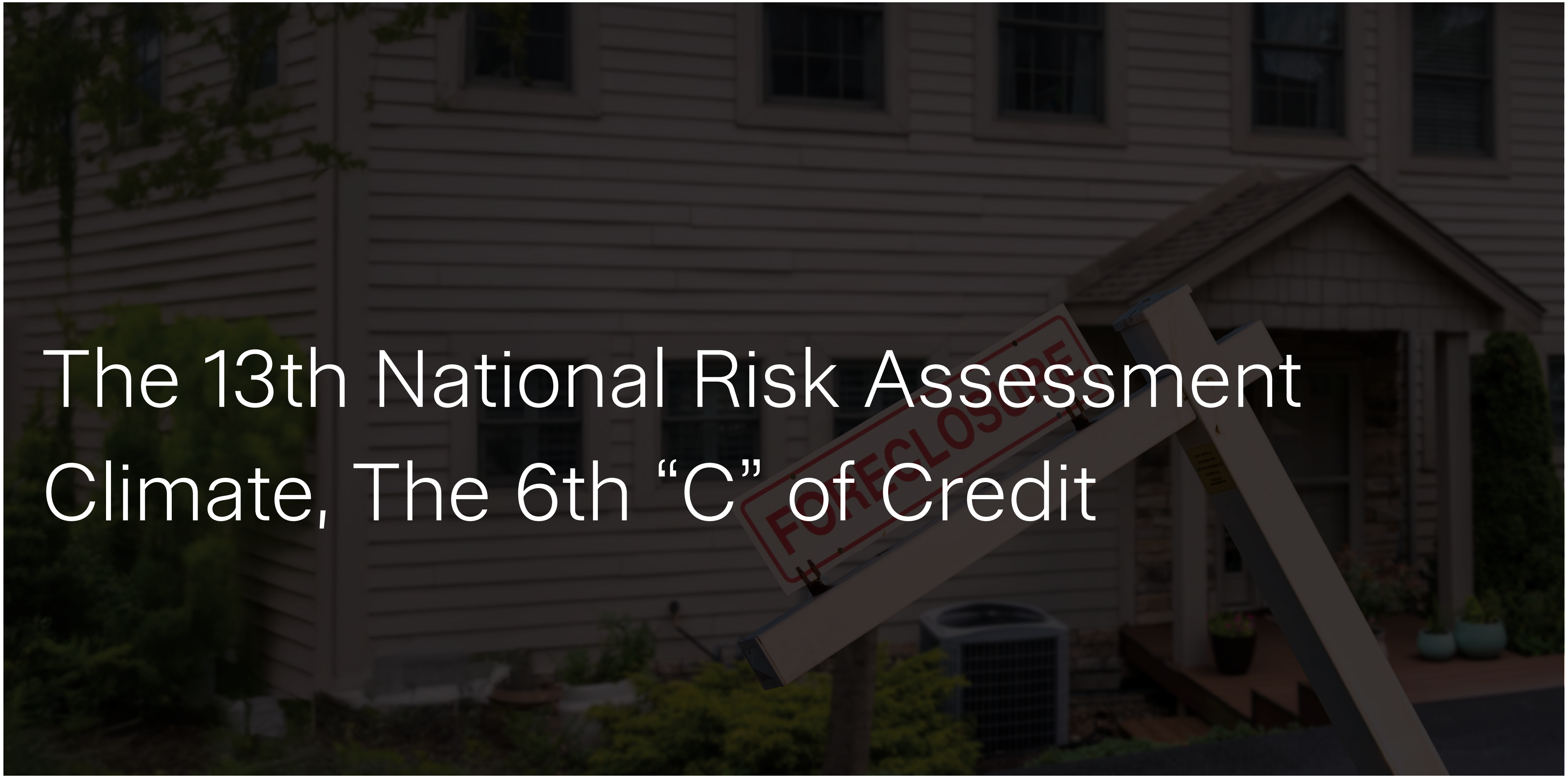
First Street

The 13th National Risk Assessment Climate, The 6th “C” of Credit



THE STANDARD FOR CLIMATE RISK FINANCIAL MODELING

FOR ALMOST A DECADE, FIRST STREET HAS EMPOWERED GOVERNMENTS, LEADING FINANCIAL INSTITUTIONS, TOP ASSET OWNERS, AND GLOBAL CORPORATIONS TO ASSESS, ANALYZE, AND ACT ON CLIMATE RISK WITH CONFIDENCE, GENERATING OUTSIZED RETURNS.

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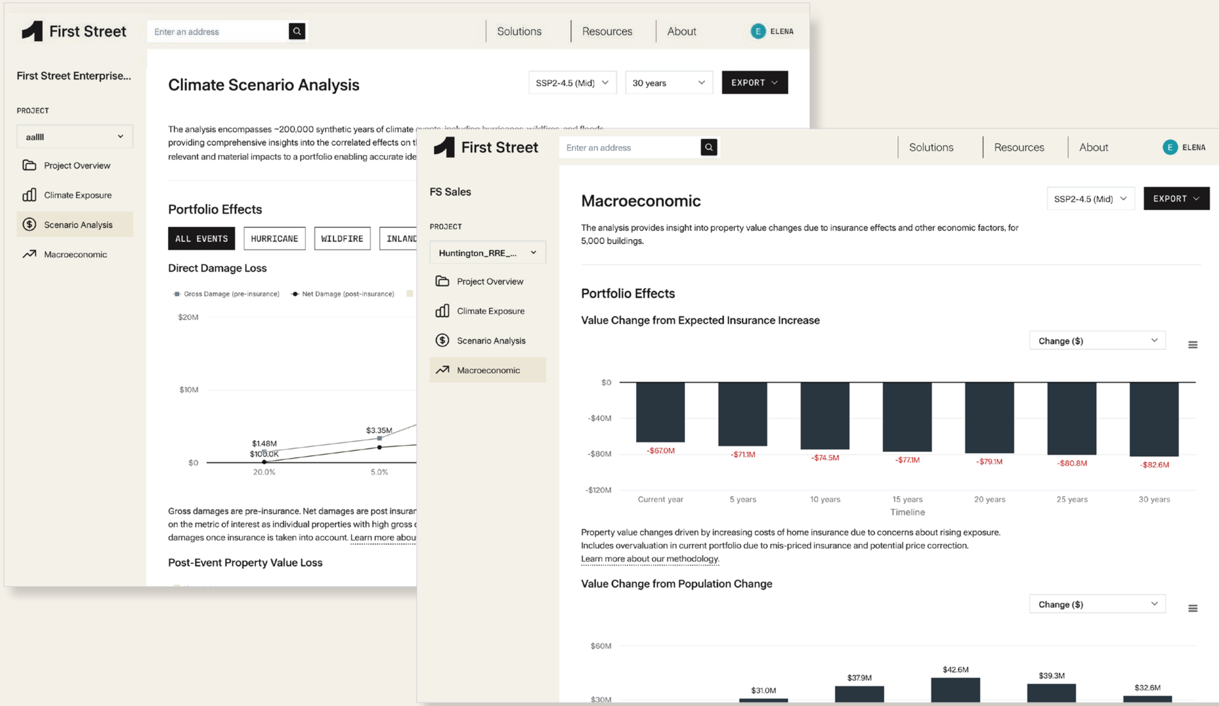

NOW TAKEN TO THE NEXT LEVEL WITH THE FIRST STREET ENTERPRISE SUITE

HIGH RESOLUTION MODELS FOR ACCURATE BUILDING LEVEL IMPACT

Our physics-based climate risk models provide actionable insights into exposure, damages, and downtime for any building or location. Covering a comprehensive range of climate hazards—including the most critical hazards of flood, wind, and wildfires—we deliver accurate data for today and decades into the future.

PORTFOLIO MITIGATION AND RESILIENCE

Identify and prioritize which assets to address with adaptation and mitigation projects - with peril-specific insight into potential damage and downtime, and the ROI that can be achieved from mitigation investments.

First Street gives you the data you need to drive climate-informed investment and underwriting decisions - maximising your individual asset and portfolio risk-adjusted return.

GROUNDBREAKING CORRELATED-RISK CATASTROPHE MODEL

Assess the financial tail risk of your portfolio with our innovative catastrophe model, uniquely designed to account for correlated risks across multiple severe climate events that could happen in a given year.

MACROECONOMIC INSIGHTS

Leverage our macroeconomic module to understand the broader implications of climate risk. See how climate-driven migration, rising insurance premiums, and local economic shifts will impact asset values, GDP, and the Home Price Index (HPI). Know where to invest and where to divest.

CORPORATE-LEVEL CLIMATE RISK ASSESSMENT

Evaluate entire companies with on-demand reports that provide a comprehensive view of climate risk across their operations allowing you to invest with confidence.

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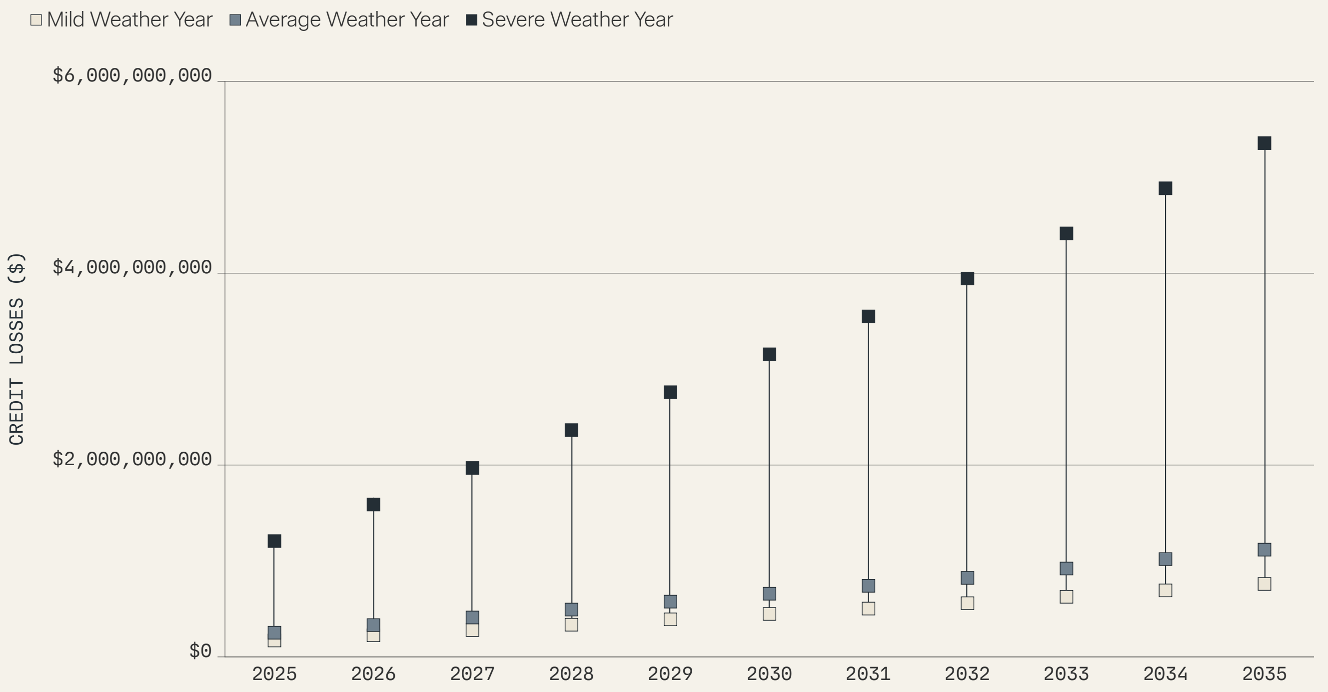
Executive Summary

Mortgage lenders have long depended on homeowners insurance as a first line of defense against loan losses, requiring coverage as a condition of mortgage approval. Historically, this arrangement has held strong: extreme-weather damage has consistently been the costliest category of homeowners insurance claims and lenders have remained largely unscathed. But as U.S. disaster costs have climbed exponentially, that protective layer is fraying. Rising premiums and the withdrawal of insurers are tightening access to wind and wildfire coverage, while a persistent gap in flood insurance leaves many exposed. As the insurance industry shifts the growing costs of climate disasters onto homeowners, the financial stability of borrowers and the performance of their mortgages are increasingly at risk. In the most severe cases, this escalating burden can ultimately lead to foreclosure.

First Street's 13th National Risk Assessment—the first national-scale analysis of the relationship between physical climate risk and mortgage defaults—uncovers the extent of foreclosures following wildfire, wind, and flooding events. The results showcase that flooding events emerge as the primary driver of post-disaster foreclosures among perils, particularly when they occur outside FEMA's Special Flood Hazard Areas (SFHAs), where flood insurance is not mandatory. Across analyzed flood events, damaged properties outside of SFHAs experience foreclosure increases averaging 51.8 percentage points more than similar, damaged properties within SFHAs.

Indirect economic pressures, such as those felt during the 2008 financial crisis, further amplify these risks. An analysis of properties impacted by Hurricane Sandy (2012) shows that home prices had declined annually by 14% over the five years preceding the hurricane, eroding borrowers' home equity. The combination of depressed home prices, lower equity, and flooding impacts led to a spike in foreclosures among damaged and flood-affected properties following Sandy. These factors produced "hidden" credit losses to banks, with Sandy resulting in $68 million in unanticipated unpaid principal and interest—equivalent to $34 million in credit losses under a 50% loss-given-default assumption—that conventional credit-risk models failed to capture, highlighting the need to include Climate Risk as the 6th "C" of a standard credit risk modeling framework.

