawmakers, the pre-trend test yields a p -value of 0.72 (model 2) and 0.82 (model 4), which indicates that the pre-treatment coefficients are jointly indistinguishable from zero. There is no evidence of differential trends among Republican lawmakers that experienced a disaster prior to the event, supporting the parallel trends assumption. This further suggests a causal link between disasters and legislative behavior for Republicans. For Democrats and Republicans, the leveling-off p -value is not statistically significant, suggesting that the effect of a disaster on voting behavior has stabilized over time.

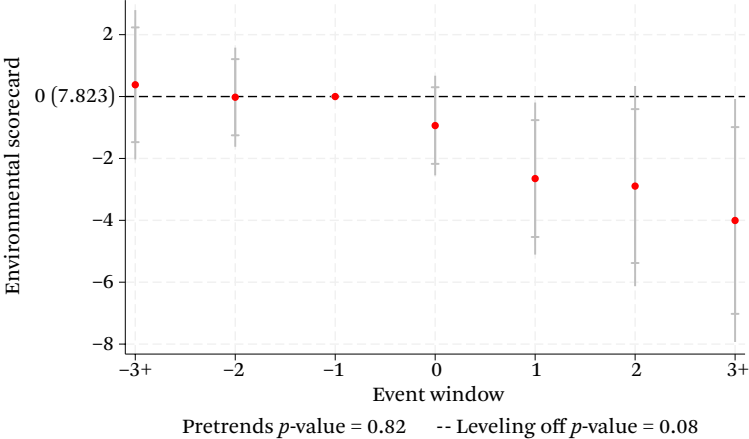
In the online appendix, I present additional

Figure 3. Results for Panel Event Study Testing Hypothesis 2, Major Event

Panel A. Environmental Scorecard, Democratic Legislators



Panel B. Environmental Scorecard, Republican Legislators



Source: Data compiled from the Federal Emergency Management Agency Disaster Declarations, the League of Conservation Voters Congressional Scorecard, and The Cook Partisan Voting Index (Federal Emergency Management Agency 2023; The League of Conservation Voters 2023; The Cook Political Report 2023). Author utilized Freyaldenhoven et al. (2022) *xtevent* Stata package for panel event study estimation.

Note: Top panel: Pretrends p -value = 0.01. Leveling off p -value = 0.32. Bottom panel: Pretrends p -value = 0.82. Leveling off p -value = 0.08.

analyses that examine the relationship between ideology and partisanship in congressional behavior after a disaster: surprisingly, members of Congress whose ideological positions are more moderate (operationalized as in the middle of the distribution of DW-NOMINATE scores) have more partisan responses to natural disasters than Democrats and Republicans overall. I examine whether members of Congress' response to climate disaster is tempered by partisanship

at the state level. In Democratic states, Republicans respond to natural disaster declarations by starkly reducing support for environmental legislation (see online appendix for more details).

The most critical threat to validity is political polarization in environmental policy over the past twenty years. I address this by limiting my analysis to within-legislator behavior. I include year fixed effects to address the impact of frequent reelection cycles. I include presidential

Table 2. Results for panel event study

	Model 1 Democrat, 1+ Disasters	Model 2 Republican, 1+ Disaster	Model 3 Democrat, Major Disaster	Model 4 Republican, Major Disaster
Event Window K-3	-0.298** (0.102)	0.039 (0.053)	-1.755 (1.615)	0.381 (0.945)
Event Window K-2	-0.263*** (0.072)	0.011 (0.035)	-2.979** (1.075)	-0.022 (0.628)
Event Window K 0	0.270*** (0.075)	0.016 (0.035)	2.564* (1.092)	-0.937 (0.631)
Event Window K+1	0.312** (0.105)	-0.075 (0.052)	1.252 (1.605)	-2.651** (0.963)
Event Window K+2	0.488*** (0.131)	-0.085 (0.068)	2.569 (2.070)	-2.894* (1.268)
Event Window K+3	0.545*** (0.155)	-0.119 (0.080)	3.633 (2.524)	-4.005** (1.538)
CVI Partisan Index	0.104 (0.095)	-0.038 (0.086)	0.103 (0.095)	-0.043 (0.086)
Presidential Era: Reference category Bush, 2000-2008				
Obama, 2008-2016	1.631 (1.480)	-6.301*** (1.313)	1.610 (1.490)	-6.414*** (1.316)
Trump, 2016-2020	10.395*** (1.398)	6.379*** (1.440)	10.586*** (1.399)	6.351*** (1.442)
Year fixed effects	Y	Y	Y	Y
Constant	87.109*** (1.561)	11.493*** (1.370)	89.045*** (2.177)	11.565*** (1.531)
Observations	2212	2098	2212	2098

Source: Data compiled from the Federal Emergency Management Agency Disaster Declarations, the League of Conservation Voters Congressional Scorecard, and The Cook Partisan Voting Index (Federal Emergency Management Agency 2023; The League of Conservation Voters 2023; The Cook Political Report 2023).

Note: Standard errors in parentheses. All models include year fixed effects. Estimated using Freyaldenhoven et al. (2022) *xtevent* Stata package for panel event study estimation, which allows estimation in settings with heterogeneous effects by cohort using the interaction weighted estimator of Sun and Abraham. Model 1 corresponds to figure 2, panel A; model 2 corresponds to figure 2, panel B; model 3 corresponds to figure 3, panel A; model 4 corresponds to figure 3, panel B.

* $p < 0.05$

administration fixed effects to address the relationship between the executive and legislative branches, as well as the president's authority over FEMA. The analysis is restricted to estimating changes in legislative behavior annually; more granular data might reveal different patterns in legislative behavior in the days, weeks, or months after a disaster, when lawmakers are facing increased scrutiny and pressure from

their constituents. The mixed methods approach provides insight into the trends in the quantitative analysis.

Policy Entrepreneurship: Content Analysis of the Congressional Record

Speeches on the floor of the 117th Congress illustrate how Representatives engage in policy entrepreneurship, focusing on problem defini-

tions and policy solutions, or how the Representative connects climate hazards to policy. The search parameters yield 1,245 congressional records mentioning a natural disaster or a specific weather event. We exclude entries that mention natural disasters as rhetorical flourishes or reference a specific candidate (one example that came up frequently is the phrase “flood of immigrants,” or references to Representative Mike Flood). After coding for context, 25 percent of the sample remained, or 318 individual speeches.

Climate hazards are frequently identified and defined as policy problems. Legislators who spoke about natural disasters on the floor had, on average, a higher number of disaster declarations in their district (mean 3.21) compared to those who did not (mean 1.83). Most legislators mentioned natural disasters only one time on the floor ($n = 117$). However, other legislators spoke more frequently about a natural disaster in their district: for example, Doug LaMalfa (CA-01, R) and Sheila Jackson Lee (TX-18, D) made twenty-six and seventeen speeches, respectively. Over 70 percent of legislators representing congressional districts impacted by a disaster declaration mentioned the disasters’ effect on their congressional district in a speech. There was no significant or substantive difference in the likelihood that Democrats and Republicans identified a natural disaster in their district as a policy problem.

Partisan differences emerged when defining and framing climate hazards as a policy problem. While the scientific community linked increases in global surface temperatures with extreme weather events and natural disasters, legislators were more reticent to connect disasters to climate change. Among legislators who mentioned natural disasters, only 53 percent connected the disaster to climate change in a speech. There is wide variation in problem definition by party: 21 percent of Republicans mentioned natural disasters and climate change, and about 70 percent of Democrats mentioned natural disasters and climate change in speeches on the floor.

Many legislators took the opportunity to define the problem by assigning blame ($n = 96$, or 30.2 percent of the sample). Figure 4, panel A presents differences in blame attribution by party. Republican legislators were more likely

to define the problem by assigning blame ($n = 24$ legislators, or 39 percent of the sample). Republicans attributed blame to a wide variety of actors, ranging from inefficient bureaucracy to the Joe Biden administration to environmentalists. Democrats and Republicans united in blaming their fellow legislators for failing to mitigate the harms from natural disasters. Democrats overwhelmingly blamed climate change for the harms accrued to their district.

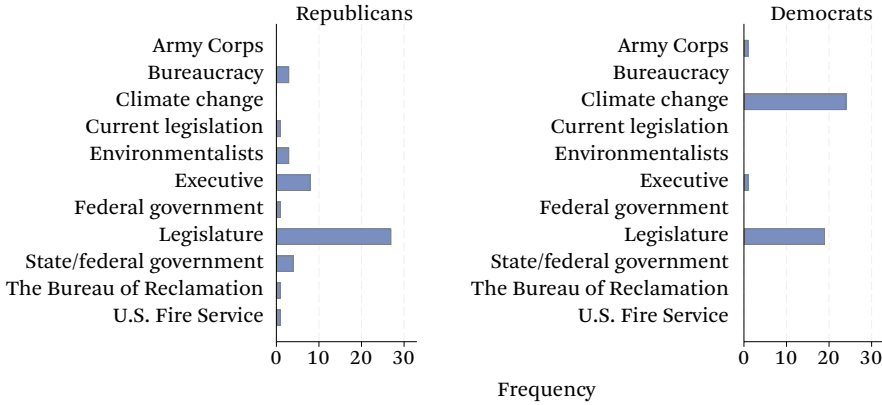
To illustrate how Democratic and Republican lawmakers vary in defining the policy problem of natural disasters, I share two speeches on the floor of the House of Representatives. The lawmakers represent districts that were devastated by Hurricane Ida in 2021. Representative Sheila Jackson Lee (TX-18, D) earned an environmental scorecard of 100, and mentioned natural disasters and climate change in seven of her speeches on the floor. Representative Jackson Lee argued that “natural disasters intensify existing social and racial and ethnic inequities. After a natural disaster, people in disadvantaged communities have worse outcomes due to stresses or exposures to other risks associated with a disaster. Low-income people and people of color are more likely to live in disaster-prone areas, live in lower-quality housing that is less safe when disasters occur, and have chronic illnesses that make them more vulnerable” (“House proceedings” 2022c).

Representative Jackson Lee connects natural disasters to climate change, using an intersectional lens to understand how climate hazards disproportionately burden low-income and minority communities. In congressional district LA-06, Republican Representative Garret Graves offers a different framing: “Just to explain what happens here, in the aftermath of a disaster . . . you have an alphabet soup of agencies that come in and offer assistance. It could be FEMA, it could be the Small Business Administration, it could be the Department of Agriculture, it could be the Department of Housing and Urban Development, or others. Madam Speaker, the last thing in the world the victim of a disaster needs is to be revictimized by their own government bureaucracy” (“House proceedings” 2022c).

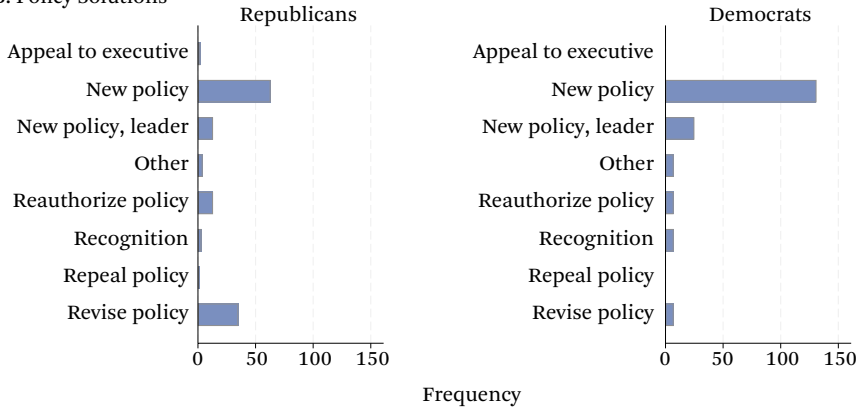
Many Republican representatives voiced frustration with the inefficiencies of the federal government and FEMA, including Troy Nehls (TX-

Figure 4. Results for Qualitative Coding of Speeches on the Floor of the House of Representatives, Blame Attribution and Policy Solutions

Panel A. Blame Attribution



Panel B. Policy Solutions



Source: Data compiled from the Congressional Record (2023).

22) (“House proceedings” 2022a), and Randy Webber (TX-14) (“House proceedings” 2022a).

Legislators also differ in their specific policy solutions. Speeches that mentioned a policy alternative or solution connect the disaster to an action, such as sponsoring new policy or revising existing legislation. Republican representatives focused on disaster response, resource management, and infrastructure development rather than broader climate change policies. Consistent with Republican core ideology favoring small government, many speeches called for revising or reauthorizing federal legislation rather than ambitious new policies. Republican lawmakers had a distinct focus on policy related to agriculture, farmers and ranchers ($n = 26$),

and food supply ($n = 14$), tailoring their policy solutions to suit their constituents in rural areas. Democrats, in contrast, focused on sponsorship or advocacy of new legislation ($n = 156$ or 85 percent) aimed at climate change policy or expanding federal capacity to respond to climate hazards. During this congressional session, Democrats had many opportunities to connect disasters in their district to climate change policy during debates on the Inflation Reduction Act. The online appendix includes a detailed list of legislation discussed by representatives.