PROJECTED ANNUAL CREDIT LOSS POTENTIAL FROM MILD TO SEVERE WEATHER YEARS, 2025-2035



First Street has projected that the combined effects of direct disaster impacts and indirect economic pressures could result in up to $1.2 billion in credit losses from severe weather events by 2025, rising sharply to $5.4 billion by 2035. This growing share of foreclosure losses is largely driven by the escalating insurance crisis and the increasing frequency and severity of flooding anticipated in the coming decade. These findings emphasize that physical climate risk has become the sixth "C" of credit assessment—a critical factor to be evaluated alongside traditional metrics such as character, capacity, capital, collateral, and conditions. Furthermore, by including high resolution climate risk data, mortgage lenders could avoid "hidden credit risk" losses in their portfolios."

Key Takeaways

1. **CLIMATE HAS BECOME THE 6TH "C" OF CREDIT**
Given climate risk's already substantial contribution to credit losses today and its projected growth into the future, lenders must consider climate as the sixth "C" of the core credit risk assessment factors alongside the traditional elements of character, capacity, capital, condition and collateral.

2. **CLIMATE-DRIVEN CREDIT LOSSES COULD COST BANKS BILLIONS**
In a severe-weather year, projected annualized climate-driven foreclosures could inflict $1.21 billion in bank losses in 2025 (about 6.7 percent of all foreclosure credit losses) and, as weather events grow more frequent and intense, direct impacts and resulting premium increases could rise credit losses to $5.36 billion (nearly 30 percent of foreclosure losses) by 2035.

3. **NATURAL DISASTERS' ESCALATING FINANCIAL TOLL**
Climate-related events are drastically increasing economic losses, with annual costs surging 1,580% over the last four decades. This surge is fundamentally altering risk assessment for households, financial institutions, and investment portfolios by eroding income and driving losses.

4. **INSURANCE INDUSTRY BEARING AND SHIFTING BURDEN**
The insurance industry faces a growing financial load from extreme weather (insurers reported $546.2 billion in losses in 2023), leading to climbing premiums and insurer retreat from high-risk areas. This is resulting in insurance gaps and increased borrower exposure to financial and physical climate impacts.

5. **FLOOD RISK HIGHLIGHTS SYSTEMIC FRAGILITY**
Flood events, despite programs like the National Flood Insurance Program (NFIP), expose significant protection gaps and rising costs (average NFIP claims up 223% since early 2000s despite the $250K structural limit remaining unchanged), increasing risks for mortgage lenders and investors in mortgage-backed securities and challenging the financial system's assumption of stability.

6. **HOUSEHOLDS ABSORBING INCREASED CLIMATE RISK**
As insurance becomes more expensive and less accessible, households with limited savings (personal savings at 4.6% of disposable income in 2024) are forced to absorb more climate risk. This shift increases the chances of missed payments and loan defaults, while also decreasing real estate investment performance due to reduced demand and declining property values.

7. **FLOODS ARE THE LEADING DRIVER OF FORECLOSURE AMONG PERILS**
Properties flooded in an extreme weather event face a 0.29-percentage-point higher foreclosure rate than nearby, unflooded homes—which historically translates to an average 40% surge in post-flood foreclosures among damaged homes across events analyzed.

8. **WIND AND WILDFIRE DAMAGES ARE INSURED, BUT RISING PREMIUMS DRIVE INDIRECT FORECLOSURE RISK**
Properties with wildfire or hurricane wind damage following an extreme weather event are 1.46 and 0.41 percentage points less likely to foreclose relative to properties undamaged by the event, respectively, because insurance payouts—often sent directly to lenders—cover repairs and outstanding balances. Yet as insurers raise rates to offset increases in payouts, the cost burden shifts back to homeowners. Every 1 percent-point increase in annual homeowners-insurance premiums is associated with a 1.05 percentage-point rise in foreclosure rates nationwide.

9. **MACROECONOMIC CONDITIONS COMPOUND CLIMATE PRESSURES**
Economic downturns, such as the financial crisis from 2007 to 2009, exacerbate climate impacts by making vulnerable homeowners with limited equity more susceptible to default, accelerating property value declines, and weakening financial stability. Even stable markets offer less reliable insulation as climate risks grow in frequency and severity.

10. **HISTORICAL CLIMATE IMPACTS HAVE RESULTED IN HIDDEN CREDIT LOSSES**
For example, after Hurricane Sandy in 2012, banks may have underestimated the number of foreclosures by 393 cases due to a failure to account for loan-level flood risk factors. This miscalculation could have led to $68 million in unexpected unpaid principal and interest, translating to $34 million in credit losses under a 50% loss-given-default assumption. Additionally, measures taken by banks in response to severe natural disasters—such as loan modifications and forbearance—carry significant financial consequences for lenders. These measures can also delay defaults, making it harder to link them directly to the disaster and complicating future risk assessments.

11. **ESCALATING FLOOD RISKS AND CLIMATE-DRIVEN MACROECONOMIC CHANGES DRIVE FUTURE FORECLOSURES**
Integrating First Street's Flood Model (FS-FM) with its Macroeconomic Implications Model (FS-MIM) shows that, if lending criteria and mitigation tactics remain unchanged, climate pressures will steadily raise foreclosure rates. Flood events trigger the initial spikes, but over the next decade, soaring insurance premiums, stagnant home-price growth, and broader economic headwinds will exert sustained upward pressure on foreclosures.

Introduction

GROWING CLIMATE RISKS AND ESCALATING INSURANCE CLAIMS

Over the past four decades, natural disasters in the United States have grown exponentially more costly (Figure 1). In the early 1980s, events such as tropical cyclones, floods, severe storms, and wildfires caused an average of $33.3 billion annually in damages and economic losses. This loss figure accounts for destruction to buildings, infrastructure, vehicles, and crops, as well as disruptions to business operations. By the early 2020s, this figure had surged by 1,580% to an annual average of $559.4 billion (NOAA, 2025). Among these damages, the most immediate and devastating have been to residential property—that is, individuals' homes. In 2022, nearly 1.9 million households—about 1 in every 65 across the U.S.—were displaced due to a natural disaster (NLIHC, 2022). The figure underscores not only the growing scale of climate-related hazards, but also the widespread financial fragility that leaves many households at risk of permanent displacement.

Among those most exposed are the 61.2% of homeowners with outstanding mortgages, for whom disaster-related disruptions often collide with the ongoing burden of monthly loan payments (U.S. Census Bureau, 2024). Homeowners affected by natural disasters often encounter numerous barriers to recovery. These challenges include underinsurance, delays or denials in insurance payouts, and restrictions imposed by mortgage lenders who control the disbursement of insurance funds. Additionally, broader economic disruptions—such as damaged infrastructure or business closures—can result in significant income loss, further complicating the recovery process. Most households are unprepared for these financial shocks: data from the 2022 Survey of Consumer Finances (SCF) show that only 43% of households report saving for emergencies like natural disasters (FRB, 2023). Even among those who do save, the average personal savings rate sits at just 4.6% of disposable income (BEA, 2025). This limited financial cushion, combined with the ongoing obligation to make mortgage payments, can quickly escalate into missed payments, delinquencies, and in more severe cases, foreclosure.

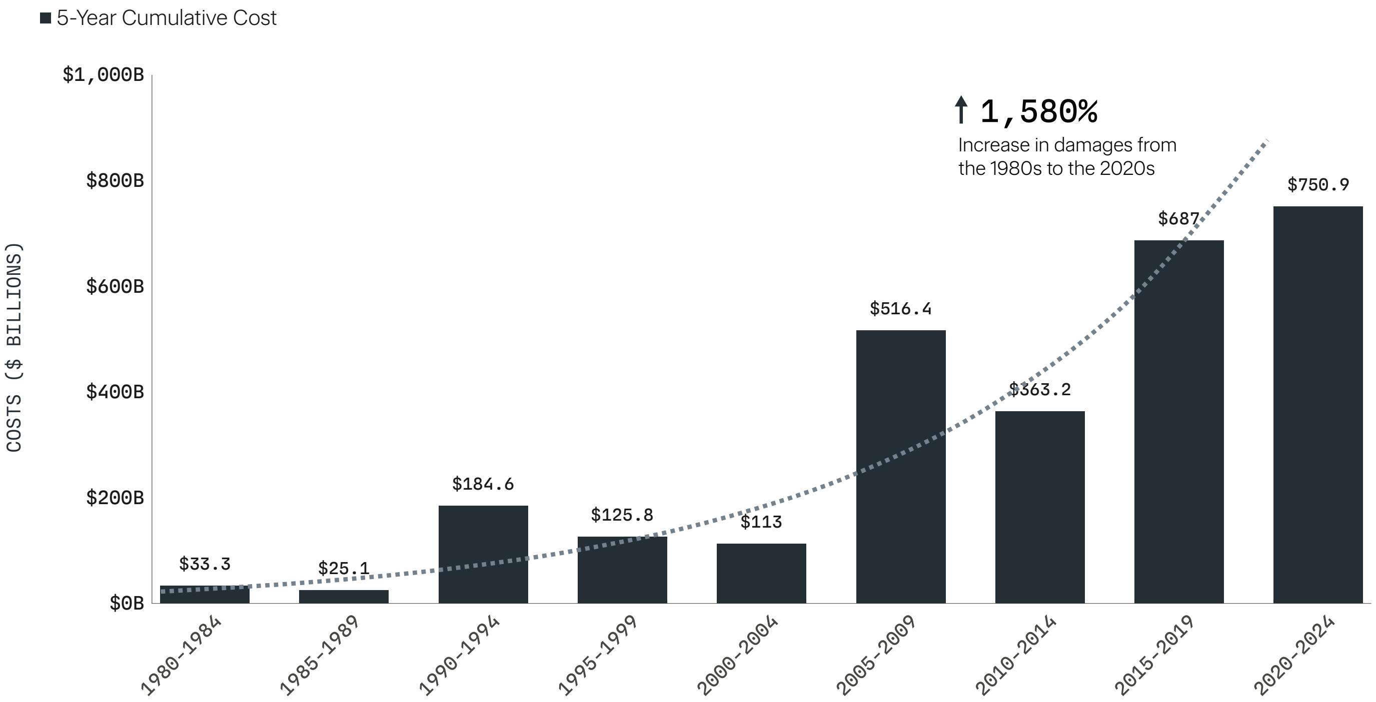


FIGURE 1. Change in Billion Dollar Disaster Costs, 1980-2024
SOURCE: NOAA Billion Dollar Disasters
NOTE: Damages summed across Flood, Tropical Cyclone, Severe Storm, and Wildfire

Introduction

Recognizing that property damage is a major source of financial instability for borrowers, mortgage lenders have long required insurance as a condition for lending, with homeowners insurance serving as the most standard form of coverage. Other types of property insurance address coverage gaps, with flood damage being the most prevalent (Table 1).

INSURANCE TYPE	COVERAGE SCOPE	EXCLUSIONS	WHO'S REQUIRED TO HAVE IT?	PROVIDER
Homeowners Insurance (HO-3)	Dwelling, other structures, personal property, liability for fire, wind, hail, theft, vandalism	Flood, earthquake, maintenance-related damage	Homeowners with mortgages	Private insurance companies
National Flood Insurance Program (NFIP)	Flood-related structural & contents damage (up to $250K for dwelling and $100K for contents)	Non-flood perils (e.g. mold, landslide, sewer backup)	Owners in Special Flood Hazard Areas (SFHAs) with federally backed mortgages	FEMA
Private Flood Insurance	Same as NFIP but with higher limits, broader contents, basement, sewer-backup endorsements	Non-flood perils varies by policy	When lenders accept private alternative to NFIP	Private insurance companies
FAIR Plan	Basic fire and named windstorm (typically up to $500K or $600K for dwelling	Flood, earthquake, theft, liability, vandalism	Homeowners declined by standard insurers in high-risk areas	State-backed plans
Windstorm Insurance	Wind- and hail-related damage (hurricanes, tornadoes, gusts) other event switch high wind gusts	Flood, storm surge, non-wind perils	Mortgage borrowers in coastal/high-wind zones where HO-3 excludes wind	State-run windstorm pools

TABLE 1. Comparison of Property Insurance Products

RISK SHARING CONCEPTUALIZATION

The financial burden of extreme weather events is increasing, with homeowners, insurers, lenders, investors, and government entities all playing a role in absorbing costs tied to property damage, declining home values, and shifting market dynamics. Yet this risk is neither static nor evenly shared—it varies by property ownership, insurance coverage, and mortgage financing. This raises a fundamental question: Who owns the risk?

Following industry-recognized definitions, risk sharing can be broken down across physical (P), transition (T), counterparty (C), and operational (O) risks, depending on homeownership scenarios (Figure C1). The diagram illustrates how climate-related risk is distributed based on financial relationships tied to a property. For an uninsured, unleveraged homeowner without a mortgage (A.1), the individual bears the full burden of both physical (e.g., wildfires, floods) and transition risks (e.g., falling property values or increased climate-related taxes). With insurance in place (A.2), part of the physical risk shifts to the insurer, though the owner still faces exposure via deductibles, coverage limits, and the potential for nonrenewal or premium hikes. Insurers manage their risk via diversification and reinsurance, but transition risks like insurance affordability often remain with the owner.