To illustrate partisan differences, I offer two examples where Democratic and Republican lawmakers connected the policy problem of

drought and wildfire to their preferred policy solutions. Democratic Representative Joe Neguse (CO-2), founder and cochair of the Bipartisan Wildfire Caucus, advocated for new legislation focused on climate hazard mitigation strategies: “As climate-change-induced drought means long-term reductions in rain, snow, and necessary water supplies, this legislation invests in droughtproof water projects like water recycling, modern desalination, advancing water data management and technology, protecting and restoring ecosystems” (“House proceedings” 2022b).

Representative Neguse sponsored the Wildfire Response and Drought Resiliency Act, which passed narrowly with one House Republican voting in favor. In contrast, Republican Representative Bruce Westerman (AR-04), chairman of the Natural Resources Committee, used concerns over droughts and forest fires to argue against conserving almost three million acres of public land across Colorado, California, Arizona, and Washington state: “Do you care about the health of our forests? Then don’t vote for this bill. The most basic types of preventive maintenance are illegal under wilderness designation. You can’t take a chain saw and cut away fire traps, and you can’t trim branches or overgrown timber stands and underbrush. (. . .) Should this become law, with its restrictions on fire prevention, we are going to see bigger and hotter fires in Colorado than ever before (“Colorado Wilderness Act of 2021” 2021).”

Representative Westerman uses the problem of droughts and fires to argue against federal wilderness designations. While Westerman does not represent an area routinely affected by drought and wildfire, his position as chairman on the Natural Resource Committee carries weight in this policy debate.

Democrats and Republicans occasionally work across the aisle. Representatives of California and Colorado used disasters in their districts to mobilize for new legislation. In California, Representative Zoe Lofgren (CA-18) thanked the bipartisan House Committee on Natural Resources for their work on the Wildfire Response and Drought Resiliency Act, remind-

ing legislators that “fires don’t rage only in Democratic districts. This calamity knows no political divide” (“House proceedings” 2022c).

CONCLUSION

This article makes a theoretical contribution to the policy process literature, helping scholars understand the dynamics of policymaking in a polarized era. Partisanship is a critical frame for understanding legislative behavior in response to climate hazards. A natural disaster serves as a focusing event if the political context is right: disasters may change the legislative behavior of Democrats, increasing their votes in favor of environmental policy issues. Content analysis of speeches on the floor of the House of Representatives demonstrates how Democrats link natural disasters to climate change, using their policy window to advocate for pro-environmental policy during the 117th Congress. Democratic Representatives also focus on environmental inequalities, demonstrating how climate hazards disproportionately impact low-income, minority residents.

For Republican legislators, major natural disasters increase conservatism on environmental policy issues. Republican legislators are less likely to vote in favor of environmental legislation after a major disaster, and their anti-environmental policy stance is substantively and statistically significant. There are myriad mechanisms for increased conservatism: a disaster may spur a “rally around the flag” effect, boosting support for the legislator and their ideological position (Groeling and Baum 2008). Alternatively, fear and insecurity stemming from major natural disasters may renew support for anti-environmental ideological positions among conservatives (Bar-Tal 2020; Dörries 2010).¹⁴ While members of Congress who support pro-environmental legislation after a disaster have no change in their total campaign contributions (Jud and Nguyen 2024), it is possible that fear of donor reprisal impacts legislative behavior on the right. Content analysis suggests that Republicans define natural disasters as policy problems that do not require pro-environmental legislation. By connecting the problem of natu-

14. Although fear-based messaging in other domains is somewhat effective, its success within the environmental domain is mixed (see Reser and Bradley 2017 for a review).

ral disasters to inefficiencies in the legislative and executive branch or the federal bureaucracy, the clear policy solution is less government oversight, not more.

Natural disasters have a long-lasting impact on legislative behavior. Major disaster recovery takes time, and communities must grapple with housing and neighborhood reconstruction. Legislators are especially responsive to issues related to their constituents' daily life (Canes-Wrone and Shotts 2004). Lags in emergency assistance from FEMA and long-term aid from federal agencies such as Housing and Urban Development, inconsistencies in federal funding, and state and local capacity all impact disaster recovery (Teles and Martin 2021). The realities of disaster recovery help explain the long-lasting impact of natural disasters on legislative behavior: congressional districts feel the effects of disasters for years. Rather than inspiring a brief change in behavior after the event, natural disasters alter legislative behavior on environmental policy issues.

Congressional testimony illustrates how policymakers seize policy windows to champion policy and distribute blame. Representatives define natural disasters as policy problems that lead to their preferred policy solution. For Democrats in the 117th Congress, natural disasters offered proof of the existential threat of climate change for their districts, allowing them to advocate for pro-environmental policy. Representatives connected climate hazards with structural inequalities in access to housing, employment, and health, in vulnerable communities, the economic burden of climate hazards causes disproportionate financial strain, building on existing inequalities. Many Republicans critiqued the Biden administration's response to disasters in their districts, and some argued pro-environmental policies, such as forest preservation, added fuel to forest fires.

Natural disasters occur locally, but have the power to shape national policy. While numerous studies have examined the effect of natural disasters on local policy outcomes (Arceneaux and Stein 2006; O'Donovan 2017; Zelin and Smith 2023), this article suggests that natural disasters have deep impacts outside of their geographic area. For example, the landmark Inflation Reduction Act (IRA) of 2022 is the first domestic

legislative effort to combat climate change in recent history, and will help the United States meet its emission reduction commitments. The IRA passed the House of Representatives on party lines with a vote of 220–207. Legislation passes by slim margins: a small change in an individual legislator's environmental policy position may have a large impact on national policy.

What do asymmetric findings along partisan lines mean for environmental policy in the United States? In the recent 2024 election, Republicans gained control of the executive and legislative branches, suggesting an uncertain future for climate policy. I find that partisanship conditions response to natural disasters, but there are important nuances to this partisan divide. For example, investment in green energy and job growth may impact perceptions of environmental legislation: about 85 percent of the announced investments from the IRA benefit Republican districts and encourage job growth in rural areas, which may shape perceptions of environmental legislation for conservative voters (Gaffney 2024). Younger elected representatives may also depart from President Trump's views on climate change: in interviews, young conservatives identify climate change, conservation, and energy as salient policy issues (Bustillo 2024). Younger Republicans are much more likely to say that human activity contributes to climate change (PEW Research Center 2024). Finally, the legislature may pursue environmental policies that resonate more with Republican voters: conservatives support expanding both fossil fuel and renewable energy sources (PEW Research Center 2024).

In lieu of concerted federal efforts, state legislatures have accomplished important policy victories in environmental protection. Many states have established commissions to address environmental injustice and climate hazard mitigation policy. However, uneven state investment in climate adaptation policy may exacerbate inequality: regions that are more likely to be impacted by climate hazards are also less likely to invest in state climate adaptation policy (Avtar et al. 2023). As we grapple with an increase in climate-change-related natural disasters and a divided electorate, scholars and activists must find ways to frame environmen-

tal policies to appeal to voters and elected representatives. Future research should examine how scientists, academics, and government officials can galvanize conservative voters and elected representatives to support environmental policy after natural disasters. Without concerted federal efforts in the legislature, inequality in climate hazard burden and adaptation will continue to grow.

REFERENCES

- Albrecht, Frederike. 2017. "Government Accountability and Natural Disasters: The Impact of Natural Hazard Events on Political Trust and Satisfaction With Governments in Europe." *Risk, Hazards & Crisis in Public Policy* 8(4): 381–410. <https://doi.org/10.1002/rhc3.12122>.
- Albright, Elizabeth A., and Deseraï A. Crow. 2021. "Capacity Building Toward Resilience: How Communities Recover, Learn, and Change in the Aftermath of Extreme Events." *Policy Studies Journal* 49(1): 89–122.
- Aldrich, John H. 1995. *Why Parties? The Origin and Transformation of Political Parties in America*. University of Chicago Press.
- Aldrich, John H., and James S. Coleman Battista. 2002. "Conditional Party Government in the States." *American Journal of Political Science* 46(1): 164–72.
- Aldrich, John H., and David W. Rohde. 2000. "The Logic of Conditional Party Government: Revisiting the Electoral Connection." PIPC Working Paper No. 00-8. Michigan State University. https://findingaids.lib.msu.edu/repositories/2/archival_objects/345660.
- Angrist, Joshua D., and Jörn-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press.
- Arceneaux, Kevin, and Robert M. Stein. 2006. "Who Is Held Responsible When Disaster Strikes? The Attribution of Responsibility for a Natural Disaster in an Urban Election." *Journal of Urban Affairs* 28(1): 43–53.
- Avtar, Ruchi, Kristian Blickle, Rajashri Chakrabarti, Janavi Janakiraman, and Maxim Pinkovskiy. 2023. "Understanding the Linkages Between Climate Change and Inequality in the United States." *Economic Policy Review* 29(1): 1–39.
- Barberá, Pablo, Andreu Casas, Jonathan Nagler, et al. 2019. "Who Leads? Who Follows? Measuring Issue Attention and Agenda Setting by Legislators and the Mass Public Using Social Media Data." *American Political Science Review* 113(4): 883–901.
- Bar-Tal, Daniel. 2020. "Creating Fear and Insecurity for Political Goals." *International Perspectives in Psychology* 9(1): 5–17.
- Baumgartner, Frank R., and Bryan D. Jones. 2010. *Agendas and Instability in American Politics*. University of Chicago Press.
- Besbris, Max, Manuel Pastor, Anna Rhodes, Wolfram Schlenker, and Pamela Winston. 2026. "The Social, Political, and Economic Consequences of Climate Hazards." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 1–32. <https://doi.org/10.7758/RSF.2026.12.4.01>.
- Best, Rachel. 2010. "Situation or Social Problem: The Influence of Events on Media Coverage of Homelessness." *Social Problems* 57(1): 74–91.
- Birkland, Thomas A. 1996. "Natural Disasters as Focusing Events: Policy Communities and Political Response." *International Journal of Mass Emergencies and Disasters* 14, no. 2: 221–243.
- Birkland, Thomas A. 1997. *After Disaster: Agenda Setting, Public Policy, and Focusing Events*. Georgetown University Press.
- Birkland, Thomas A. 1998. "Focusing Events, Mobilization, and Agenda Setting." *Journal of Public Policy* 18(1): 53–74.
- Birkland, Thomas A. 2006. *Lessons of Disaster: Policy Change After Catastrophic Events*. Georgetown University Press.
- Birkland, Thomas A., and Megan Warnement. 2013. "Defining, Explaining, and Testing the Role of Focusing Events in Agenda Change: 30 Years of Focusing Event Theory." Paper presented at the American Political Science Association annual meeting, 2013. SSRN. <https://papers.ssrn.com/abstract=2300441>.
- Bromley-Trujillo, Rebecca, Mirya Holman, and Andres Sandoval. 2019. "Hot Districts, Cool Legislation: Evaluating Agenda Setting in Climate Change Bill Sponsorship in U.S. States." *State Politics & Policy Quarterly* 19(3): 375–95. <https://doi.org/10.1177/1532440019842175>.
- Cairney, Paul. 2015. "Paul A. Sabatier, An Advocacy Coalition Framework of Policy Change and the Role of Policy-Oriented Learning Therein." In *The Oxford Handbook of Classics in Public Policy and Administration*, edited by Martin Lodge, Edward C. Page, and Steven J. Balla. Oxford University Press.