Risk sharing shifts with a mortgage (A.3): lenders now share transition risk with homeowners and rely on insurers to cover catastrophic losses, while also assuming counterparty (C) and operational (O) risks tied to insurance performance and servicing stability. When loans are sold to government-sponsored enterprises (GSEs) like Fannie Mae and Freddie Mac, insured by FHA, or securitized through private-label MBS (A.4), risk is further spread to secondary market actors, including investors and federal entities.

	PROPERTY OWNER	INSURANCE PROVIDER	LENDER	GOVERNMENT SPONSORED ENTITIES
A.1 Homeowners without a mortgage	P			
A.2 Homeowners without a mortgage with insurance	P T C	P T	T C O	
A.3 Homeowners with a mortgage	P T C	P T	T C O	
A.4 Mortgages sold to GSEs	P T C	P T	T C O	T C O

P Physical Risk T Transition Risk C Counterparty Risk O Operational Risk

FIGURE C1. Architecture of Risk Ownership
SOURCE: Mortgage Bankers Association, 2024.

Introduction

Insurance requirements for mortgages have provided critical protection, as reflected in the rising volume and cost of insurance claims over time. Since 2007, homeowners' insurance claims due to extreme weather events- like wildfires, strong winds, and hail- have surged by 117.6% (Insurance Information Institute, 2025). This growth rate is 2.5 times greater than the overall increase in homeowners insurance claims, which rose by 53.8% during the same timeframe (Figure 2).

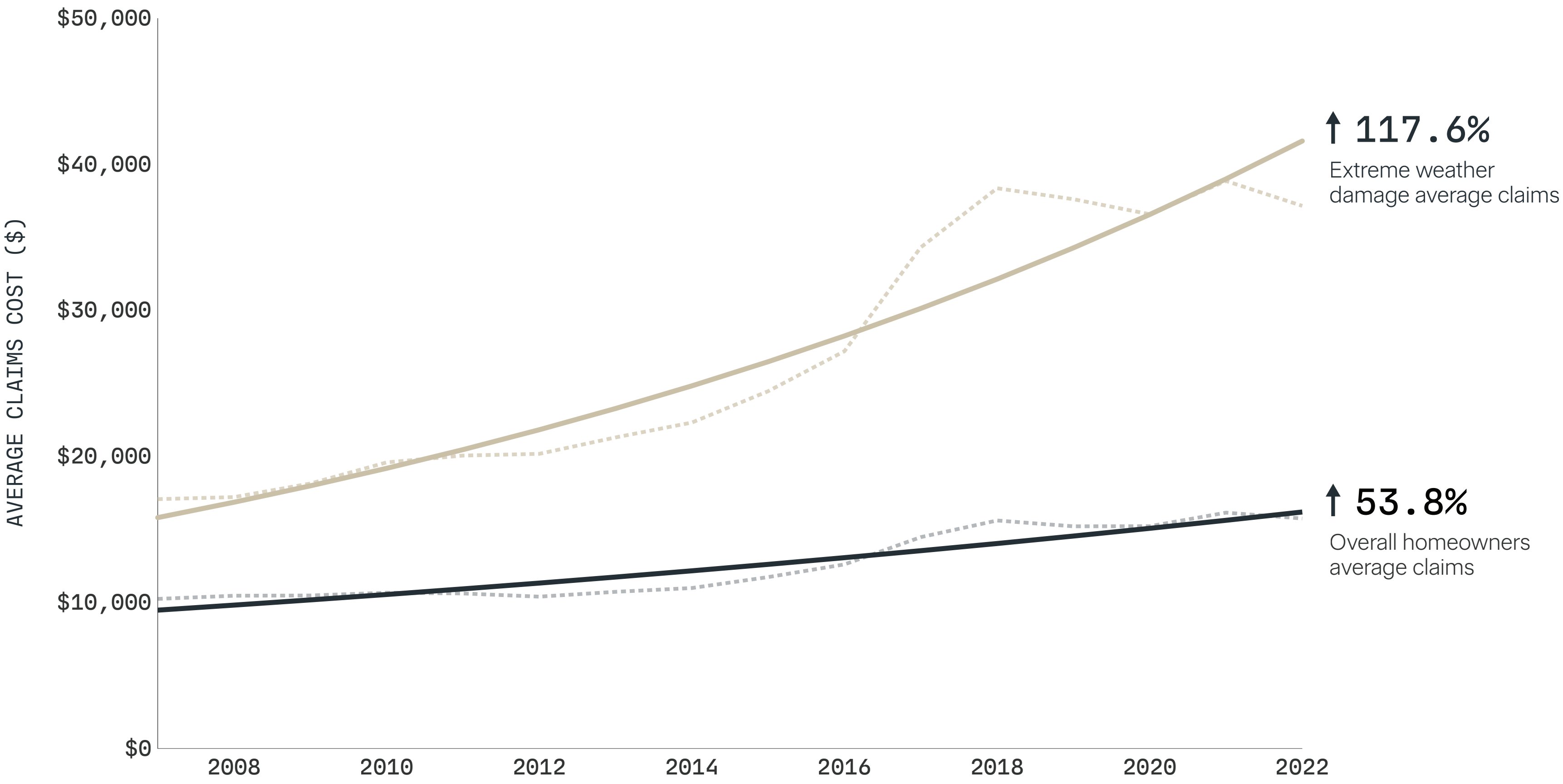
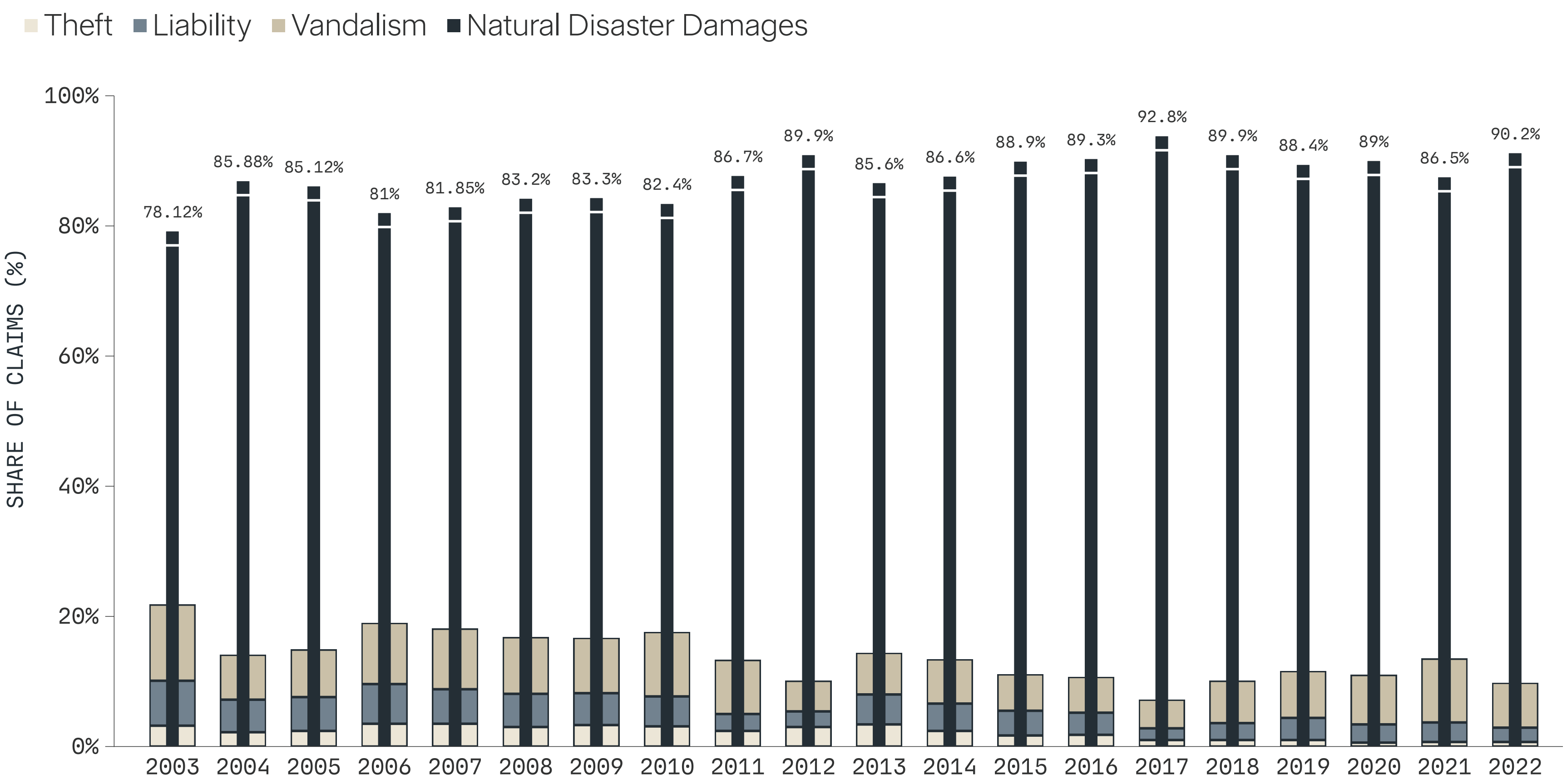


FIGURE 2. Average Homeowners Insurance Claims, 2007-2022
SOURCE: Insurance Information Institute, 2025

Introduction

By 2022, the average claim for weather-related damage reached $37,152, more than double the $15,747 average for all homeowners insurance claims. As a result, extreme weather has come to dominate the insurance landscape, accounting for 90% of all homeowners claims in 2022. While claims related to theft, vandalism, and liability have declined, natural disaster claims alone have increased by 12.1 percentage points (from 78.1% to 90.2%), between 2003 to 2022, underscoring the importance of protection against extreme weather events for homeowners. (Figure 3).



↓4.7 pp
Theft
2003-2022

↓2.5 pp
Liability
2003-2022

↓4.8 pp
Vandalisim
2003-2022

↑12.1 pp
Natural Disaster
2003-2022

FIGURE 3. Homeowners Insurance Claims by Peril Type

SOURCE: Insurance Information Institute, 2025

Introduction

Homeowners face an additional challenge when it comes to insurance: while standard homeowners insurance does cover water damages from internal sources like burst pipes or leaky appliances, it does not cover water damage from external sources, such as storm surge, runoff, or heavy rainfall. The external flood exclusion exists due to the massive costs and widespread impact of such events. Among all physical climate impacts, flooding is the most financially burdensome in terms of its scale and intensity. Just one inch of floodwater can cause approximately $25,000 in damages to a single home (FEMA, 2025).

To protect against this risk, homeowners may purchase separate flood insurance and are specifically required to if they simultaneously have a federally-backed mortgage and are located in a Special Flood Hazard Area (SFHA)—regions the Federal Emergency Management Agency (FEMA) has identifies with at least a 1% annual chance of flooding. Flood insurance is primarily obtained through the National Flood Insurance Program (NFIP) provided by FEMA. Although far less common than homeowners insurance, NFIP coverage has become increasingly important as flood events grow in frequency and severity. Since 2000, the average NFIP claim has surged by 223%, rising from $19,800 (2000–2004 average) to $64,100 (2020–2024 average), reflecting the growing impact of flooding on US homes (Figure 4).