- Cairney, Paul, and Michael D. Jones. 2016. "Kingdon's Multiple Streams Approach: What Is the Empirical Impact of This Universal Theory?" *Policy Studies Journal* 44(1): 37–58. <https://doi.org/10.1111/psj.12111>.
- Cairney, Paul, and Nikolaos Zahariadis. 2016. "Multiple Streams Approach: A Flexible Metaphor Presents an Opportunity to Operationalize Agenda Setting Processes." In *Handbook of Public Policy Agenda Setting*, edited by Nikolaos Zahariadis. Edward Elgar Publishing.
- Carey, John M. 2007. "Competing Principals, Political Institutions, and Party Unity in Legislative Voting." *American Journal of Political Science* 51(1): 92–107. <https://doi.org/10.1111/j.1540-5907.2007.00239.x>.
- "Colorado Wilderness Act of 2021." 2021. Congressional Record 167 (36) (February 25): H661–H702. <https://www.congress.gov/117/crec/2021/02/25/modified/CREC-2021-02-25-pt1-PgH661.htm>.
- Congressional Record. 2023. 117th Congress (2021–2022). <https://www.congress.gov/congressional-record/117th-congress/browse-by-date>.
- Cook, Angus, Jill Watson, Paul van Buyster, Andrew Robertson, and Phil Weinstein. 2008. "10th Anniversary Review: Natural Disasters and Their Long-Term Impacts on the Health of Communities." *Journal of Environmental Monitoring* 10(2): 167–75.
- The Cook Political Report. 2023. *Cook Partisan Voting Index (PVI)*. <https://www.cookpolitical.com/cook-pvi>.
- Cox, Gary W., Thad Kousser, and Mathew D. McCubbins. 2010. "Party Power or Preferences? Quasi-Experimental Evidence from American State Legislatures." *Journal of Politics* 72(3): 799–811.
- Cox, Gary W., and Mathew D. McCubbins. 2005. *Setting the Agenda: Responsible Party Government in the US House of Representatives*. Cambridge University Press.
- DeLeo, Rob A., Kristin Taylor, Desera Anderson, and Thomas A. Birkland. 2021. "During Disaster: Refining the Concept of Focusing Events to Better Explain Long-Duration Crises." *International Review of Public Policy* 3(1). <https://doi.org/10.4000/irpp.1868>.
- Desilver, Drew. 2022. "The Polarization in Today's Congress Has Roots That Go Back Decades." Pew Research Center. March 10. <https://www.pewresearch.org/short-reads/2022/03/10/the-polarization-in-todays-congress-has-roots-that-go-back-decades/>.
- Dörries, Matthias. 2010. "Climate Catastrophes and Fear." *WIREs Climate Change* 1(6): 885–90.
- Emrich, Christopher T., Sanam K. Aksha, and Yao Zhou. 2022. "Assessing Distributive Inequities in FEMA's Disaster Recovery Assistance Fund Allocation." *International Journal of Disaster Risk Reduction* 74: 102855. <https://doi.org/10.1016/j.ijdr.2022.102855>.
- Federal Emergency Management Agency. 2023. *Disaster Declarations Summaries (NEMIS)* [dataset]. U.S. Department of Homeland Security. <https://catalog.data.gov/dataset/disaster-declarations-summaries-nemis>.
- Ferrara, Andreas, Patrick A. Testa, and Liyang Zhou. 2024. "New Area- and Population-Based Geographic Crosswalks for US Counties and Congressional Districts, 1790–2020." NBER Working Paper 32206. National Bureau of Economic Research. March. https://www.nber.org/system/files/working_papers/w32206/w32206.pdf.
- Francis, Dania V., and Keren M. Horn. 2026. "Impacts of Climate Hazards on Employment and Earnings by Hazard Type, Industry, Race, and Ethnicity." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 134–55. <https://doi.org/10.7758/RSF.2026.12.4.06>.
- Freyaldenhoven, Simon, Christian Hansen, Jorge Pérez Pérez, and Jesse Shapiro. 2022. "XTEVENT: Stata Module to Estimate and Visualize Linear Panel Event-Study Models." *Statistical Software Components* S458987. Boston College Department of Economics. Revised July 12, 2024. <https://ideas.repec.org/c/boc/bocode/s458987.html>.
- Freyaldenhoven, Simon, Christian Hansen, and Jesse M. Shapiro. 2019. "Pre-Event Trends in the Panel Event-Study Design." *American Economic Review* 109(9): 3307–38.
- Gaffney, Austyn. 2024. "The Clean Energy Boom in Republican Districts." *New York Times*, November 21. <https://www.nytimes.com/2024/11/21/climate/ira-republicans-clean-energy.html> (January 16, 2025).
- Garrett, Thomas A., and Russell S. Sobel. 2003. "The Political Economy of FEMA Disaster Payments." *Economic Inquiry* 41(3): 496–509. <https://doi.org/10.1093/ei/cbg023>.
- Glaser, Jochen, and Grit Laudel. 2019. "The Discovery of Causal Mechanisms: Extractive Qualitative

- Content Analysis as a Tool for Process Tracing." *Forum: Qualitative Social Research* 20(3). <https://doi.org/10.17169/fqs-20.3.3386>.
- Godwin, Marcia L., and Jean Reith Schroedel. 2000. "Policy Diffusion and Strategies for Promoting Policy Change: Evidence from California Local Gun Control Ordinances." *Policy Studies Journal* 28(4): 760–76. <https://doi.org/10.1111/j.1541-0072.2000.tb02061.x>.
- Golder, Matt. 2006. "Presidential Coattails and Legislative Fragmentation." *American Journal of Political Science* 50(1): 34–48. <https://doi.org/10.1111/j.1540-5907.2006.00168.x>.
- Groeling, Tim, and Matthew A. Baum. 2008. "Crossing the Water's Edge: Elite Rhetoric, Media Coverage, and the Rally-Round-the-Flag Phenomenon." *Journal of Politics* 70(4): 1065–85.
- Hadden, Jennifer, and Aseem Prakash. 2024. "Introduction: What Scholars Know (and Need to Know) About the Politics of Climate Change." *PS: Political Science & Politics* 57(1): 17–20. <https://doi.org/10.1017/S1049096523000562>.
- Hager, Gregory L., and Jeffery C. Talbert. 2000. "Look for the Party Label: Party Influences on Voting in the U.S. House." *Legislative Studies Quarterly* 25(1): 75–99.
- Heikkila, Tanya, and Andrea K. Gerlak. 2013. "Building a Conceptual Approach to Collective Learning: Lessons for Public Policy Scholars." *Policy Studies Journal* 41(3): 484–512.
- "House proceedings." 2022a. Congressional Record 168 (97) (June 14): H5237–H5335. <https://www.congress.gov/congressional-record/volume-168/issue-97/house-section/article/H5262-13>.
- "House proceedings." 2022b. Congressional Record 168 (127) (July 27). <https://www.congress.gov/congressional-record/volume-168/issue-127/house-section/article/H7419-5>.
- "House proceedings." 2022c. Congressional Record 168 (178) (November 15). <https://www.congress.gov/congressional-record/volume-168/issue-178/house-section>.
- Hunt, Charles R. 2021. "Beyond Partisanship: Outperforming the Party Label with Local Roots in Congressional Elections." *Congress & the Presidency* 48(3): 343–72. <https://doi.org/10.1080/07343469.2020.1811425>.
- Husted, Thomas, and David Nickerson. 2014. "Political Economy of Presidential Disaster Declarations and Federal Disaster Assistance." *Public Finance Review* 42(1): 35–57.
- Jewitt, Caitlin E., and Sarah A. Treul. 2019. "Ideological Primary Competition and Congressional Behavior." *Congress & the Presidency* 46(3): 471–94. <https://doi.org/10.1080/07343469.2019.1600173>.
- Jones, Bryan D., Frank R. Baumgartner, and Jeffery C. Talbert. 1993. "The Destruction of Issue Monopolies in Congress." *American Political Science Review* 87(3): 657–71.
- Jud, Stefano, and Quynh Nguyen. 2024. "Disasters and Divisions: How Partisanship Shapes Policy-maker Responses to Climate Change." June 26. SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4870935.
- Kingdon, John W. 1984. *Agendas, Alternatives and Public Policies*. Little, Brown.
- Kingdon, John W. 1995. *Agendas, Alternatives, and Public Policies*. 2nd ed. Longman.
- Kousky, Carolyn, Karina French, Carlos Martin, and Manann Donoghoe. 2023. "The US Needs a New System for Declaring Natural Disasters and Distributing Federal Aid." Brookings. July 14. <https://www.brookings.edu/articles/the-us-needs-a-new-system-for-declaring-natural-disasters-and-distributing-federal-aid/> (August 7, 2024).
- Lazarus, Richard J. 2023. *The Making of Environmental Law*. University of Chicago Press.
- League of Conservation Voters. 2023. *Congressional Scorecard*. <https://www.lcv.org/congressional-scorecard>.
- Leyk, Stefan, Johannes H. Uhl, Dylan S. Connor, et al. 2020. "Two Centuries of Settlement and Urban Development in the United States." *Science Advances* 6(23): eaba2937.
- Lindblom, Charles E. 1959. "The Science of 'Muddling Through.'" *Public Administration Review* 19(2): 79–88. <https://doi.org/10.2307/973677>.
- Lott Jr., John R., and Stephen G. Bronars. 1993. "Time Series Evidence on Shirking in the US House of Representatives." *Public Choice* 76(1–2): 125–49.
- Mann, Thomas E., and Bruce E. Cain. 2008. *Party Lines: Competition, Partisanship, and Congressional Redistricting*. Brookings Institution Press.
- Mayhew, David R. 2004. *Congress: The Electoral Connection*. 2nd ed. Yale University Press.
- McDaniel, Tyler W. 2026. "The Impacts of Repeated Disasters on School Attendance and Learning." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 156–77. <https://doi.org/10.7758/RSF.2026.12.4.07>.

- O'Donovan, Kristin. 2017. "An Assessment of Aggregate Focusing Events, Disaster Experience, and Policy Change." *Risk, Hazards & Crisis in Public Policy* 8(3): 201-19.
- Pelling, Mark, and Kathleen Dill. 2006. "'Natural Disasters' as Catalysts of Political Action." *Media Development* 53(4): 7.
- Pew Research Center. 2024. *Americans' Views on Energy and Climate*. Washington, DC: Pew Research Center. https://www.pewresearch.org/wp-content/uploads/sites/20/2024/06/PS_2024.6.27_energy_REPORT.pdf.
- Poole, Keith T. 2007. "Changing Minds? Not in Congress!" *Public Choice* 131(3): 435-51. <https://doi.org/10.1007/s11127-006-9124-y>.
- Pralle, Sarah B. 2009. "Agenda-Setting and Climate Change." *Environmental Politics* 18(5): 781-99.
- Reny, Tyler T., and Benjamin J. Newman. 2021. "The Opinion-Mobilizing Effect of Social Protest Against Police Violence: Evidence from the 2020 George Floyd Protests." *American Political Science Review* 115(4): 1499-1507.
- Rode, Jacob B., Amy L. Dent, Caitlin N. Benedict, Daniel B. Brosnahan, Ramona L. Martinez, and Peter H. Ditto. 2021. "Influencing Climate Change Attitudes in the United States: A Systematic Review and Meta-Analysis." *Journal of Environmental Psychology* 76: 101623. <https://doi.org/10.1016/j.jenvp.2021.101623>.
- Roth, Jonathan, Pedro H.C. Sant'Anna, Alyssa Bilinski, and John Poe. 2023. "What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature." *Journal of Econometrics* 235(2): 2218-44.
- Sabatier, Paul A. 1988. "An Advocacy Coalition Framework of Policy Change and the Role of Policy-Oriented Learning Therein." *Policy Sciences* 21(2-3): 129-68.
- Sabatier, Paul A., and Hank C. Jenkins-Smith. 1999. "The Advocacy Coalition Framework: An Assessment." In *Theories of the Policy Process*, edited by Paul A. Sabatier. Westview Press.
- Sabatier, Paul A., and Christopher M. Weible, eds. 2014. *Theories of the Policy Process*. Westview Press.
- Schattschneider, Elmer. 1975. *The Semi-Sovereign People: A Realist's View of Democracy in America*. Wadsworth Publishing.
- Stone, Deborah A. 1989. "Causal Stories and the Formation of Policy Agendas." *Political Science Quarterly* 104(2): 281-300. <https://doi.org/10.2307/2151585>.
- Stone, Deborah A. 2007. *Policy Paradox: The Art of Political Decision Making*. W.W. Norton & Co.
- Teles, Daniel, and Carlos Martin. 2021. "Why Does Disaster Recovery Take So Long? Five Facts About Federal Housing Aid After Disasters." Urban Wire, Urban Institute. January 25. <https://www.urban.org/urban-wire/why-does-disaster-recovery-take-so-long-five-facts-about-federal-housing-aid-after-disasters>.
- Tollefson, Jeff. 2017. "Trump Pulls United States out of Paris Climate Agreement." *Nature* 546: 198. <https://doi.org/10.1038/nature.2017.22096>.
- Unsworth, Kerrie L., and Kelly S. Fielding. 2014. "It's Political: How the Salience of One's Political Identity Changes Climate Change Beliefs and Policy Support." *Global Environmental Change* 27: 131-37.
- US Department of the Treasury. 2023. "Fact Sheet: The Impact of Climate Change on American Household Finances." September 29. <https://home.treasury.gov/news/press-releases/jy1775>.
- Valencia-Uribe, Claudia, Carlo A. Chunga Pizarro, and Michael Méndez. 2026. "Growing Adaptability Among Undocumented Communities During Climate-Induced Disasters: An Analysis of the Role of Migrant-Serving Organizations." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 206-31. <https://doi.org/10.7758/RSF.2026.12.4.09>.
- VanGronigen, Bryan A., and Coby V. Meyers. 2019. "How State Education Agencies Are Administering School Turnaround Efforts: 15 Years After No Child Left Behind." *Educational Policy* 33(3): 423-52.
- Weber, Elke U. 2016. "What Shapes Perceptions of Climate Change? New Research Since 2010." *WIREs: Climate Change* 7(1): 125-34.
- Wood, Robert S. 2006. "Tobacco's Tipping Point: The Master Settlement Agreement as a Focusing Event." *Policy Studies Journal* 34(3): 419-36.
- World Meteorological Organization. 2021. "Weather-Related Disasters Increase over Past 50 Years, Causing More Damage but Fewer Deaths." World Meteorological Organization, August 31.
- Zelin, William A., and Daniel A. Smith. 2023. "Weather to Vote: How Natural Disasters Shape Turnout Decisions." *Political Research Quarterly* 76(2): 553-64.

Social Class Targeting of Property Buyouts



MEGAN MULLIN 

As local governments face the burden of responding to climate-related hazards, their actions layer on top of existing class inequalities. This article reports on a survey experiment examining the responses of elected city and county officials to a proposed voluntary buyout of properties at risk from climate impacts. An experiment embedded in the survey tests whether politicians' responses to a buyout proposal depend on identification of recipients as wealthy or low-income. Results show a significant difference in support across the targeted recipients: even with an identical cost recovery period, elected officials were more likely to support buyouts for low-income homeowners. The effect of social class targeting became larger after respondents considered wide-ranging benefits and drawbacks of buyouts: they favored buyouts to a greater degree for low-income recipients, and to a lesser degree for wealthy recipients, than for homeowners not identified with a class marker. If these responses translate into differential provision of buyout opportunities across income groups, it could help mitigate large class-based disparities in capacity to recover from disasters, while at the same time contributing to class-based disparities in climate migration.

Keywords: managed retreat, climate adaptation, property buyouts, climate justice, social class, survey experiment, local government

In the United States, the burden of responding to climate-related hazards falls overwhelmingly on local governments. Through their control over land use, their responsibilities for infrastructure and public services, and their ability to set taxes, local governments can help reduce—or amplify—harm and disruption caused by flooding, wildfire, and other hazards. As communities attempt to become more resilient to climate risks, they may enact policies that rein-

force existing inequalities. Research in local political economy demonstrates that local governments historically have exercised their powers in ways that benefit wealthy White property owners, contributing to widespread segregation and unequal access to public services (Einstein et al. 2019; Fischel 2001; Rothstein 2017; Trounstein 2018). Mechanisms intended to manage environmental risk often become instruments for exclusion or the protection of property val-

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ues (Glaeser and Ward 2009; Mullin 2009; Mullin et al. 2019). More recently, however, local land use and climate plans have started giving attention to equity and justice (Loh and Kim 2021; Diezmartínez and Short Gianotti 2022), suggesting a readiness among local governments to address legacies of inequality as they confront climate hazards.

Among the most controversial responses to climate hazards is managed retreat: the relocation of people and properties out of high-risk areas, especially through property buyout programs. For a purely willing participant, a buyout provides a welcome avenue for exit from a damaged or at-risk property. Those whose properties have been identified as eligible for buyouts may not have full agency over the decision, however, whether for reasons of property ownership, financial loss, event-related trauma, or perceptions of being coerced. Broader collective benefits of buyouts can include avoided government expenditures on infrastructure, response, and recovery in areas most vulnerable to climate hazards, as well as the provision of hazard mitigation and recreational benefits if acquired properties are then used as amenities such as restored wetlands or greenways. Yet buyouts may also produce collective harms by contributing to deterioration in property values, tax revenue, and quality of life in the surrounding community. The experience of buyouts both for recipients and for surrounding communities varies widely across contexts, with benefits most likely to be achieved when willing residents are matched with public officials who have the capacity and political will to deliver a buyout (Phillips et al. 2012; Koslov 2016; Siders 2019).

The decision-making processes that fund and implement buyouts are complex and multilevel, creating multiple avenues for inequities to manifest (Kraan et al. 2021). One avenue is through the decision making of local elected officials, because local governments nearly always play a leading role in coordinating and prioritizing buyout proposals, as well as funding the buyouts at least in part. Decisions about buyouts most commonly arise as part of post-disaster recovery planning, though a growing number of communities are executing buyouts as part of long-term risk reduction programs. In either case, local officials must consider a range of

factors, including direct costs, competing recovery or mitigation needs, and the long-term fiscal impacts of converting developed to vacant lots (BenDor et al. 2020). On top of these considerations about collective costs and benefits are the identities of the residents who would receive the buyouts. Property buyouts typically occur in spatially concentrated clusters. Because of widespread patterns of residential segregation—patterns reinforced by the amenities and disamenities of living near water—affected residents often share class-based attributes that differ from the broader community. They may be wealthier than the typical resident or poorer. Consistent with how class and income have long shaped local land use practice (Whittemore 2021; Lens and Monkkonen 2016), the identities of buyout recipients may contribute to local officials' willingness to pursue a buyout.

This study investigates how the social class targeting of a property buyout proposal affects local elected officials' support for the buyout. Data come from a survey conducted in spring 2020 of over 400 elected US city and county officials nationwide. An experiment embedded in the survey tested whether politicians' responses to a buyout proposal brought forward by a group of homeowners depended on identification of recipients as wealthy or low-income. Results show a significant difference in support across the targeted recipients: even with an identical cost recovery period, elected officials were more likely to support buyouts for low-income homeowners.

Because most local elected officials were not likely to be familiar with property buyouts, the survey provided information and opportunity for reflection about a wide range of buyout benefits and drawbacks. After respondents considered the impacts of buyouts, the gap in support between income groups grew: Respondents expressed greater support for buyouts targeted for low-income recipients and lower support for wealthy recipients than for homeowners not identified with a class marker. Preferences for targeting low-income homeowners were stronger among politicians representing more Democratic communities, and survey responses indicate that resistance to buyouts for wealthy homeowners was rooted not in concerns about cost, but instead in concerns about fairness.

Although respondent officeholders were disinclined to support buyout proposals overall, their responses demonstrated a clear preference toward using buyouts to support recipients perceived as in need. Implications for inequality are complex. While this preference for targeting buyouts to low-income residents could help narrow gaps in people's financial capacity to respond to climate hazards, it may contribute to class-based disparities in climate migration.

PROPERTY BUYOUTS IN US COMMUNITIES

Exposure to climate risks is escalating throughout the United States, as communities confront record-breaking heat, rising sea levels, escalating wildfire hazards, and more frequent and intense storms. These hazards are not evenly experienced across people from different income and racial groups (Chakraborty et al. 2018; Qiang 2019). When exposure is mapped onto geographic patterns of social vulnerability, the disparities in risk from the impacts of current and future climate change are pronounced (Davies et al. 2018; Martinich et al. 2013; Tate et al. 2016; US Environmental Protection Agency 2021).

The concentration of people with low incomes and people of color in areas with higher exposure to environmental hazards is a legacy of local government planning, zoning, and financial practices that legalized segregation and reinforced disadvantage. Zoning ordinances dictate both the opportunity and the cost of living in risk-prone areas, and development in these areas has community-wide consequences for protective expenditures over the long term. Choices about where and how much to invest in protection privilege some neighborhoods or communities over others and may shift the financial burden of protection from public to private, or vice versa (Woodruff et al. 2020). Processes of planning and development that have unfolded over decades create zones of prosperity and disadvantage that manifest vulnerability to climate impacts (Hendricks and Van Zandt 2021).

Those experiencing high risk or repeat impact from hazards such as flooding or fire might choose to move, and studies show that extreme events often drive outmigration (Boustan et al. 2020; McConnell et al. 2024; Hornbeck 2012).

But many who are most exposed to climate impacts face barriers or incentive problems that limit their mobility. They may not be able to afford relocation if their house value is less than what they owe on the property or than the cost of purchasing a comparable property elsewhere (Binder and Greer 2016; Keeler et al. 2022). Meanwhile, their incentive to sell may be low if they expect federal disaster assistance to absorb some of their expenses from remaining in place (Conrad et al. 1998).

Government funding for voluntary buyouts helps enable relocation away from vulnerable properties. Buyouts provide pre-event fair market value for the purchase of properties that have been substantially damaged, primarily by floods. The largest source of government support for buyouts is through the Hazard Mitigation Grant Program (HMGP) under the Federal Emergency Management Agency (FEMA). The Community Development Block Grant program under the Department of Housing and Urban Development offers another avenue for federal funding of buyouts, including for properties that are at high risk of flooding, and not just those that already have been damaged. On top of these federal sources of support, numerous states and localities have adopted their own buyout programs, self-financed from sales taxes, stormwater fees, green bonds, and general funds. In combination, these programs have accounted for thousands of additional property acquisitions (K. Peterson et al. 2020). The number of buyout programs is on the rise as localities expand their scope of activities in managing stormwater and begin to consider buyouts as a tool for managing wildfire risk (McConnell and Kolslov 2024). In most cases—and by requirements of HMGP funding—acquisitions are deed-restricted against future structural improvements, with parcels permanently converted to green space or wetlands.

Regardless of funding source, local governments play a leading role in decision making to offer property buyouts. Although policy processes following an extreme weather event take place across multiple venues (Albright and Crow 2015), it is typically a local government agency that coordinates assistance requests for channeling to state and federal authorities. Of the more than 40,000 buyouts funded by FEMA as

of 2017, 94 percent were administered by a local government (Mach et al. 2019b). Many states also work with local governments outside of disaster circumstances to identify and prioritize at-risk properties. In deciding to pursue federal or state support for a buyout program, a local government must define which properties are eligible and secure the agreement of participating property owners. It also commits to funding the required cost-share (typically 25 percent under the federal programs) and to managing the acquired property. All in all, these are consequential political decisions that engage the participation of elected officeholders (Binder et al. 2020).

The impacts of property buyouts are context-dependent, shaped by the discretionary power of local decision-makers and the experiences of policy recipients (Revillard 2024). Some property owners battle to access a buyout, perceiving it as the only option for leaving a place that has already been abandoned (Koslov 2016). For others, refusing a buyout is a form of resistance to abandoning a place with history and community attachment (Phillips et al. 2012). Buyouts implemented with federal HMGP funding must be voluntary, executed without invoking the local government's power of eminent domain, but in some cases, property owners have felt that they had no choice but to participate (Binder and Greer 2016; Rakow et al. 2003; Siders 2019; de Vries and Fraser 2012). Renters and mobile home park residents often have no voice at all in decisions about loss of their homes (Dundon and Camp 2021; Kraan et al. 2021).

Beyond those immediately participating in the program, buyouts may contribute to deterioration in property values and quality of life for neighbors of the acquired properties and have negative impacts for the broader jurisdiction through the loss of tax revenue and reputational status (Ruppert et al. 2018). They also reshape the demographic makeup of communities if they contribute to disproportionate out-migration by one group over another. For all these reasons, the prospect of buyouts can seem threatening, and even the prospect of long-term planning for the abandonment of at-risk coastal properties has sparked local political battles (Bragg et al. 2021).

How these considerations influence the de-

cisions of local officials may depend on the identity of potential buyout recipients. The collective benefits of buyouts are highest when properties are spatially clustered (BenDor et al. 2020). Because of widespread segregation in housing, residents of any small cluster of units are likely to be more economically and racially homogeneous than the broader community (Jayajit et al. 2014; Ueland and Warf 2006). In some cases, the vulnerable area is a low-lying, inland flood zone occupied by those who are most disadvantaged. In other cases, it is high-value properties on the coast or riverfront that are most at risk. All else equal, purchasing lower-value rather than higher-value properties allows the limited resources of disaster mitigation funds and cash-strapped local governments to be stretched further. Details of buyout implementation, including requirements for benefit-cost analysis and the importance of property value in the formula for designating substantial damage, can additionally favor the purchase of low-value properties (Siders 2019). However, higher-value properties may offer larger contributions to collective benefits such as infrastructure savings or land for recreation or flood control (Binder et al. 2020). Layered onto these programmatic rationales are the preferences and biases that inform government decisions of all types, potentially including decision-makers' predispositions about different constituent groups.

POLICY TARGETING AND PROPERTY BUYOUTS

Political scientists have documented the disproportionate responsiveness of the US political system to the interests and views of more affluent Americans (Bartels 2016; Gilens 2012; Wright and Rigby 2020). This bias in representation reaches down to the local government level, where public officials better represent the views of a community's wealthiest residents than the views of those who are less well-off (Schaffner et al. 2020). The lack of representation has meaningful consequences, including decades of local decision-making that has contributed to segregation by income and race and disparities in access to public services (Seamster and Purifoy 2020; Trounstone 2018). One of the primary domains for class-based local conflict is in housing, because of the private benefits or harms

that can result from decision-making about broader public goods (Danielson 1976; Einstein et al. 2019; Goetz and Sidney 1994).