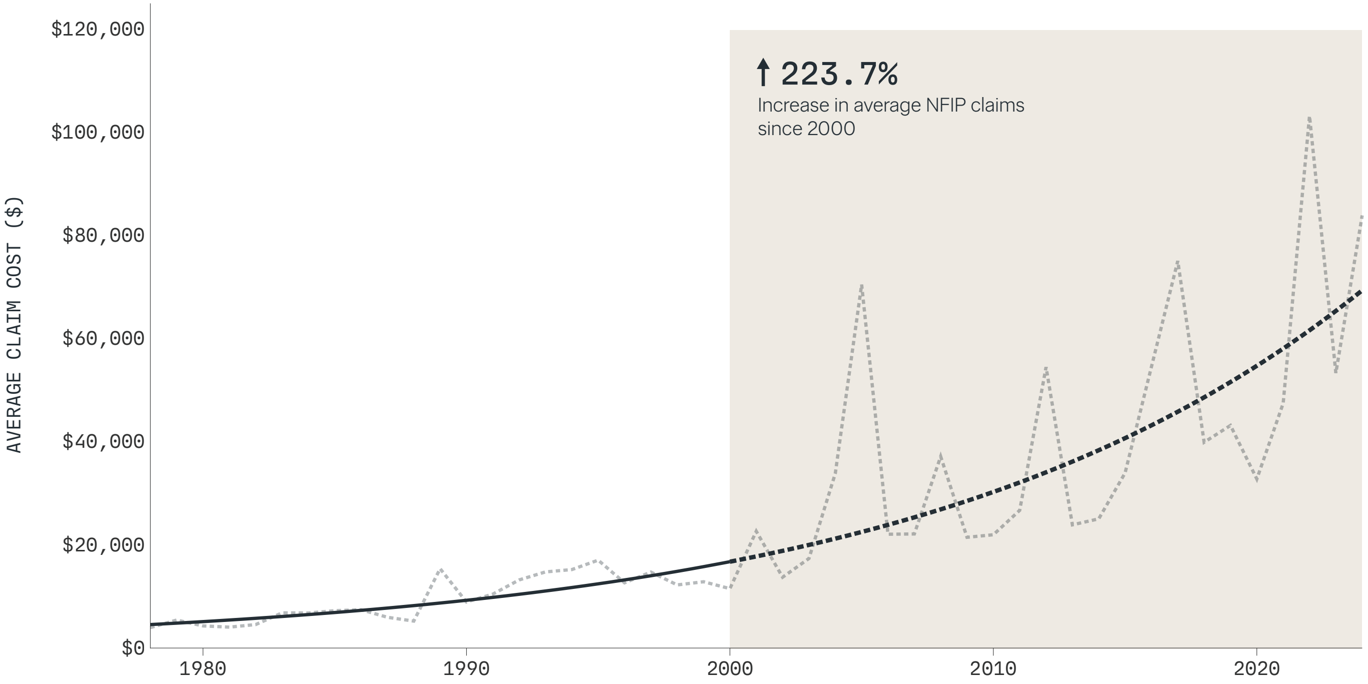


FIGURE 4. Average NFIP Claim, 1980-2020

SOURCE: Federal Emergency Management Agency (FEMA) (2025), NFIP Redacted Claims

Introduction

INSURERS RESPOND BY INCREASING RATES OR EXITING MARKETS

Rapid increases in insurance claims have led to equally rapid growth in insurer payouts, straining the industry. These mounting effects culminated for the homeowners insurance industry in 2023, when insurance providers incurred $546.2 billion in net losses—nearly double the $284.9 billion paid out in 2014 (NAIC, 2024). When combined with operating costs, the industry recorded three consecutive years of underwriting losses from 2020 to 2023, largely driven by a rise in natural catastrophes. During this period, 16 hurricanes and 3 major wildfires caused more than $1 billion in damages each, totaling $232.2 billion in losses across affected areas (NOAA, 2025). FEMA has also been feeling this strain through the NFIP: major hurricanes and inland floods have driven the flood insurance program's debt above $30 billion at its peak. Even after a $16 billion debt cancellation by Congress following Hurricane Harvey, the NFIP still owed over $20 billion as of 2024 (Congressional Research Service, 2024).

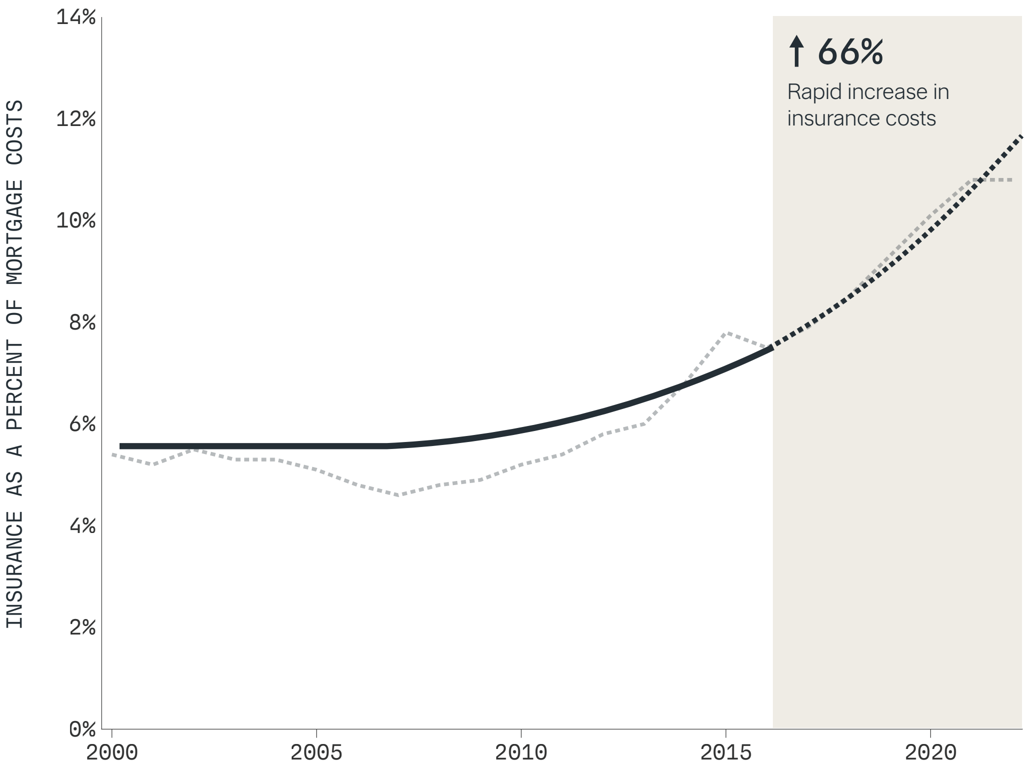


FIGURE 5. Insurance Premiums as a Share of Mortgage Costs, 2000-2022

SOURCE: Bureau of Labor Statistics (2022), Consumer Expenditure Survey (CE)

Homeowners insurers and FEMA have been adjusting their policies to account for the increasing costs associated with extreme weather events. Since 2018, the homeowners insurance industry has experienced 25 consecutive quarters of premium rate hikes as insurers strive to keep pace with the rising volume and cost of claims (NAIC, 2024). These increases have been concentrated in high-climate risk areas, where average homeowners' insurance premiums surged by 22%, compared to a 13% national average increase since 2020 (The Guardian, 2024). Today, the highest-risk parts of the country now face average premiums as high as $10,000 or more (Consumer Affairs, 2025).

Similarly, FEMA implemented Risk Rating 2.0 (RR2.0) in 2021, a new pricing structure that seeks to more accurately incorporate increasing flood risk into its rate calculations. Despite the caps on annual NFIP premium increases introduced through Biggert-Waters and subsequent legislation, the reforms under RR2.0 have triggered steep premium hikes. For instance, in Plaquemines Parish, LA, NFIP premiums skyrocketed by 545%, while Brevard County, FL, experienced a 255% surge in rates.

The rising cost of property insurance across coverage types is made evident when looking at its growing share of monthly mortgage expenses. From the 2000s through the early 2010s, insurance consistently accounted for just 5% of combined mortgage and interest payments. However, since 2013, this once-stable ratio has surged by 115%, with more than half of that increase occurring after 2017 (Figure 5). By 2022, insurance costs made up over 10% of monthly mortgage payments. While increasing rates imply that the availability of insurance coverage remains, these higher costs are driving up the overall cost of homeownership, indirectly straining households' budgets.

Introduction

As a result, increases in insurance premiums are causing homeowners to have to reevaluate their spending allocations. In Plaquemines Parish, LA, for example, a family aiming to keep total housing costs within 40% of household income would need a 12% income increase just to offset the near-doubling of flood insurance premiums under NFIP's RR2.0 reforms (Table 2). Some households may also require cutting discretionary spending to absorb the added cost. But for others, this shift could lead to missed mortgage payments and a heightened risk of default– particularly in lower-income or hazard-prone areas where insurance burdens are rising fastest.

VARIABLE	LEGACY NFIP	FEMA'S "RISK RATING 2.0"	
Home Price	$325,600	$325,600	
Downpayment ($)	$32,600	$32,600	
Mortgage Amount	$293,000	$293,000	
Monthly Mortgage Payment	$1,900	$1,900	
Monthly PMI	$200	$200	
Monthly Insurance	$400	$800	
Monthly Taxes	$100	$100	
Total Monthly Cost	$2,600	$3,000	
Required HH Income	**$6,600**	**$7,400**	+12%

TABLE 2. Home Affordability Exercise

Introduction

At the same time, the insurance market is undergoing significant changes in availability. In areas where outsized claims have made business unprofitable, homeowners insurers are exiting markets entirely, dismantling the protective structure that homeowners insurance is meant to provide, especially in the places that need it most. In 2023, the national non-renewal rate—defined as the share of homeowners insurance policies not offered renewal—averaged 0.99%. However, states exposed to frequent and severe hurricanes and wildfires like Florida, Louisiana, and California face rates double to triple the national average (Senate Budget Committee, 2024). The top 10 states with the highest non-renewal rates are all either coastal states prone to hurricanes or other states prone to major wildfire or hail losses (Figure 6). Non-renewals typically follow a devastating period of disasters, such as the destructive storm seasons of 2020–2021, which caused multiple carriers to leave Louisiana's market (Louisiana Legislative Auditor, 2022).

Similarly, major insurers like State Farm, Allstate, and Farmers Insurance have reduced or halted new policies in wildfire-prone areas of California, exemplified most recently by the thousands of policies State Farm canceled right before the LA wildfires in January 2025 (CBS, 2025).

Some state governments have sought to preemptively reduce non-renewals, by decoupling major damaging perils from homeowners insurance coverage. For example, Florida decoupled wind from homeowners policies in the aftermath of Hurricane Andrew's landfall in Miami-Dade County in 1992. As a result of non-renewals and decoupling perils from homeowners insurance coverage, the property insurance market is fragmenting. Homeowners are now increasingly forced to layer multiple coverage products or rely on government-backed insurers to protect against specific peril risks.

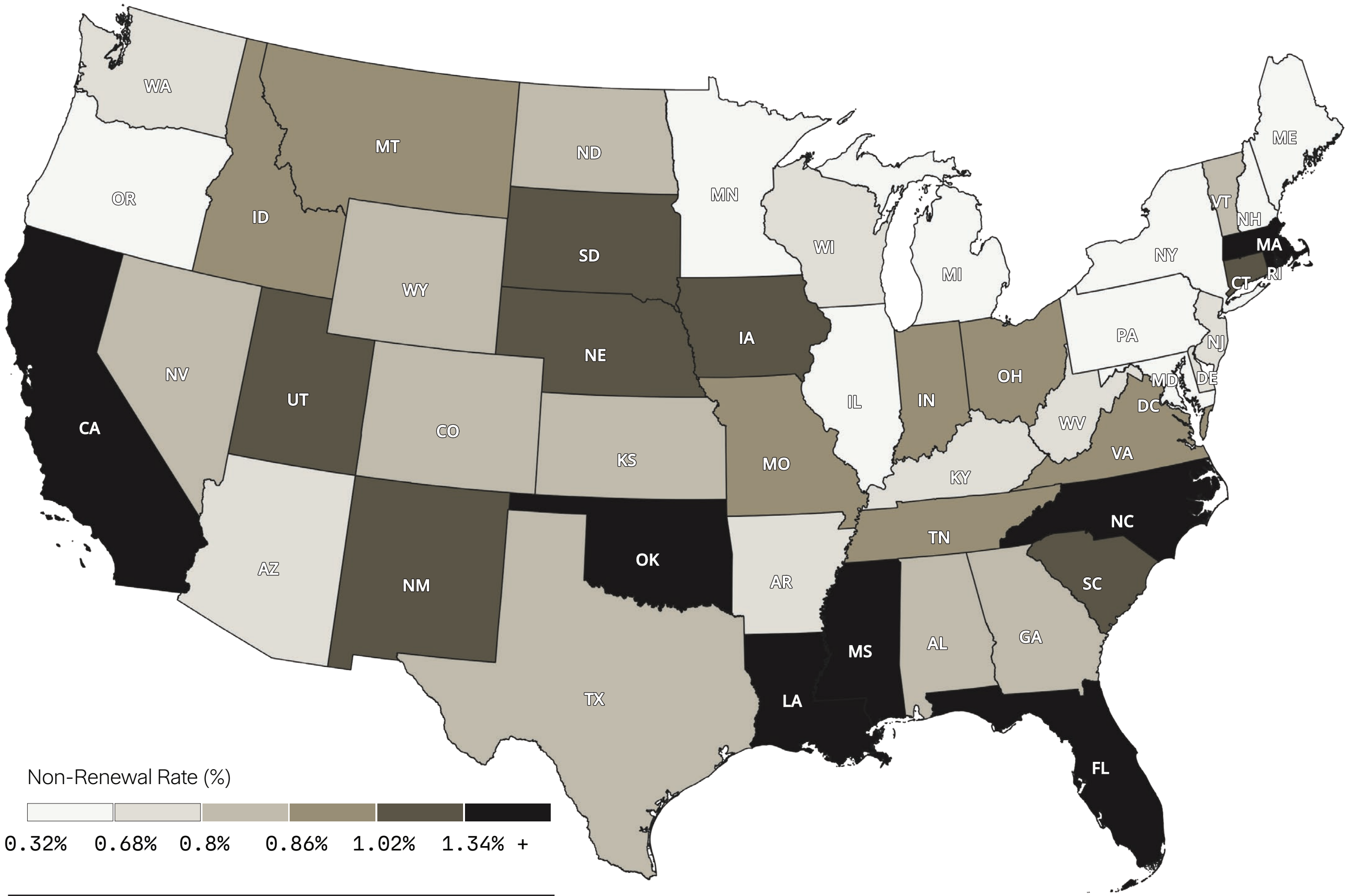


FIGURE 6. Map of Average Non-Renewal Rates by State, 2019 - 2023

SOURCE: Senate Budget Committee (2024)

Introduction

INSURERS OF LAST RESORT LEAD TO INCREASED COVERAGE GAPS

The exodus of private insurers has resulted in the rise of residual markets, often referred to as the insurers of last resort. These markets are largely made up of state-run Fair Access to Insurance Requirements (FAIR) plans, which, as of 2025, are offered in 35 states (Figure 7). Nevada is close to follow with a bill establishing a plan in their state pending approval as of March 2025 (Insurance Business, 2025). Since getting established across participating states, enrollment in FAIR plans has surged. California's FAIR Plan saw its number of policies double between 2018 to 2023. Florida's Citizens Property Insurance Corporation, initially designed as a last-resort insurer, has become the state's largest property insurer, covering almost one million policies by the end of 2024 (Citizens, 2024).