How do class-based considerations shape politicians' responses to buyouts for willing property owners? Prior literature offers four possibilities. If demonstrated patterns of bias in local representation and outcomes reflect the personal biases of elected officials, they might favor buyouts that are targeted for wealthy constituents. The interests of the affluent consistently win out in local disputes over housing (Einstein et al. 2019), and politicians could justify a preference for buying out higher-value properties based on their perceptions about impacts on the broader community. Whereas acquired properties in affluent areas often become neighborhood amenities, adding to nearby property values, local planning processes fail to deliver the same benefits in less-affluent areas, where buyout sites more commonly become neglected or used for large-scale flood infrastructure (Loughran et al. 2019). A politician's preference for buyouts that target wealthy residents might therefore become stronger after consideration of community impacts, because of the dominant belief that a city's interests are aligned with those of its affluent residents (P. E. Peterson 1981).

Alternatively, local officials might favor buyouts for low-income residents, perceiving that they have few or no other options for moving from an unsafe property. If buyouts are a scarce resource to be distributed among those exposed to hazard, a commitment to fairness or environmental justice would lend itself to a preference for distributing buyouts to those with less wealth. Redistributive policies that promote upward mobility and make the poor better off are widely perceived as more fair (Rodon and Sanjaume-Calvet 2020). Social constructions depict the wealthy as less or perhaps equally deserving of benefits as compared to the poor, and the two groups are notably different in their perceived political power (Ingram et al. 2007; Kreitzer and Smith 2018). If politicians conceive of buyouts as a redistributive benefit, they should be more likely to favor the policy when it is directed at targets who have been constructed as dependents—deserving, but limited in power. Buyouts fit well with the type of policy

benefits that dependents typically receive: highly visible but narrowly applied, and offering recipients little control over implementation (Schneider and Ingram 1993).

The third possible impact of class-based considerations is for judgments about buyouts to depend more on whether any group is targeted than on the identity of the particular targeted group. Politicians often favor policies depicted as more universal over those directed toward identified groups of recipients (Skocpol 1991). Mass public support for policies also tends to elevate general over specific benefits, for example favoring welfare policies directed at economic risks such as unemployment or housing loss that are not primarily experienced by those who are economically disadvantaged (Rehm et al. 2012). When faced with decisions about benefits for a subset of constituents, politicians might prefer if those considerations were not made salient. Finally, politicians may not be responsive at all to identifying markers when considering a buyout proposal. Audit studies testing whether public officials demonstrate class bias in responding to constituent requests have produced null results across numerous political settings, including for city mayors (Carnes and Holbein 2019; Hayes and Bishin 2020).

The purpose of this study is to understand how social class targeting affects local elected officials' responses to voluntary property buyouts. The study contributes to a growing, multidisciplinary literature on buyouts that generally focuses on completed buyouts, through case studies or quantitative analysis of the distribution of federally backed buyouts over time. The latter studies show that buyouts have occurred in counties that are wealthier and more populous than counties without buyouts, highlighting the importance of local government capacity in securing federal and state support after disasters. Within counties, results are more sensitive to modeling choices related to the treatment of income and race, but suggest that neighborhoods receiving buyouts have lower incomes and housing values relative to surrounding neighborhoods (Elliott et al. 2020; Mach et al. 2019a; Nelson and Molloy 2021).

Because of the complexity of buyout processes, any patterns in observed buyout inci-

dence cannot be attributed to decisions by local public officials. Buyouts may be more prevalent for lower-value properties because of higher exposure to natural hazards, higher likelihood of severe damage, higher willingness among property owners to accept a buyout, or many other processes not in the control of local officials. This article brings an explicitly political lens to understanding decision-making by local elected officials—including those who have yet to face serious impacts from flood, fire, or severe storms—by asking them directly about their buyout preferences. In examining the attitudes of a broad swath of elected officials, and not just those who have already faced buyout decisions, we can begin to anticipate how property buyouts and managed retreat might help shape the futures of climate-impacted communities.

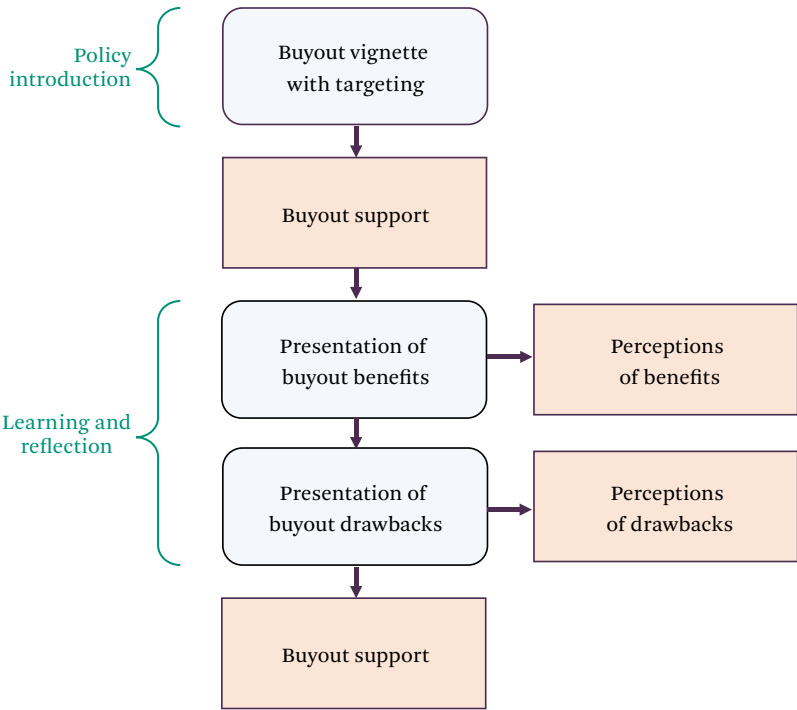
STUDY DESIGN

The study used a pre-registered vignette survey experiment to test the impact of class-based targeting on local elected officials' support for a buyout proposal. Because most local elected officials are not likely to be familiar with buyout policy, the survey provided information and opportunity for personal reflection about the wide-ranging impacts of buyouts. When people begin to form opinions about a new public issue or policy question, they typically do so in an environment of competing messages (Chong and Druckman 2007). Exposure to different arguments or frames can motivate more conscious consideration in opinion formation (Druckman 2004). Research on deliberative democracy has demonstrated that internal reflection about arguments related to an issue contributes to changes in opinion and policy knowledge, sometimes to an even greater degree than the discussion stage of a deliberative process (Esterling et al. 2011; Goodin and Niemeyer 2003; Luskin et al. 2002). Although politicians may be more directionally motivated than members of the mass public in how they process new information (Baekgaard et al. 2019), individual reflection is nonetheless a critical part of collective policy learning (Heikkila and Gerlak 2013). To the extent possible within the limitations of a single survey, the design simulated the competing messages environment that would exist in communities as they consider a buyout proposal.

Figure 1 illustrates the experimental design. The survey presented a vignette, displayed in figure 2, introducing the concept of buyouts and outlining a buyout request from a group of homeowners who had experienced repeated flooding. The buyout would be funded primarily from a state program and, consistent with HMGP requirements, would require a 25% local match. In the experimental element of the vignette, respondents were randomly assigned to learn that the request had come from low-income homeowners (33 percent of respondents), wealthy homeowners (34 percent), or homeowners not identified by income (33 percent). Wording of the vignette was otherwise identical, and respondents were asked their likelihood of supporting the buyouts. In order to elicit responses based on respondents' attitudes about the recipient homeowners, rather than the direct cost of the program, the vignette specified an identical thirty-year cost recovery period across all conditions. It also stated that homeowners were requesting the buyout, so that assumptions about buyout recipients' consent would not confound the results.

Following the vignette, the survey displayed lists of benefits and drawbacks to buyouts, asking respondents to rate the importance of each. These questions provided the opportunity for learning and reflection about the impacts of buyouts on recipients, other homeowners, and the broader community. Considerations included on each list came from the literature on property buyouts (for example, BenDor et al. 2020; Environmental Law Institute and University of North Carolina-Chapel Hill 2017; Koslov 2016; Ruppert et al. 2018; Siders 2019) and were presented in randomized order. Although the intent was to balance the number, complexity, and strength of considerations across the two lists, a buyout program's direct costs is likely to be the strongest consideration in its availability and accessibility to local elected officials and in their ability to apply the consideration to an unfamiliar policy (Chong and Druckman 2007). After rating the importance of each benefit and drawback, respondents were asked again about their likelihood of supporting the local cost share for the buyout in a question that repeated the identity of recipients as wealthy or low-

Figure 1. Experimental Design



Source: Author's diagram.

income for those respondents assigned to a treatment group.

The survey was conducted by CivicPulse, a nonprofit organization that maintains comprehensive lists of US government officials and their publicly available contact information for the purpose of conducting surveys on government issues. For this survey, CivicPulse invited a random sample of township, municipal, and county elected officials to participate. A total of 616 elected officials responded. Results are reported for the 435 respondents who received the same survey instrument.¹ To protect respondents' confidentiality, CivicPulse did not provide their specific jurisdictions in the data release, sharing only the terciles that a respondent's jurisdiction fall into for population, urbanicity, education, and county-level presidential vote. I used these terciles in my analyses, but could

not introduce additional covariates specific to an officeholder or a jurisdiction, such as data on local buyout history or hazard exposure.

Online appendix table A.1 reports descriptive information provided by CivicPulse about the respondents, who come from forty-eight states.² The jurisdictions represented by the local government officials who responded to the survey are somewhat larger and more urban than the averages nationwide, but they are a more representative sample than in most local government research, which typically uses a minimum population threshold when sampling jurisdictions. Demographic characteristics of respondents generally conform to what is known about people who run for office. As reported in table A.2, random assignment produced treatment groups that were well-balanced on most personal and jurisdiction characteristics.

1. Respondents randomly selected to receive an additional long survey module on an unrelated topic before the buyouts module were omitted from the analysis in order to remove any bias from selective non-response. For more detail on non-random attrition in this survey, see the supplementary material in Mullin and Hansen (2023).

2. The online appendix can be found at <https://www.rsfjournal.org/content/11/4/254/tab-supplemental>.

Figure 2. Buyout Vignette

Some local governments have used voluntary buyouts to help people whose homes are at risk from flooding or wildfire. Buyouts also can reduce hazards community-wide and save local governments money over the long term by bringing down costs for emergency response and damage to public facilities.

Suppose, after repeated flooding, a group of [low-income/wealthy/–] homeowners in a town or small city requested buyouts from a state program requiring a 25% local cost share. The local cost is expected to be recovered over 30 years based on future savings.

With only this information, how likely or unlikely would you be to support the buyouts?

Source: Author-designed survey vignette.

Two survey questions measured respondents' perceptions about risks to their own communities from extreme weather events. Aggregate responses to these questions appear in figure 3. When asked about their level of concern about risks from flood, wildfire, and other extreme events over the next twenty years, elected officials exhibited a good deal of variation in their responses. The modal response was slight concern, but over a quarter indicated that they were very or extremely concerned. Respondents were also asked about the percentage of properties in their communities that they expected would be damaged by extreme events over twenty years. The mean response was 16 percent of properties, and less than 4 percent of respondents expected no properties to be damaged. Analyses in table A.3 reveal lower levels of concern among Republicans (relative to independents and Democrats), elected officials in the Midwest, and city officials (relative to county). Damage expectations were highest among Democrats and female elected officials, and lowest among those in the Midwest.