To add another layer of complexity and cost, in many hurricane-prone coastal states, FAIR plans are often supplemented by separate windstorm or beach plans, such as Texas's Windstorm Insurance Association (TWIA) and North Carolina's Coastal Property Insurance Pool. Homeowners in these regions are often required to carry multiple policies to obtain comprehensive protection—one for wind, another for flood, and a third for general property coverage. While FAIR plans now serve a critical role in maintaining access to insurance, they are not a substitute for the broader, more comprehensive coverage that the private market once provided.

While NFIP flood insurance is accessible nationwide, significant coverage gaps persist. FEMA requires properties with federally backed mortgages in SFHAs to maintain NFIP coverage. However, only 48.3% of households in SFHAs are insured, leaving more than half vulnerable (Bradt, 2022). This low percentage can be attributed to weaknesses in enforcement of insurance requirements, which often results in non-compliance. Additionally, not all properties in SFHAs carry outstanding mortgages, meaning that homeowners may feel less compelled to obtain flood insurance. Outside these high-risk zones, coverage rates drop even further, as homeowners face no legal mandate, minimal financial incentives, and often lack awareness of their flood risk.

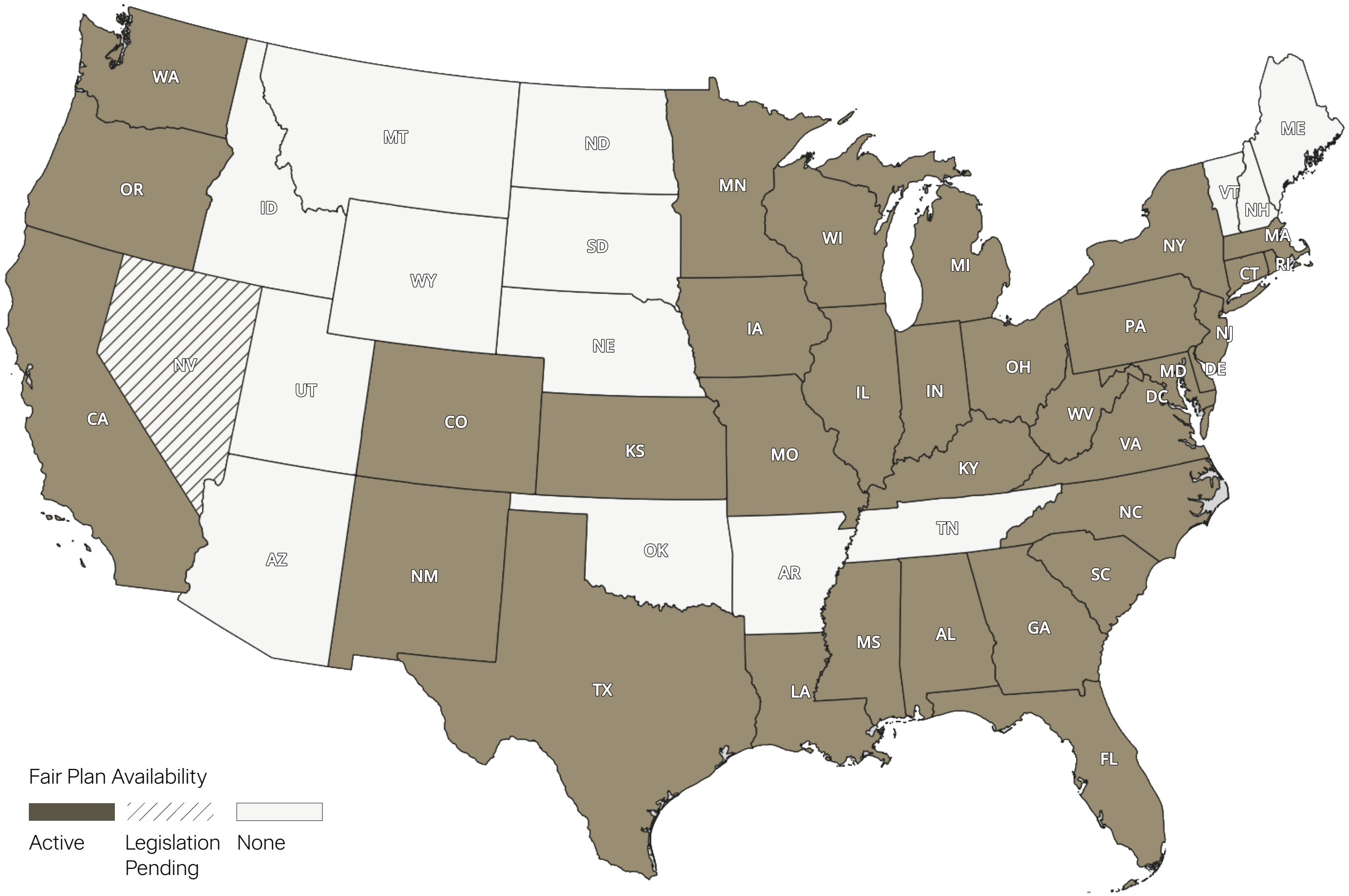


FIGURE 7. Map of State FAIR Plan Availability
SOURCE: Todoroff and Claeys (2025)

Introduction

Adding to the problem, FEMA's flood mapping is incomplete and outdated. Approximately 40% of the continental U.S. remains unmapped, while many existing maps fail to reflect current risks, leaving millions of homeowners exposed to unassessed flood threats (Congressional Budget Office, 2024). According to First Street's Flood Model, approximately 17.7 million properties nationwide face a 1-in-100 annual flood risk or greater (First Street, 2023). This represents about 2.2 times more properties than those identified within FEMA's SFHAs. Of the properties identified by FSF-FM, approximately 9.8 million are likely unaware of their flood exposure because they fall outside FEMA-designated SFHAs and have not received official risk communication (Figure 8).

The real-world implications of these gaps have been starkly highlighted by major disasters. During hurricanes like Harvey and Sandy, only about 20% of affected homeowners in Houston and New York had flood insurance (Washington Post, 2017; USA Today, 2017). More recently, Hurricane Helene in September 2024 caused catastrophic flooding near Asheville, North Carolina, yet just 0.7% of homeowners in Buncombe County carried NFIP policies (Federal Reserve Bank of Richmond, 2024). These events underscore the urgent need to expand insurance uptake and improve flood risk mapping to protect vulnerable communities.

Even homeowners enrolled in NFIP or those that fall back on FAIR plans experience limitations in coverage, leaving them financially exposed. This is especially apparent when examining caps on structural damage coverage, including a home's foundation, walls, roof, and built-in systems. Standard homeowners insurance policies typically offer coverage tailored to the full replacement cost of a home in the event of a total loss. In contrast, NFIP and FAIR plans are far less comprehensive. The NFIP, for instance, caps structural coverage at $250,000—an amount that often falls short of the cost to rebuild, particularly in high-risk coastal areas. Most FAIR plans limit their coverage to a maximum of $500,000 to $600,000. While more comprehensive than NFIP coverage, these caps still mean that homeowners faced with a total loss event must cover tens to hundreds of thousands of additional dollars in damages themselves. As climate risk intensifies and FAIR plan enrollment increases, these coverage gaps will grow more apparent and impactful on communities.

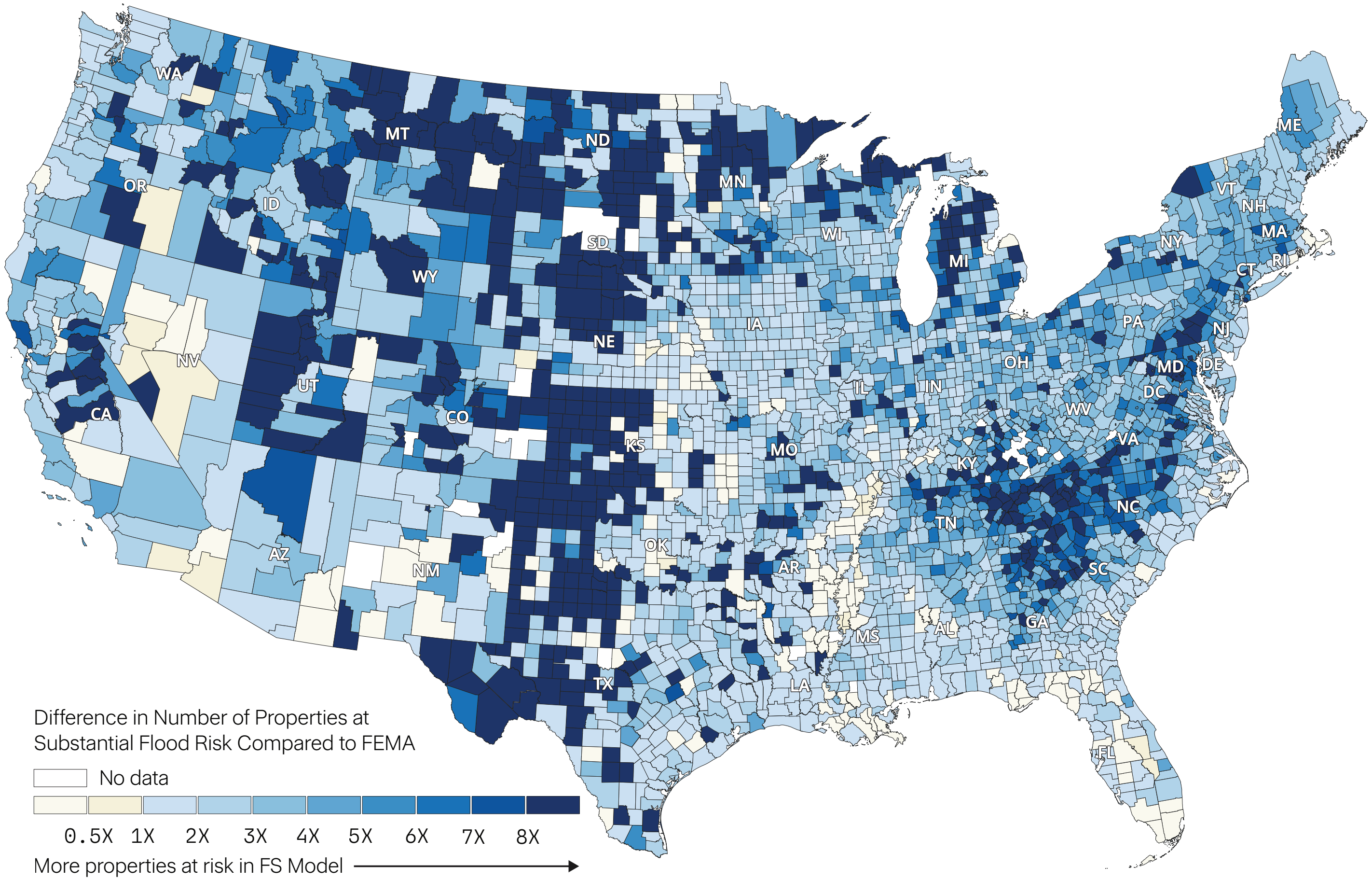


FIGURE 8. Difference in the Number of Properties Facing Substantial Flood Risk per First Street Compared to FEMA.
SOURCE: First Street Internal Analysis

Introduction

INSURANCE ISSUES AND INDIRECT IMPACTS LEAD TO FINANCIAL INSTABILITY

In practice, even when homeowners have sufficient insurance coverage, accessing payouts after a natural disaster is often far from straightforward. Disputes, delays, and complex claims processes can leave homeowners financially stranded for extended periods. This is especially evident after hurricane events, where distinguishing between wind and flood damage frequently leads to lengthy, contested claims. A major source of dispute is the anti-concurrent causation (ACC) clause found in many homeowners insurance policies. These clauses allow insurers to deny a claim if an excluded peril (e.g., flooding) contributed to the loss, even if a covered peril (e.g., wind) was also involved (ClaimsMate, 2020). For example, if hurricane winds damage a roof and floodwaters subsequently enter through the opening, the insurer may deny the entire claim based on the ACC clause. While some states have moved to limit or reject enforcement of these clauses, others–such as hurricane-prone states like Louisiana and Texas continue to uphold them. As a result, many policyholders are left to cover the full extent of the damages when these clauses are applied.

In other cases, insurance payouts are significantly delayed. Many states have laws requiring insurers to process claims within specific timeframes, typically 30 to 45 days to review and up to 90 days to issue payment after approval (Gimbel, 2022), but insurers often fail to meet these deadlines. Survey data from five of the most destructive wildfires in recent years show that more than half of all dwelling claims remained unsettled even one year after the events (United Policyholders, 2025). A follow-up survey on the 2018 Camp Fire revealed that, even two years later, 23% of homeowners still had unresolved claims for structural damage (United Policyholders, 2021). Similar delays affect flood insurance. A recent analysis of NFIP data found that only 61% of flood insurance claims were fully settled within 90 days. While nearly 80% of claimants received at least partial payment within that period, many were left waiting longer for full resolution (Hossain and Orellana-Li, 2024) (Figure 9).

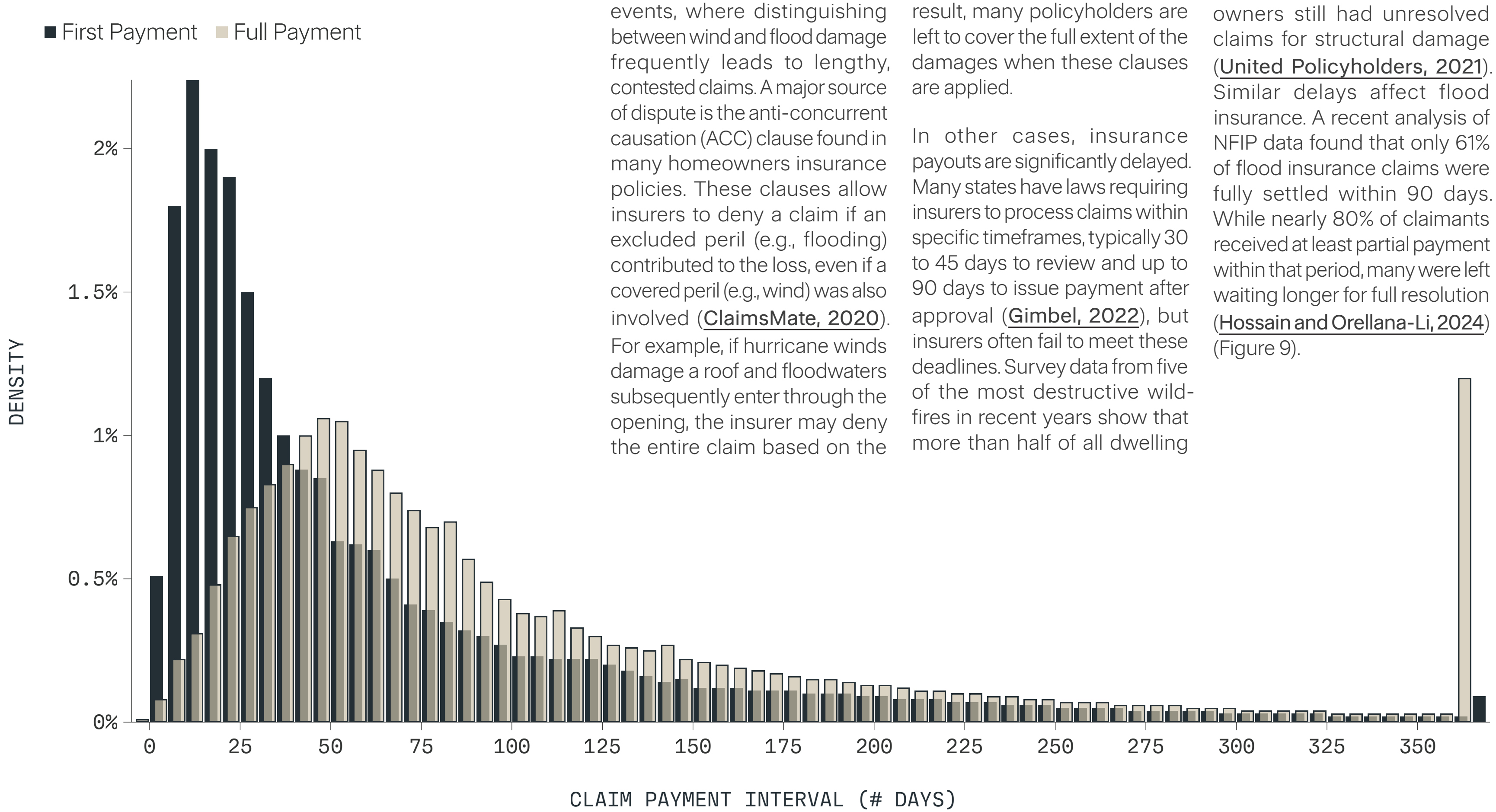


FIGURE 9. Histogram of First and Final Claim Payment Intervals

SOURCE: Hossain and Orellana-Li (2024)

Gaps in coverage, disputes, and delays, compounded by financial pressures like income loss, create substantial financial and housing insecurity for many homeowners. A survey conducted after Hurricane Michael, a Category 5 storm that struck Florida's Panhandle in October 2018, found that almost 50% of respondents reported not having enough money to cover expenses such as evacuation, temporary housing, medical bills, and debris clean-up, just three weeks after the disaster. (Sweeney et al., 2022). For most respondents, this financial strain was driven by lost income and limited savings coupled with unexpected and burdensome expenses from temporary housing and home repairs. For some, the lack of immediate funds led to missed mortgage payments.

Introduction

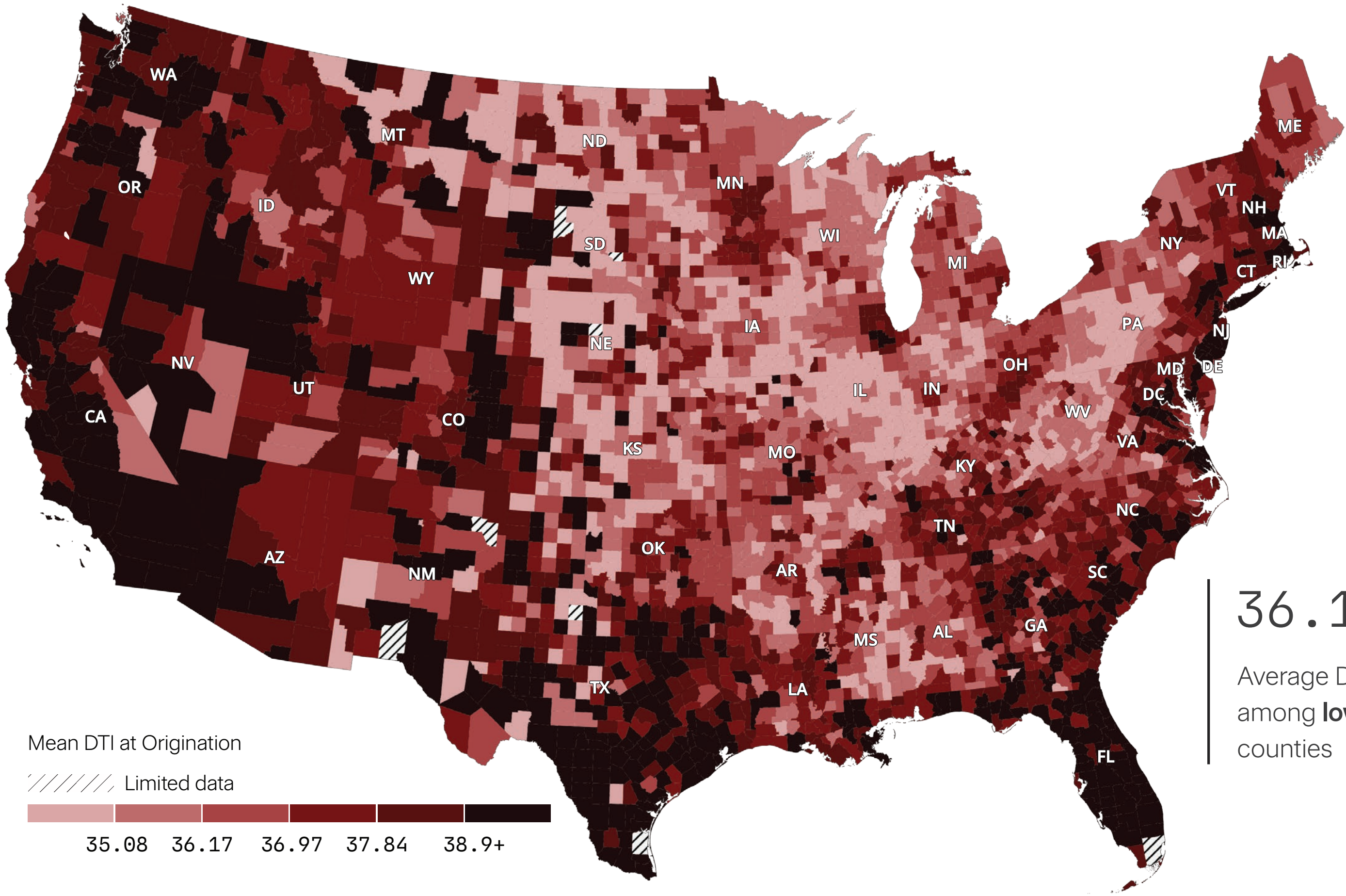


FIGURE 10. Mean Debt-to-Income Ratio by County, 2024

SOURCE: Polygon Research (2025), HMDAVision

Natural disaster impacts and insurance challenges may be especially acute for financially burdened homeowners with outstanding mortgages. These individuals often have lower incomes, higher debt levels, and limited financial reserves, all while juggling monthly mortgage payments. An analysis of mortgages conducted in 2024 shows that borrowers in high climate-risk areas also tend to carry higher debt loads. In areas at high risk of flooding, hurricanes, or wildfires, the average debt-to-income (DTI) ratio—representing the portion of a borrower's gross monthly income allocated to debt payments—stood at 38%. This figure was nearly two percentage points higher than the average DTI in low-risk counties. (Figure 10). This suggests that a convergence of climate risk and existing financial vulnerability creates conditions where natural disasters are more likely to push already-strained borrowers into delinquency or default.

36.1

Average DTI among **low-risk** counties

37.4

Average DTI among **moderate-risk** counties

38

Average DTI among **high-risk** counties

Introduction

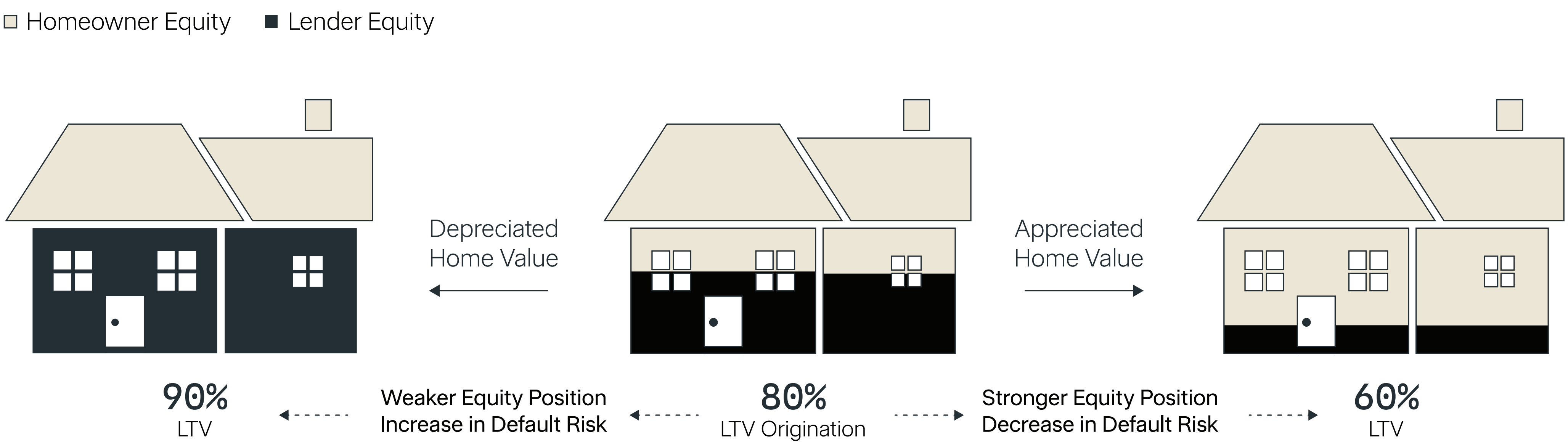


FIGURE 11. Loan-to-Value and Lender Risk Mechanics

Climate change also exerts significant pressure on property values through two key channels: rising insurance costs, which increase the cost of homeownership, and declining location desirability, which reduces housing demand. First Street's 12th National Report found that these forces may have a compounding effect over time, lowering property values by an average of 6.2% in high-risk areas projected to experience population decline (First Street, 2025). Even in otherwise desirable markets with growing populations—such as some cities in Florida—property values are expected to decline as rising insurance premiums erode affordability, with average decreases of 1.7% projected by 2055.

Changes in home values affect all homeowners with a mortgage through their loan-to-value (LTV) ratio. LTV governs a homeowner's equity position in their mortgage by representing the ratio between the amount of the mortgage loan and the current market value of the home. As homeowners pay down their loan and the property appreciates, the LTV decreases—indicating a stronger equity position. In contrast, when a home's value declines, the LTV rises, meaning the homeowner owes a larger proportion of the home's value (Figure 11). In severe cases of home depreciation, the LTV can exceed 100%, leaving the homeowner "underwater"—owing more on the mortgage than the property is worth. Higher LTV ratios are closely linked to both an increased risk of mortgage default. This is partly because they reduce a homeowner's financial stake in the property, increasing the likelihood of strategic defaults. Additionally, high LTV ratios often coincide with broader financial hardship or a reduced willingness to continue making mortgage payments. This also has implications for lenders, as LTV ratios that exceed 100% mean the lender would not recover a portion of the original loan.