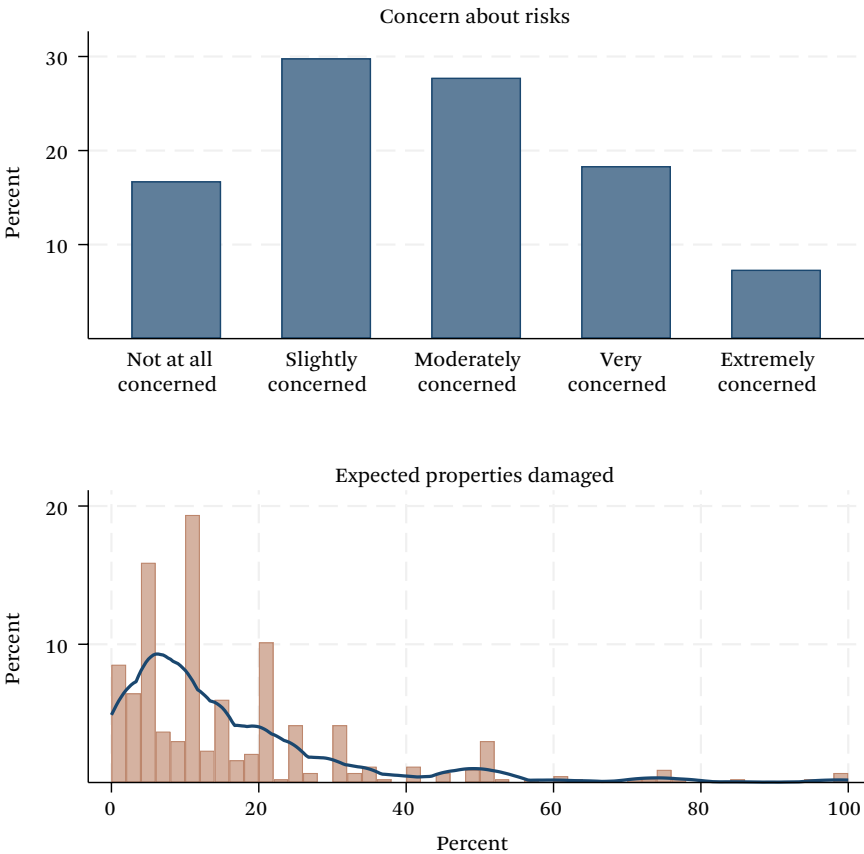
The survey was in the field from April 2 to May 14, 2020—during the early weeks of the COVID-19 lockdown, and before George Floyd's murder sparked widespread protests spotlighting racial inequality. While the epidemic and associated lockdowns may have contributed over time to higher levels of sensitivity toward people with low incomes, evidence from an unrelated panel survey shows that Americans' mean support for economic inequality and inequality-oriented government policies had not changed in May 2020 from a year prior (Wiwad et al. 2021). Because buyout policy is less directly tied to inequality than the policies examined in that

study, as well as less familiar to most respondents, attitudes reported here should be similarly consistent with attitudes prior to the emergence of COVID-19. How well the survey represents current attitudes is less clear. Over the five years since this survey was conducted, the United States experienced an average of twenty-three \$1 billion weather and climate disaster events per year, a rate more than double that of the decades prior to 2020 (NOAA 2025). Rising public attention to these climate risks and the growing visibility of environmental justice on the national political agenda may contribute to even stronger preferences among local officials for policy that supports economically disadvantaged people in confronting climate impacts. These preferences may also be more divided than at the time of the survey, reflecting the growth in partisan polarization that has coincided with rising attention to environmental justice and climate risks (Egan and Mullin 2024).

RESULTS

Elected officials' overall responses to the buyouts vignette, aggregated across experimental conditions, appear in figure 4. Unsurprisingly for a complex policy choice in an unfamiliar domain, some respondents reported that they would be neither likely nor unlikely to support the described buyouts. However, over two-thirds provided a directional response, with a majority of these (62 percent) indicating when first asked that they would be unlikely or very unlikely to support the buyouts. After respondents spent time learning and reflecting about the advantages and disadvantages of voluntary buyouts, opposition increased. With the support

Figure 3. Concern About and Perceptions of Risk to Community from Extreme Events over Twenty Years



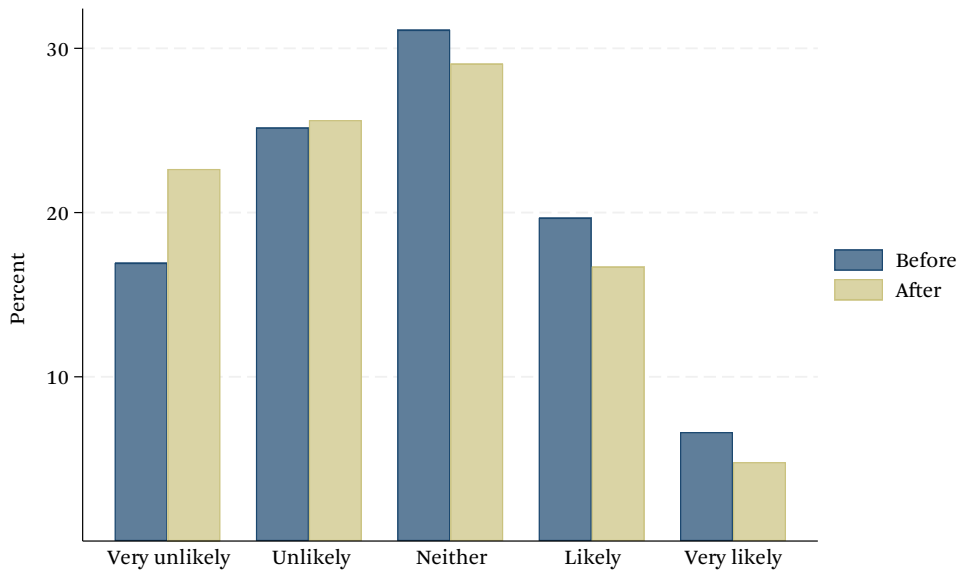
Source: Survey responses to the questions, “Turning to your own community, how concerned, if at all, are you about risks from flood, wildfire, or other extreme natural events over the next 20 years?” [top] and “If you had to guess, approximately what percentage of properties in your community will be damaged by flood, wildfire, or another extreme natural event within the next 20 years?” [bottom].
Note: $N = 435$.

scale scored 0-1, the mean score declined by 0.05, a statistically significant difference ($p < .001$) driven mostly by an increase in those very unlikely to support the buyout.

Effects of Targeting on Buyout Support

Results from the targeting experiment appear in figure 5. Effect estimates are from OLS regressions with robust standard errors, controlling for covariates specified in the study’s pre-analysis plan (partisanship and education of the respondent, and population size and government type of the jurisdiction). As shown in

the top panel of figure 5, elected officials initially were more likely to support buyouts when they were targeted for low-income homeowners. Support also was higher for low-income targeting than for targeting to the wealthy, consistent with a pre-registered hypothesis about the directional effect of class targeting. Specifying recipients as low-income increased buyout support by 0.07 points on the 0-1 outcome scale, an effect that is modest in size but significant. Targeting buyouts to wealthy homeowners had no effect on buyout support. In combination, attaching a class identifier to the buyout recipients had no

Figure 4. Likelihood of Supporting Buyout, Before and After Presentation of Benefits and Drawbacks

Source: Survey responses to the vignette, aggregated across treatment and control groups.

Note: $N = 435$.

effect on initial buyout support, counter to my pre-registered hypothesis that elected officials would be more likely to support buyouts when the policy was portrayed in more universal terms and recipients were not specified as wealthy or low-income.

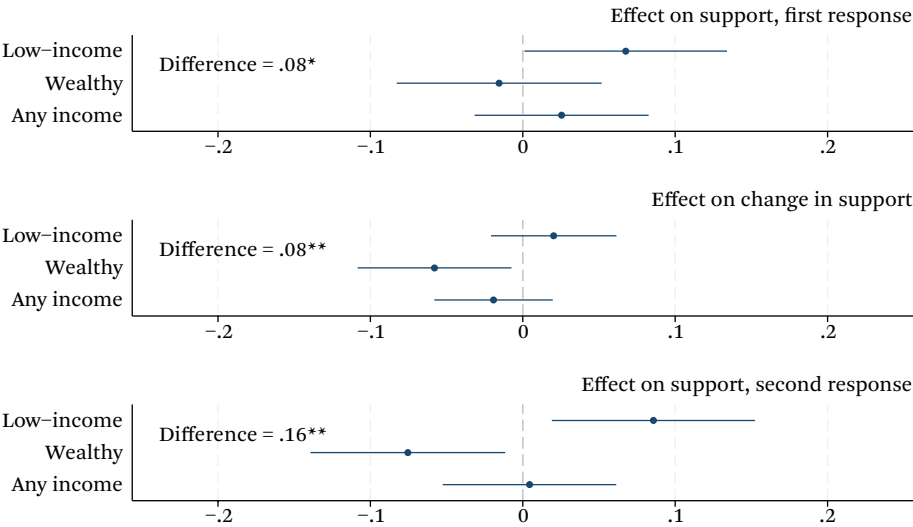
The second panel of figure 5 shows the effect of targeting on change in support after reflection about the advantages and disadvantages of buyouts. Although all respondents were exposed to the same arguments for and against buyouts, expectations about who would receive the buyouts could have influenced how respondents interpreted and processed those arguments. Results show that the decline in support for a buyout proposal after consideration of balanced arguments is concentrated among those faced with a proposal to buy out wealthy homeowners. Exposure to buyout considerations slightly increased buyout support for low-income homeowners while significantly reducing support targeted to wealthy homeowners, counter to a pre-registered hypothesis. The bottom panel shows that after reflection, elected officials clearly favored buyouts to a greater degree for low-income recipients, and to a lesser

degree for wealthy recipients, than for homeowners not identified with a class marker. Between the two groups with class identifiers, support was 0.16 points higher for low-income recipients as compared to wealthy recipients, a difference of more than half a standard deviation in the outcome. As a comparison, the effect of targeting buyouts to low-income rather than wealthy homeowners was approximately the same size as the difference in overall buyout support between Democratic and Republican officeholders.

Effects of Targeting on Buyout Considerations

To understand the mechanisms producing a preference for buyouts that target low-income homeowners, I examined responses to substantive arguments about the benefits and drawbacks of buyouts. Response distributions on the importance of these considerations appear in figure 6. The items are highly intercorrelated, especially for buyback benefits; on average, respondents did not draw large distinctions in the importance of different benefits. Those seen as most important were community-level ben-

Figure 5. Effects of Class Targeting on Buyout Support, Before and After Presentation of Benefits and Drawbacks



Source: Survey responses to the vignette.

Note: Estimates from OLS models presented in online appendix tables A.5–A.7. $N = 405$.

* $p < .05$; ** $p < .01$ (two-tailed)

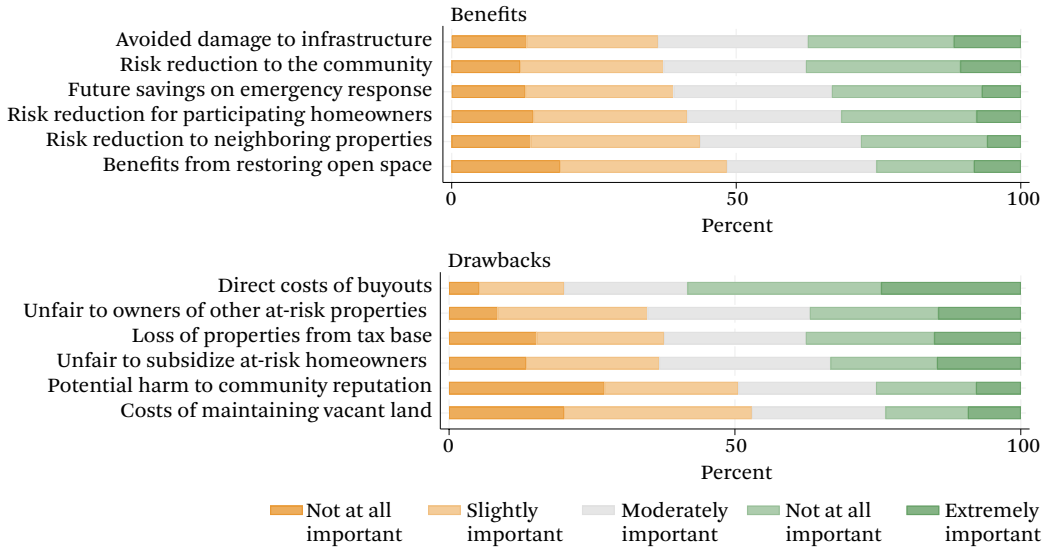
efits, especially those with fiscal effects like avoided infrastructure damage and savings on emergency response. Respondents attached slightly less importance to risk reduction for immediate recipients or their neighbors. Among drawbacks, the direct cost of buyouts was clearly the overriding consideration for elected officials. Concern about fairness to other at-risk property owners and loss of properties from the tax base also resonated for respondents. Whether framed as a benefit or drawback, the use of vacated land lagged behind other considerations.

Figure 7 displays the effects of class targeting on the importance that respondents attached to these various considerations. Overall, targeting did not have a sizable impact on how respondents perceived the benefits and drawbacks of buyouts. For several of the arguments about buyout benefits, any specification about the policy’s beneficiaries increased the perceived importance of the benefit, regardless of whether the beneficiaries were specified as wealthy or low-income. Any form of policy targeting may have made it easier for respondents to visualize how these benefits would manifest in their own communities, but responses did not meaning-

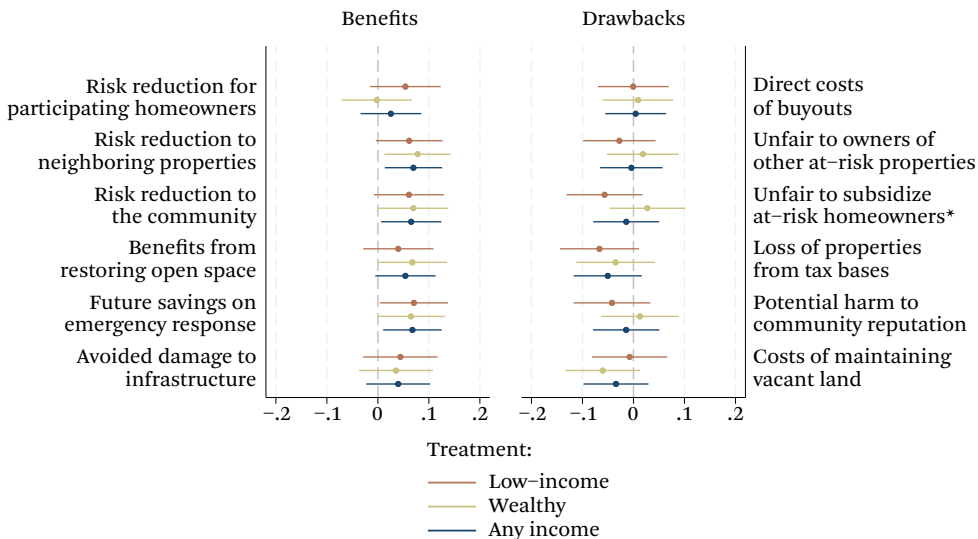
fully diverge based on the class identity of recipients.

Among drawbacks, the absence of any treatment effect on the importance of direct costs is notable, because it provides assurance that results are not attributable to expectations about program cost. If respondents were withholding support for buyouts under the wealthy homeowner condition out of concern about cost, then buyout cost should be a more important consideration for those respondents. Instead, their concern is equal to those considering buyouts for low-income or unspecified homeowners, suggesting that considerations other than cost are likely driving the difference in buyout support across class recipients.

Among all stated policy benefits and drawbacks, only the argument about unfairness in subsidizing at-risk homeowners generated significantly different responses between the two treatment groups. Unfairness was deemed a more important consideration when buyouts were targeted to wealthy homeowners. Although the substantive effect size is small, this result suggests that politicians’ responses to a buyout proposal are rooted partly in their beliefs about fairness.

Figure 6. Importance of Buyout Benefits and Drawbacks

Source: Survey responses to the questions, “Local officials have discussed a variety of possible benefits and drawbacks to voluntary buyouts. In thinking about your own views on the issue, how important or unimportant are each of the following benefits of voluntary buyouts?” [top] and “How important or unimportant to you are each of the following drawbacks of voluntary buyouts?” [bottom].

Figure 7. Effects of Class Targeting on Importance of Buyout Benefits and Drawbacks

Source: Survey responses to questions about buyout benefits and drawbacks.

Note: Estimates from seemingly unrelated regression models presented in online appendix table A.8 and A.9. Difference between treatment group coefficients significant at * $p < .05$; ** $p < .01$ (two-tailed).

Differences in Targeting Effects Across Officeholders

To further explore officeholders' motivations, I tested the heterogeneous effects of buyout targeting across respondents' personal political attributes, constituency characteristics, and perceptions of risk in their own communities. Personal attributes included three political considerations and predispositions: the respondent's self-reported partisanship, whether they faced an opponent in the previous election, and their ambition to run for higher office. Constituency characteristics included demographic composition of the respondent's locality and partisan composition of the county. Perceptions of risk were measured with the two questions reported in figure 3. Tests for heterogeneity included interactions between these attributes and treatment, first for each of the two targeting treatments separately, and then with the two class treatments combined together for a single measure of targeting.

Overall, respondents' personal political considerations do not seem to play a role in explaining their preference for buying out the properties of low-income, rather than wealthy, homeowners (table A.10). Across partisanship, the competitive context of an incumbent's own seat, and their plans for future officeholding, the two class targeting treatments had similar effects. Democrats more strongly support buyout proposals overall, but they are not differentially responsive to the identity of buyout recipients. Targeting of any kind reduces buyout support among Democrats and Republicans more than among independent officeholders, but this result is only weakly significant. The results also lend no support for two pre-registered hypotheses that any form of targeting would have a larger effect on politicians experiencing electoral pressure because of their ambition for higher office or the competitiveness of their current seat. In fact, those who did not intend to run for higher office were the most responsive to targeting, though there is considerable uncertainty around that result because of the small portion of the sample (7.5 percent) in the category of "not ambitious" based on the survey's question wording (online appendix B).

Elected officials may be influenced more by the composition of their communities than by

their own political predispositions in responding to the vignette. Controlling for other political and community characteristics (table A.11), the partisanship of a respondent's home county has the strongest association with their response to the vignette. Elected officials representing more Democratic areas were more favorable to buyouts designated with any class identifiers, and especially those designated for low-income households. Although the variable for partisanship is measured at the county level rather than for the specific municipalities where most respondents serve, the result may reflect responsiveness to constituency preferences for more redistributive policy, consistent with other findings of policy responsiveness in local government settings (Tausanovitch and Warshaw 2014). Combined with the results on buyout considerations, the targeting of buyouts for low-income households may reflect a concern about fairness that is more prevalent in more strongly Democratic communities. This result is not decisive, however, considering the mismatch in measurement scale and the multiple tests (with mostly null results) conducted in the heterogeneity analysis.

Finally, the tests offer no evidence that the effects of targeting differ across local officials based on their level of concern about or expectations for impacts of extreme events in their own communities. Consistent with a pre-registered hypothesis, risk concern is associated with higher overall support for buying out properties from willing owners; a shift in concern from the minimum to the maximum value is associated with a 0.14-point increase in support for the buyout proposal. The test of a hypothesized relationship between damage expectations and buyout support produced a null result (table A.4). Neither concern nor expectations about damage is related to the class-based treatment effects (table A.12). Whether or not a policymaker anticipates that they may face a buyout decision does not seem to affect their attitudes about who should benefit from the policy.

DISCUSSION

As climate impacts become more visible and widespread, local governments are coming under growing pressure to take actions that protect lives and property. In some cases, the decision

is about protecting residents in place through the construction of physical infrastructure. In others, the decision is to reduce exposure through regulation that controls development in risky locations. Where residents are already exposed and protection in place is not viable, the decision is to help people relocate out of harm's way. Managed retreat is attracting more attention as a growing number of states and cities develop programs for voluntary buyouts, even in the absence of federal financial assistance.

This article offers evidence about local elected officials' support for managed retreat. The broadly representative survey was conducted in the absence of a pressing hazard or event that would bring buyouts to the top of a local agenda. Instead, it presented a typical scenario and balanced policy arguments to encourage deliberate reflection on a topic that, in many settings, can prompt resistance and heated debate (Bragg et al. 2021). Results indicate that even outside a setting where buyouts might be considered in the short term, buyouts were not immediately popular among elected officials, and deeper consideration increased opposition to a buyout proposal. Opposition was particularly strong, especially after consideration, for buyouts of properties of wealthy homeowners.

When asked directly about their concerns related to buyouts, the leading concern for politicians was the direct financial cost. Because cost concerns were no higher among those considering buyouts for wealthy homeowners than among those presented with a proposal for low-income or unspecified homeowners, the direct cost of the buyout proposal seems not to be the primary driver of differences in support in this survey. In the real world, the importance of cost cannot be ignored. Since the time of this study, buyouts of high-value properties have been undertaken, but with unusual conditions that minimize taxpayer support. In the coastal North Carolina community of Rodanthe, oceanfront properties that had received national press coverage for the public hazard created as they collapsed into the sea finally were removed in 2023 through buyouts funded from the federal Land and Water Conservation Fund, which invests earnings from offshore oil and gas leases. In 2024, the southern California coastal city of Ran-

cho Palos Verdes obtained a commitment for \$42 million in FEMA HMGP funds for voluntary buyouts of less than two dozen high-value properties being destroyed by landslides. The 25 percent local match is being borne by property owners—a departure from the provision of pre-disaster fair market value under other HMGP-funded programs—while the city pays only certain in-kind costs. In both contexts, covering even a 25 percent share of buyouts for all the high-value properties on the verge of collapse may be a fiscal impossibility for local government. It may also defy decision-makers' ideas of fairness, which the survey demonstrated to be an important consideration when buyouts were targeted to the wealthy.

The vignette experiment has limitations. On the one hand, it is overly general, ignoring the specifics of any community context. On the other hand, it is overly specific, with responses that apply only to the language of the vignette. Responses are first (and second) impressions, about a policy that may not be relevant in many respondents' communities. Although the survey was designed to encourage reflection, it cannot capture opinion change that would occur after a community conversation. Future work could be designed to test explanations of local officials' preferences in more depth and explore attitudes toward buyouts of less willing property owners.

Even with these limitations, the study offers a glimpse of the complex interplay between local inequality and political response to climate risk. If treated as a redistributive policy, property buyouts may help mitigate the gap in adaptive capacity across income groups. Poorer households have fewer options for hardening their homes against natural hazards or finding buyers for properties they want to leave. Buyouts can provide an exit option for those who lack financial flexibility to reduce their vulnerability through other means. Yet while buyouts offer an option to those who feel trapped, inequities persist through migration and resettlement. After a buyout, property owners from less-wealthy neighborhoods resettle farther from their old homes and from one another, disrupting structures of social support (Elliott et al. 2023). Meanwhile, those with more privilege often relocate through market means to safer

housing in more affluent neighborhoods (see Elliott et al. 2026, this volume). Buyouts must also be considered as part of the full package of local government actions to protect communities from climate risk. In other areas of adaptation policy, patterns of privilege continue to be replicated. Local governments are more likely to plan for flood risks when those risks are concentrated in high-income neighborhoods (Buntaine et al. 2025), and they make investments in protective infrastructure that ultimately allow the wealthy to adapt in place (Mullin et al. 2019). In combination, the consequences of local decision-making may be to relocate people with the most economic need, even as localities continue to protect remaining property owners.

REFERENCES

- Albright, Elizabeth A., and Desera A. Crow. 2015. "Learning in the Aftermath of Extreme Floods: Community Damage and Stakeholder Perceptions of Future Risk." *Risk, Hazards & Crisis in Public Policy* 6(3): 308–28.
- Baekgaard, Martin, Julian Christensen, Casper Mondrup Dahlmann, Asbjørn Mathiasen, and Niels Bjørn Grund Petersen. 2019. "The Role of Evidence in Politics: Motivated Reasoning and Persuasion Among Politicians." *British Journal of Political Science* 49(3): 1117–40.
- Bartels, Larry M. 2016. *Unequal Democracy: The Political Economy of the New Gilded Age*. Princeton University Press.
- BenDor, Todd K., David Salvesen, Christian Kamrath, and Brooke Ganer. 2020. "Floodplain Buyouts and Municipal Finance." *Natural Hazards Review* 21(3): 04020020.
- Binder, Sherri Brokopp, and Alex Greer. 2016. "The Devil Is in the Details: Linking Home Buyout Policy, Practice, and Experience After Hurricane Sandy." *Politics and Governance* 4(4): 97–106.
- Binder, Sherri Brokopp, Alex Greer, and Elyse Zavar. 2020. "Home Buyouts: A Tool for Mitigation or Recovery?" *Disaster Prevention and Management: An International Journal* 29(4): 497–510.
- Boustan, Leah Platt, Matthew E. Kahn, Paul W. Rhode, and Maria Lucia Yanguas. 2020. "The Effect of Natural Disasters on Economic Activity in US Counties: A Century of Data." *Journal of Urban Economics* 118: 103257.
- Bragg, Wendy Karen, Sara Tasse Gonzalez, Ando Rabearisoa, and Amanda Daria Stoltz. 2021. "Communicating Managed Retreat in California." *Water* 13(6): 1–18.
- Buntaine, Mark, Matthew Barnett, and Sara Hughes. 2025. "Floods and Fairness: How Politics Drives Unequal Exposure to Climate Change." SSRN <https://ssrn.com/abstract=5519038> or <http://dx.doi.org/10.2139/ssrn.5519038>.
- Carnes, Nicholas, and John Holbein. 2019. "Do Public Officials Exhibit Social Class Biases When They Handle Casework? Evidence from Multiple Correspondence Experiments." *PLOS One* 14(3): 1–9.
- Chakraborty, Jayajit, Timothy W. Collins, and Sara E. Grineski. 2018. "Exploring the Environmental Justice Implications of Hurricane Harvey Flooding in Greater Houston, Texas." *American Journal of Public Health* 109(2): 244–50.
- Chakraborty, Jayajit, Timoty W. Collins, Marilyn C. Montgomery, and Sara E. Grineski. 2014. "Social and Spatial Inequities in Exposure to Flood Risk in Miami, Florida." *Natural Hazards Review* 15(3): 4014006.
- Chong, Dennis, and James N. Druckman. 2007. "A Theory of Framing and Opinion Formation in Competitive Elite Environments." *Journal of Communication* 57(1): 99–118.
- Conrad, David R., Ben McNitt, and Martha Stout. 1998. *Higher Ground: A Report on Voluntary Property Buyouts in the Nation's Floodplains: A Common Ground Solution Serving People at Risk, Taxpayers and the Environment*. National Wildlife Federation.
- Danielson, Michael N. 1976. *The Politics of Exclusion*. Columbia University Press.
- Davies, Ian P., Ryan D. Haugo, James C. Robertson, and Phillip S. Levin. 2018. "The Unequal Vulnerability of Communities of Color to Wildfire." *PLOS One* 13(11): 1–15.
- de Vries, Daniel H., and James C. Fraser. 2012. "Citizenship Rights and Voluntary Decision Making in Post-Disaster U.S. Floodplain Buyout Mitigation Programs." *International Journal of Mass Emergencies and Disasters* 30(1): 1–33.
- Diezmartínez, Claudia V., and Anne G. Short Gianotti. 2022. "US Cities Increasingly Integrate Justice into Climate Planning and Create Policy Tools for Climate Justice." *Nature Communications* 13: 5763.
- Druckman, James N. 2004. "Political Preference Formation: Competition, Deliberation, and the