Introduction

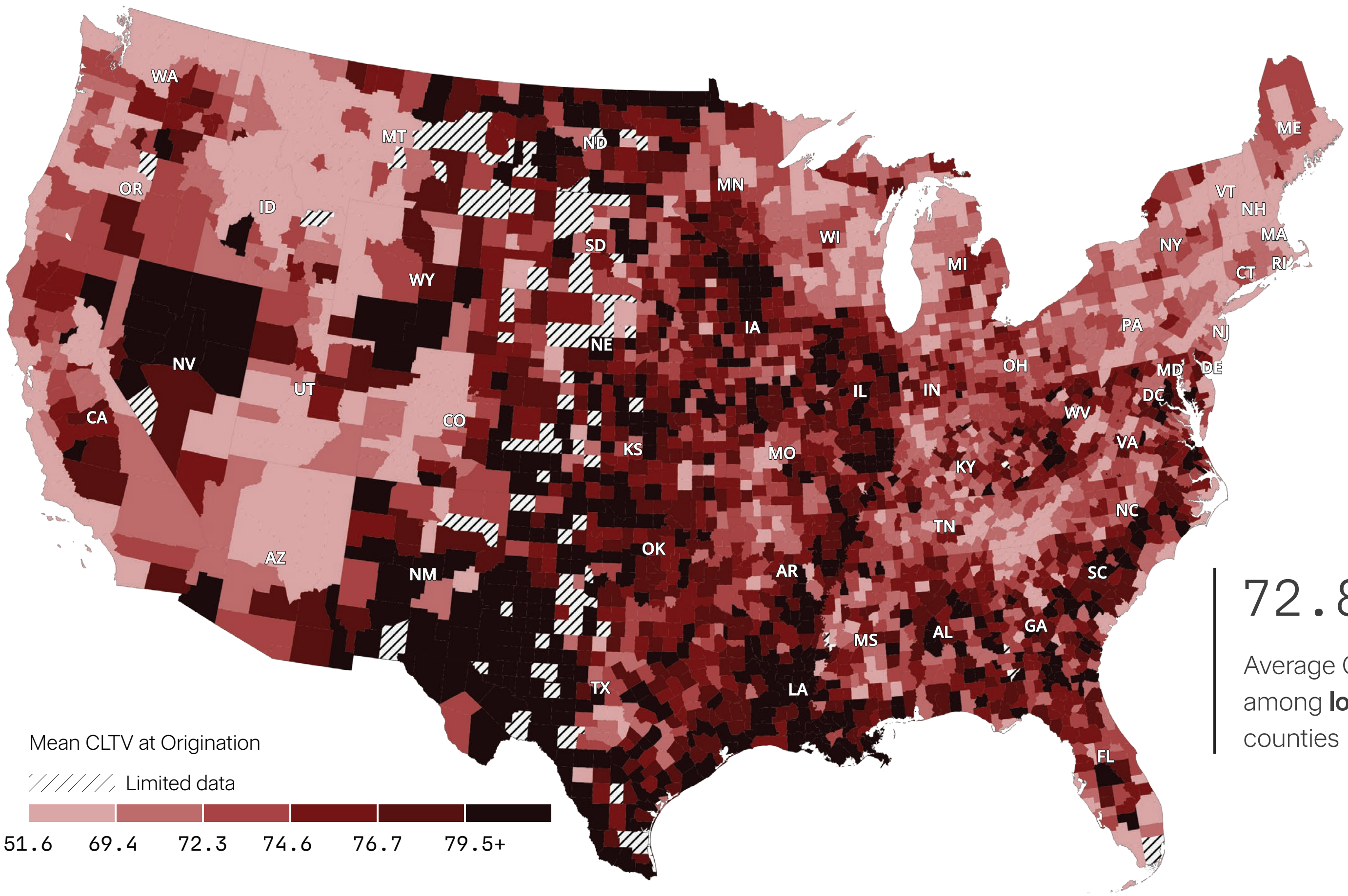


FIGURE 12. Mean Combined Loan-to-Value by County, 2024

SOURCE: Polygon Research (2025), HMDAVision

Similar to DTI trends, an analysis of 2024 mortgage originations shows that average combined loan-to-value (CLTV) ratios—a metric of LTV that includes second mortgages or home equity lines of credit—are higher in areas with elevated climate risk. In counties with high risk of flooding, hurricanes, or wildfires, the average CLTV was 74.9%, compared to 72.8% in low-risk counties (Figure 12). This suggests that mortgages in high climate-risk areas are not only more leveraged but also more vulnerable to default, particularly if climate-related pressures begin to erode property values and drive CLTVs even higher.

72.8

Average CLTV among **low-risk** counties

73.9

Average CLTV among **moderate-risk** counties

74.9

Average CLTV among **high-risk** counties

Introduction

CLIMATE RISK IS A THREAT TO RESIDENTIAL REAL ESTATE MARKET STABILITY

Climate-driven effects on insurance availability and affordability, coverage gaps, and property value declines all contribute to the likelihood of missed mortgage payments by increasing monthly housing costs, reducing household financial resilience, and undermining homeowner equity. These pressures are reflected in metro area mortgage performance trends, with areas prone to frequent hurricanes, flooding, and wildfires experiencing higher delinquency rates than the national average. While the Federal Housing Finance Authority (FHFA) tracked that 1.6% of mortgages became delinquent in 2024, with payments at least 30 days past due (DPD), delinquency rates in high-risk areas were much greater (FHFA, 2025). For example, Baton Rouge and New Orleans had delinquency rates of 3.7% and 3.0%, respectively (Figure 13). In fact, many of the metro areas with the highest delinquency rates also share a similar pattern of higher climate risk, with delinquency rates in 2023 considerably higher than the national average (1.6%); this includes cities like Columbia, SC (2.7%), and Bakersfield, CA (2.3%), while lower risk cities see far lower delinquency rates than average like St. Louis, MO (1.1%) and Milwaukee, WI (1.3%).

This trend extends to foreclosures as well, with these same metro areas seeing foreclosure rates that are two to three times higher than the national rate, which stands at just 0.1% of all mortgages (FHFA, 2025).

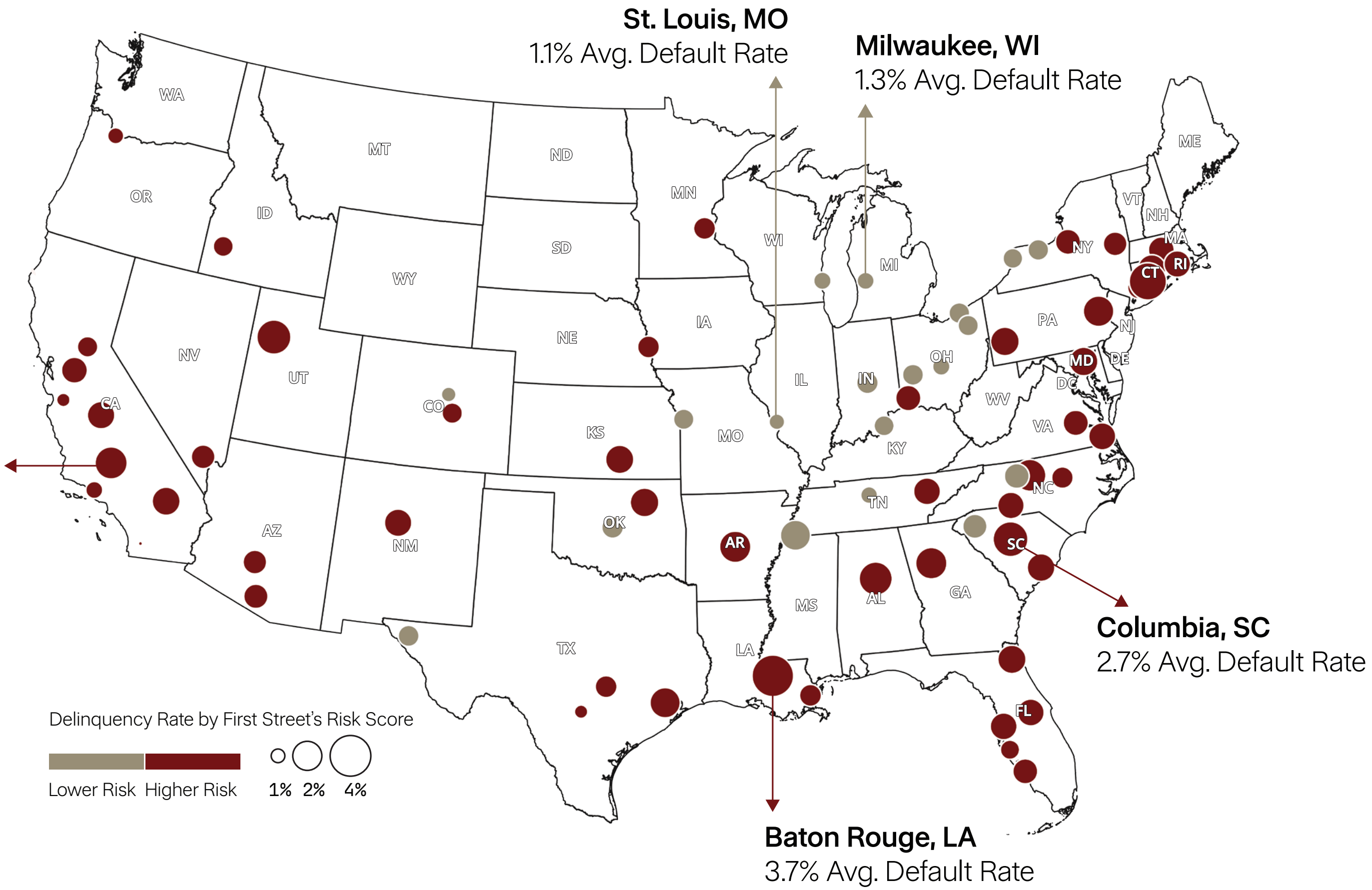


FIGURE 13. Metro Area Delinquency Rates across 100 select Metropolitan Statistical Areas (MSAs), 2023

SOURCE: FHFA National Mortgage Database (NMDB) (2025), Residential Mortgage Performance Statistics

Introduction

Even in dynamic markets like Houston, these risks materialize. In the years following Hurricane Harvey, delinquency rates in Houston jumped from 1% in Q4 of 2017 to 3% in Q4 of 2018—a 300% increase and the largest increase year-over-year since the financial crisis (Figure 14). Today, Houston faces a 2.4% delinquency rate, 0.8 percentage points higher than the national average (FHFA, 2025).

In recognition of climate risk threat to the real estate industry, the FHFA, which oversees Fannie Mae and Freddie Mac, issued an Advisory Bulletin on Climate-Related Risk Management in 2024, requiring government-sponsored enterprises (GSEs) to integrate climate risk into their enterprise risk management programs (FHFA, 2024). This includes addressing physical risks from extreme weather events like hurricanes, wildfires, and floods. As a result of these new efforts, FHFA assessed the climate risk exposure of the GSEs' single-family and multifamily portfolios, revealing that roughly 43% and 42% of these portfolios, respectively, are located in areas with moderate to very high climate risk (FHFA, 2025). Notably, $57.6 billion in GSE residential assets are located in areas with very high composite risk, where climate hazards, such as floods, wildfires, and hurricanes, constitute a major share of overall physical risk exposure. These figures are particularly significant given that the GSEs collectively guarantee $6.6 trillion in Agency Mortgage-Backed Securities (MBS), representing 50% of all outstanding U.S. mortgage debt (JPMorgan, 2025). Since MBS rely on stable mortgage performance to maintain their value, widespread climate-related defaults or declining property values could weaken these securities, posing risks to both investors and the broader financial system.

Leveraging First Street's Flood Model, the Kansas City Federal Reserve provide empirical evidence supporting the FHFA's focus on flood risk. Their analysis of historical mortgage and MBS data reveals a clear link between flood risk and mortgage defaults. Specifically, they found that properties with the highest First Street flood risk scores (6 or higher) have a 1.2 to 1.8 percentage point higher default rate compared to those with the lowest risk. Given an average default rate of 5.9 percent, this translates to a 21 to 30 percent increase in the likelihood of default (Federal Reserve Bank of Kansas, 2024). This finding holds even after controlling for a range of borrower, loan, economic, and demographic factors. This highlights the potential for climate-related events to destabilize mortgage performance – a key concern for the FHFA given the GSEs' significant holdings of MBS.