- (Ir)Relevance of Framing Effects." *American Political Science Review* 98(4): 671–86.
- Dundon, Leah A., and Janey S. Camp. 2021. "Climate Justice and Home-Buyout Programs: Renters as a Forgotten Population in Managed Retreat Actions." *Journal of Environmental Studies and Sciences*.
- Egan, Patrick J., and Megan Mullin. 2024. "US Partisan Polarization on Climate Change: Can Stalemate Give Way to Opportunity?" *PS: Political Science & Politics* 57: 30–35.
- Einstein, Katherine Levine, David M. Glick, and Maxwell Palmer. 2019. *Neighborhood Defenders: Participatory Politics and America's Housing Crisis*. Cambridge University Press.
- Elliott, James R., Phylicia Lee Brown, and Kevin Loughran. 2020. "Racial Inequities in the Federal Buyout of Flood-Prone Homes: A Nationwide Assessment of Environmental Adaptation." *Socius: Sociological Research for a Dynamic World* 6: 237802312090543.
- Elliott, James R., Kevin Loughran, and Phylicia Lee Brown. 2023. "Divergent Residential Pathways from Flood-Prone Areas: How Neighborhood Inequalities Are Shaping Urban Climate Adaptation." *Social Problems* 70: 869–892.
- Elliott, James R., Kevin Loughran, A. Alexander Priest, and Phylicia Lee Brown. 2026. "The Revolving Door of Risk: Climate Hazards, Risk Containment, and the Hidden Social Dynamics of Managed Retreat." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 12(4): 34–53. <https://doi.org/10.7758/RSF.2026.12.4.02>.
- Environmental Law Institute, and University of North Carolina-Chapel Hill. 2017. *Floodplain Buyouts: An Action Guide for Local Governments on How to Maximize Community Benefits, Habitat Connectivity, and Resilience*. Environmental Law Institute.
- Esterling, Kevin M., Michael A. Neblo, and David M. J. Lazer. 2011. "Means, Motive, and Opportunity in Becoming Informed About Politics: A Deliberative Field Experiment with Members of Congress and Their Constituents." *Public Opinion Quarterly* 75(3): 483–503.
- Fischel, William A. 2001. *The Homevoter Hypothesis: How Home Values Influence Local Government Taxation, School Finance, and Land-Use Policies*. Harvard University Press.
- Gilens, Martin. 2012. *Affluence and Influence: Economic Inequality and Political Power in America*. Princeton University Press.
- Glaeser, Edward L., and Bryce A. Ward. 2009. "The Causes and Consequences of Land Use Regulation: Evidence from Greater Boston." *Journal of Urban Economics* 65(3): 265–78.
- Goetz, Edward G., and Mara Sidney. 1994. "Revenge of the Property Owners: Community Development and the Politics of Property." *Journal of Urban Affairs* 16(4): 319–34.
- Goodin, Robert E., and Simon J. Niemeyer. 2003. "When Does Deliberation Begin? Internal Reflection Versus Public Discussion in Deliberative Democracy." *Political Studies* 51(4): 627–49.
- Hayes, Thomas J., and Benjamin G. Bishin. 2020. "Do Elected Officials Serve the Poor on Health Care? Evidence from a Field Experiment on Members of Congress and State Legislators." *Social Science Journal* 61(1): 1–17.
- Heikkila, Tanya, and Andrea K. Gerlak. 2013. "Building a Conceptual Approach to Collective Learning: Lessons for Public Policy Scholars." *Policy Studies Journal* 41(3): 484–512.
- Hendricks, Marccus D., and Shannon Van Zandt. 2021. "Unequal Protection Revisited: Planning for Environmental Justice, Hazard Vulnerability, and Critical Infrastructure in Communities of Color." *Environmental Justice* 14(2): 87–97.
- Hornbeck, Richard. 2012. "The Enduring Impact of the American Dust Bowl: Short- and Long-Run Adjustments to Environmental Catastrophe." *American Economic Review* 102(4): 1477–1507.
- Ingram, Helen, Anne L. Schneider, and Peter DeLeon. 2007. "Social Construction and Policy Design." In *Theories of the Policy Process*, edited by Paul A. Sabatier. Westview.
- Keeler, Andrew G., Megan Mullin, Dylan E. McNamara, and Martin D. Smith. 2022. "Buyouts with Rentbacks: A Policy Proposal for Managing Coastal Retreat." *Journal of Environmental Studies and Sciences* 12: 646–51.
- Koslov, Liz. 2016. "The Case for Retreat." *Public Culture* 28(2): 359–87.
- Kraan, Caroline M., Miyuki Hino, Jennifer Niemann, A. R. Siders, and Katharine J. Mach. 2021. "Promoting Equity in Retreat Through Voluntary Property Buyout Programs." *Journal of Environmental Studies and Sciences* 11: 481–92.
- Kreitzer, Rebecca J., and Candis Watts Smith. 2018. "Reproducible and Replicable: An Empirical Assessment of the Social Construction of Politically

- Relevant Target Groups." *PS: Political Science and Politics* 51(4): 768–74.
- Lens, Michael C., and Paavo Monkkonen. 2016. "Do Strict Land Use Regulations Make Metropolitan Areas More Segregated by Income?" *Journal of the American Planning Association* 82: 6–21.
- Loh, Carolyn G., and Rose Kim. 2021. "Are We Planning for Equity? Equity Goals and Recommendations in Local Comprehensive Plans." *Journal of the American Planning Association* 87: 181–96.
- Loughran, Kevin, James R. Elliott, and S. Wright Kennedy. 2019. "Urban Ecology in the Time of Climate Change: Houston, Flooding, and the Case of Federal Buyouts." *Social Currents* 6(2): 121–40.
- Luskin, Robert C., James S. Fishkin, and Roger Jowell. 2002. "Considered Opinions: Deliberative Polling in Britain." *British Journal of Political Science* 32(3): 455–87.
- Mach, Katharine J., Caroline M. Kraan, Miyuki Hino, A. R. Siders, Erica M. Johnston, and Christopher B. Field. 2019a. "Managed Retreat Through Voluntary Buyouts of Flood-Prone Properties." *Science Advances* 5(10): eaax8995.
- Mach, Katharine J., Caroline M. Kraan, Miyuki Hino, A. R. Siders, Erica M. Johnston, and Christopher B. Field. 2019b. "Managed Retreat Through Voluntary Buyouts of Flood-Prone Properties: Supplementary Materials." *Science Advances* 5(10).
- Martinich, Jeremy, James Neumann, Lindsay Ludwig, and Lesley Jantarasami. 2013. "Risks of Sea Level Rise to Disadvantaged Communities in the United States." *Mitigation and Adaptation Strategies for Global Change* 18(2): 169–85.
- McConnell, Kathryn, Elizabeth Fussell, Jack De-Waard, et al. 2024. "Rare and Highly Destructive Wildfires Drive Human Migration in the U.S." *Nature Communications* 15: 6631.
- McConnell, Kathryn, and Liz Koslov. 2024. "Critically Assessing the Idea of Wildfire Managed Retreat." *Environmental Research Letters* 19(4). <https://doi.org/10.1088/1748-9326/ad31d9>.
- Mullin, Megan. 2009. *Governing the Tap: Special District Governance and the New Local Politics of Water*. MIT Press.
- Mullin, Megan, and Katy Hansen. 2023. "Local News and the Electoral Incentive to Invest in Infrastructure." *American Political Science Review* 117(3): 1145–50.
- Mullin, Megan, Martin D. Smith, and Dylan E. McNamara. 2019. "Paying to Save the Beach: Effects of Local Finance Decisions on Coastal Management." *Climatic Change* 152(2): 275–89.
- Nelson, Katherine S., and Michael Molloy. 2021. "Differential Disadvantages in the Distribution of Federal Aid Across Three Decades of Voluntary Buyouts in the United States." *Global Environmental Change* 68: 102278.
- Peterson, Kelsey, Emily Apadula, David Salvesen, Miyuki Hino, Rebecca Kihlsinger, and Todd K. Bendor. 2020. "A Review of Funding Mechanisms for US Floodplain Buyouts." *Sustainability* 12(23): 1–20.
- Peterson, Paul E. 1981. *City Limits*. University of Chicago Press.
- Phillips, Brenda, Patricia Ann Stukes, and Pamela Jenkins. 2012. "Freedom Hill Is Not for Sale—and Neither Is the Lower Ninth Ward." *Journal of Black Studies* 43(4): 405–26.
- Qiang, Yi. 2019. "Disparities of Population Exposed to Flood Hazards in the United States." *Journal of Environmental Management* 232: 295–304.
- Rakow, Lana F., Becky Belter, Heidi Dyrstad, Jodi Hallsten, Jay Johnson, and Keri Indvik. 2003. "The Talk of Movers and Shakers: Class Conflict in the Making of a Community Disaster." *Southern Communication Journal* 69(1): 37–50.
- Rehm, Philipp, Jacob S. Hacker, and Mark Schlesinger. 2012. "Insecure Alliances: Risk, Inequality, and Support for the Welfare State." *American Political Science Review* 106(2): 386–406.
- Revillard, Anne. 2024. "How People Experience Policies: The Study of Policy Reception." In *Handbook of Public Policy Implementation*, edited by Fritz Sager, Céline Mavrot, and Lael R. Keiser. Edward Elgar Publishing.
- Rodon, Toni, and Marc Sanjaume-Calvet. 2020. "How Fair Is It? An Experimental Study of Perceived Fairness of Distributive Policies." *Journal of Politics* 82(1): 384–91.
- Rothstein, Richard. 2017. *The Color of Law: A Forgotten History of How Our Government Segregated America*. Liveright.
- Ruppert, Thomas, John Fergus, and Enio Russe-Garcia. 2018. "Property Buyouts at the Local Level : Seeking Benefits and Limiting Harms." *Environmental Law Reporter* 48: 10520–34.
- Schaffner, Brian F., Jesse H. Rhodes, and Raymond J. La Raja. 2020. *Hometown Inequality: Race, Class,*

- and Representation in American Local Politics.* Cambridge.
- Schneider, Anne, and Helen Ingram. 1993. "Social Construction of Target Populations: Implications for Politics and Policy." *American Political Science Review* 87(2): 334–47.
- Seamster, Louise, and Danielle Purifoy. 2020. "What Is Environmental Racism for? Place-Based Harm and Relational Development." *Environmental Sociology* 7(2): 110–21.
- Siders, A. R. 2019. "Social Justice Implications of US Managed Retreat Buyout Programs." *Climatic Change* 152(2): 239–57.
- Skocpol, Theda. 1991. "Targeting within Universalism: Politically Viable Policies to Combat Poverty in the United States." In *The Urban Underclass*, edited by Christopher Jencks, and Paul E. Peterson. Brookings Institution.
- Tausanovitch, Chris, and Christopher Warshaw. 2014. "Representation in Municipal Government." *American Political Science Review* 108(3): 605–41.
- Trounstein, Jessica. 2018. *Segregation by Design: Local Politics and Inequality in American Cities.* Cambridge University Press.
- Ueland, Jeff, and Barney Warf. 2006. "Racialized Topographies: Altitude and Race in Southern Cities." *Geographical Review* 96(1): 50–78.
- US Environmental Protection Agency. 2021. "Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts." US Environmental Protection Agency. September.
- Whittemore, Andrew H. 2021. "Exclusionary Zoning: Origins, Open Suburbs, and Contemporary Debates." *Journal of the American Planning Association* 87: 167–80.
- Wiwad, Dylan, Brett Mercier, Paul K. Piff, Azim Shariff, and Lara B. Aknin. 2021. "Recognizing the Impact of COVID-19 on the Poor Alters Attitudes Towards Poverty and Inequality." *Journal of Experimental Social Psychology* 93: 104083.
- Woodruff, Sierra C, Megan Mullin, and Malini Roy. 2020. "Is Coastal Adaptation a Public Good? The Financing Implications of Good Characteristics in Coastal Adaptation." *Journal of Environmental Planning and Management* 63(12): 2082–101.
- Wright, Gerald C., and Elizabeth Rigby. 2020. "Income Inequality and State Parties: Who Gets Represented?" *State Politics and Policy Quarterly* 20(4): 395–415.