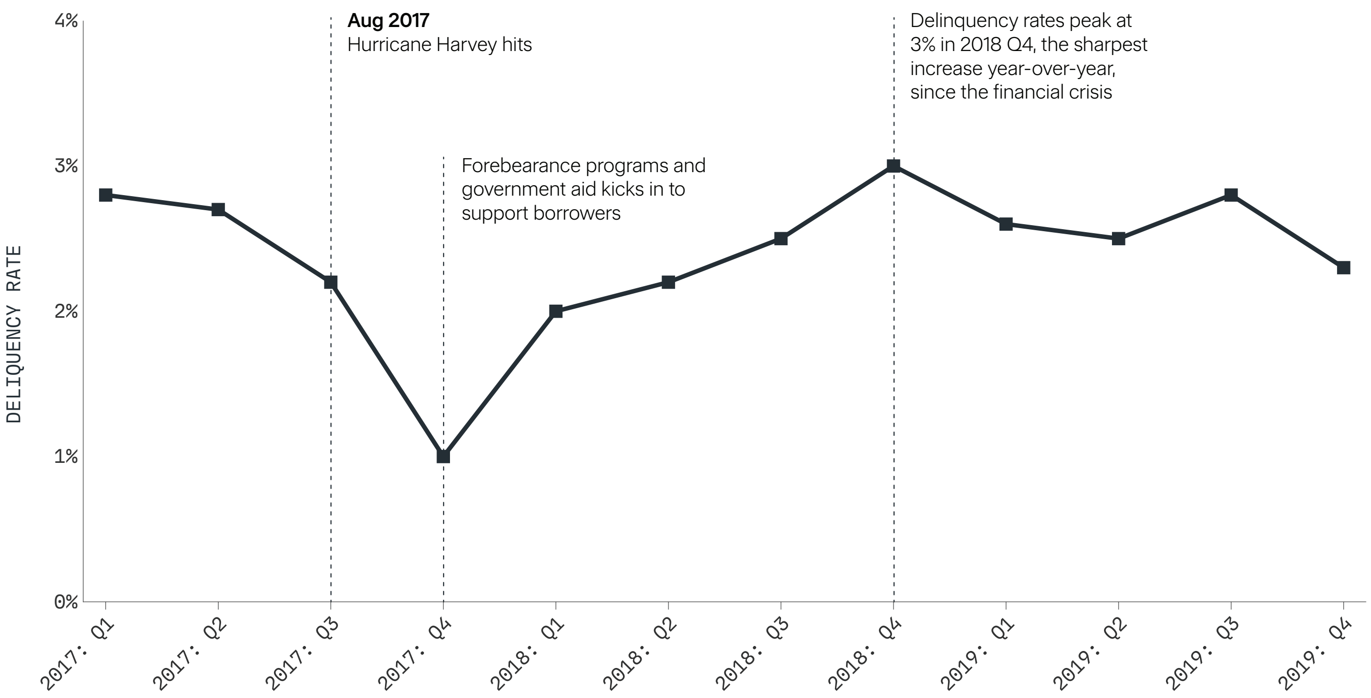


FIGURE 14. Delinquency Rates, Houston MSA 2017-2019

SOURCE: FHFA National Mortgage Database (NMDB) (2025), Residential Mortgage Performance Statistics

In light of the GSEs' exposure to disaster-related risk, the FHFA now requires GSE servicers operating in federally declared disaster areas to offer disaster forbearance, suspend foreclosure activity for up to 90 days, and assess borrowers for appropriate loss mitigation options once the forbearance period concludes (FHFA, 2025).

However, temporary forbearance solutions are not without costs. A detailed study on the Florida housing market by Calabrese et al. (2024), analyzing a portfolio of 69,046 loans, reveals a clear correlation between the intensity of tropical cyclones and the likelihood of mortgage default. Their analysis indicates that the hazard ratio associated with a Category 3 or higher hurricane is 3.34, compared to 1.65 for a Category 2 hurricane, demonstrating that the risk of default more than doubles as hurricane intensity increases. This increase is likely attributable to the more severe structural damage inflicted on properties by stronger storms.

Introduction

Hurricane Harvey Flooding and Damage

In March 2025, the FHFA, under newly appointed Director Bill Pulte, withdrew its initial Advisory Bulletin, prompting concerns that critical climate risks in the real estate market could go unmanaged. However, state governments and private financial institutions remain interested in the influence of physical climate risk on the market and are taking steps to address these challenges independently. For example, other federal entities, such as the Climate-related Financial Risk Advisory Committee (CFRAC), have emphasized the need for regulators and institutions to integrate climate risk into core financial supervision frameworks, with mortgage exposure identified as a priority area (CFRAC, 2025). Furthermore, the Mortgage Bankers Association (MBA) has expressed that climate risk poses direct and indirect impacts on existing financial risk categories governing the mortgage system including credit risk, market risk, operational risk, and liquidity risk, encouraging bankers to consider climate risk in their work (MBA, 2025).

In parallel with emerging climate risk initiatives, long standing foreclosure loss mitigation efforts across both federal programs and private-sector practices have been designed to assist borrowers facing financial hardship—whether due to job loss, medical emergencies, economic downturns, or increasingly, disaster-related events. Federal agencies such as the Federal Housing Administration (FHA) have implemented a range of borrower assistance tools, including loan forbearance, interest rate reductions, loan modifications, and payment deferrals, all aimed at avoiding foreclosure while maintaining the performance of federally backed mortgage portfolios (HUD, 2023). Similarly, the FHFA requires the GSE to offer borrower assistance through programs like the Flex Modification Program, which adjusts loan terms to improve affordability

Hurricane Harvey Flooding and Damage

for distressed borrowers (FHFA, 2025). These programs are essential for preserving homeownership and limiting credit risk to the Enterprises and investors in MBS. While these tools were originally developed to address financial or economic hardship, climate-related events have increasingly triggered their use.

Beyond federal channels, private mortgage servicers and lenders also play a central role in foreclosure prevention. In times of climate disasters or economic shocks, these institutions often provide proprietary forbearance and loan modification options—either in response to borrower hardship or prompted by state regulators. For instance, after the January 2025 Los Angeles wildfires, over 400 financial institutions collaborated with California's Department of Financial Protection and Innovation (DFPI) to offer relief measures such as deferred payments and reduced repayment plans (DFPI, 2025).

While such forbearance programs offer critical short-term relief, they often fall short in addressing the longer-term affordability challenges posed by escalating climate-related risks. Similarly, loan modifications—although longer-lasting—are also vulnerable to these mounting pressures. Moreover, forbearance is not without cost to lenders. Using a present value (PV) framework to evaluate the time value of modified payment streams, data from the CARES Act following the 2020 pandemic show that 20% and 30% payment reductions translated into lender losses between $3 billion and $7 billion across a sample of 1.95 million properties. When extrapolated to all properties under forbearance at that time, total PV-based costs could have reached $11 billion to $33 billion, with $8 billion to $25 billion specifically to federally insured mortgages (Federal Reserve Bank of Philadelphia, 2021).

Though many mortgages are held for fewer years or paid off early, the 30-year duration of standard mortgage loans creates direct exposure to escalating climate risks. As climate conditions worsen, even early in the loan period, these long-term financial obligations become increasingly vulnerable to default when disaster-related damages or insurance costs overwhelm homeowners' financial capacity. The combination of insufficient insurance coverage and a lack of financial preparedness exposes homeowners to a greater risk of default and foreclosure in the aftermath of disasters. Climate risk is therefore an emerging factor in mortgage risk management, compounding financial pressures on homeowners and lenders alike.

Hurricane Harvey Flooding and Damage

Methodology

First Street's analysis estimates both the direct and indirect impacts of natural disasters on foreclosure outcomes and extends those insights to determine how they affect credit risk outcomes both today and into the future as climate risks intensify. Direct effects are measured through a quasi-experimental framework that links spatially defined disaster events—floods, wildfires, and hurricane winds—to changes in foreclosure rates at the property level. Indirect effects are assessed through county- and ZIP code-level analyses of how broader economic shifts, rising insurance premiums, and home value changes influence foreclosure trends. Together, these approaches provide a comprehensive foundation for understanding how climate has interacted with foreclosure trends in the past and what future foreclosure risks may look like in the context of escalating climate-related pressures on housing markets.

Hurricane Matthew Aftermath Greenville, NC Flooding

DIRECT-IMPACTS: EVENT-BASED FORE CLOSURES

To quantify the direct effect of natural disasters on foreclosures, this analysis examined three major hazard types known to cause property damage: flood, hurricane wind, and wildfire. The methodology employed integrated spatial event boundaries—including floodplains, wildfire burn perimeters, and hurricane wind swaths—with property-specific damage assessments derived from both observed and modeled data. By linking these disaster parameters with foreclosure records at the property level, changes in foreclosure rates before and after disaster events were tracked, revealing disruptions in normal housing market patterns within affected communities.

EVENT SELECTION AND PROCESSING

The analysis began by selecting historical events, their geographic extents, and associated properties impacted from First Street's comprehensive database of historical disasters. Selection criteria were based on years of available data and peril-specific intensity thresholds sufficient to cause a meaningful impact on residential properties and communities.

First Street's flood event database contains fluvial (riverine) and hurricane-driven floods from 2001 to 2019. These events are historical recreations of flood depths and extents which were created through the application of First Street's Flood Model (FS-FM) to observed river and tide gauge water levels, with the methods used for this approach peer-reviewed (Wing et al., 2021). These simulations yielded property-level flood depth measurements for all structures within affected areas. Flood damage estimates were derived using fragility curves developed by Arup, a global engineering firm, which account for property characteristics such as first-floor elevation and foundation type. Like the flood simulations, the damage functions are reflective of the process in which flood damages are computed for First Street's larger model through a partnership with Arup, and their "first principles of engineering approach" to calculating climate exposure damages. Through this partnership, flood, wildfire, and hurricane wind damages are calculated using this same framework. These curves estimate damages that would likely occur to a building of a certain land use class (residential, commercial, etc.) and the normative location and cost of building infrastructure (i.e., the location of HVAC, elevator controls, electrical outlets, etc.) as a dollar value. The curves reflect how different materials, construction methods, and elevations respond to varying water depths. In total, 53 flood events met the inclusion criteria.

For wildfire events, First Street's collection of historical events draws from the Monitoring Trends in Burn Severity (MTBS) program and the National Interagency Fire Center (NIFC). MTBS uses Landsat satellite imagery to map burn severity and perimeters for fires larger than 1,000 acres. NIFC aggregates incident data from federal and state agencies to create consistent wildfire records. The selection focused on wildfires exceeding 10,000 acres that occurred from 2013 onward, aligning with established research on wildfire impacts on real estate markets. California wildfires were prioritized due to the availability of property-level impact data through the CAL FIRE's Damage Inspection (DINS) database, which provides structural damage assessments from certified inspectors. This process identified 146 qualifying wildfire events.

First Street's hurricane wind database utilized the International Best Track Archive for Climate Stewardship (IBTrACS) wind tracks. Surrounding wind swaths were generated for each tropical cyclone track through reconstructing the storm's wind field at each point along its path using recorded wind speeds in different directions, then combining these into a single area showing where damaging winds occurred. The analysis focused on hurricanes occurring since 2000 for consistency with other hazard types, and set a minimum intensity threshold of Category 1 hurricane wind speeds (74 mph) on the Saffir-Simpson Hurricane Wind Scale—the minimum velocity known to cause structural damage to residential properties. As hurricane events result in both wind damages and flooding, properties deemed as having high flood risk from coastal and fluvial flooding were excluded to distinguish wind impacts from flooding effects in coastal regions. This method identified 23 qualifying hurricane wind events.

FORECLOSURE SALES PROCESSING

Foreclosure sale records were sourced from a county assessor database across 2,059 counties nationwide (representing approximately 66% of all U.S. counties) through data provider Lightbox. These records included transaction-level details such as transaction type (new construction sale, resale, refinance, or foreclosure sale), property classification (single-family residential, condominium, commercial properties, etc.), loan value, and transaction date. For this analysis, only single-family residential foreclosures and other sales transactions were considered. Foreclosure transactions were also assumed to only occur among properties with a mortgage, limiting the analysis to mortgaged properties.

To link natural disasters with foreclosure patterns, properties affected by each disaster event were spatially joined with those in the transaction database, creating a detailed record of transactions within disaster-affected areas. A 72-month window centered on each event

Methodology

date was applied, keeping only those properties with transactions occurring within 36 months before and 36 months after the disaster. This timeframe covers all disaster-related effects, from forbearance and relief measures that can halt mortgage payments and legal actions for up to a year, delaying foreclosure proceedings. This is informed by research that shows impacts following a natural disaster often extend far beyond the immediate aftermath, years and sometimes decades after an event (Ratcliffe et al., 2020; Boustan et al., 2020).

To ensure robust analysis, a minimum of 30 total sales transactions as well as at least one foreclosure in both pre-event and post-event periods was required.

To contextualize foreclosure volumes, total property counts within each event area were incorporated from First Street's comprehensive property database. This allowed for foreclosure rates to be calculated alongside raw counts, providing a standardized measure of disaster impact across events.

Of the 223 disaster events initially compiled, only 55 had sufficient foreclosure activity—defined as at least one foreclosure before and after the event—to warrant further analysis. These included 29 flood events, 10 wildfire events, and 16 hurricane wind events (Figure 15). The remaining 168 events lacked sufficient transaction records to meet the analysis criteria and were therefore excluded. Of these, 137 were wildfire events, likely due to the localized nature of many disasters in rural areas with limited housing stock and few sales and foreclosure transactions, as well as broader economic conditions that may have reduced transaction activity.

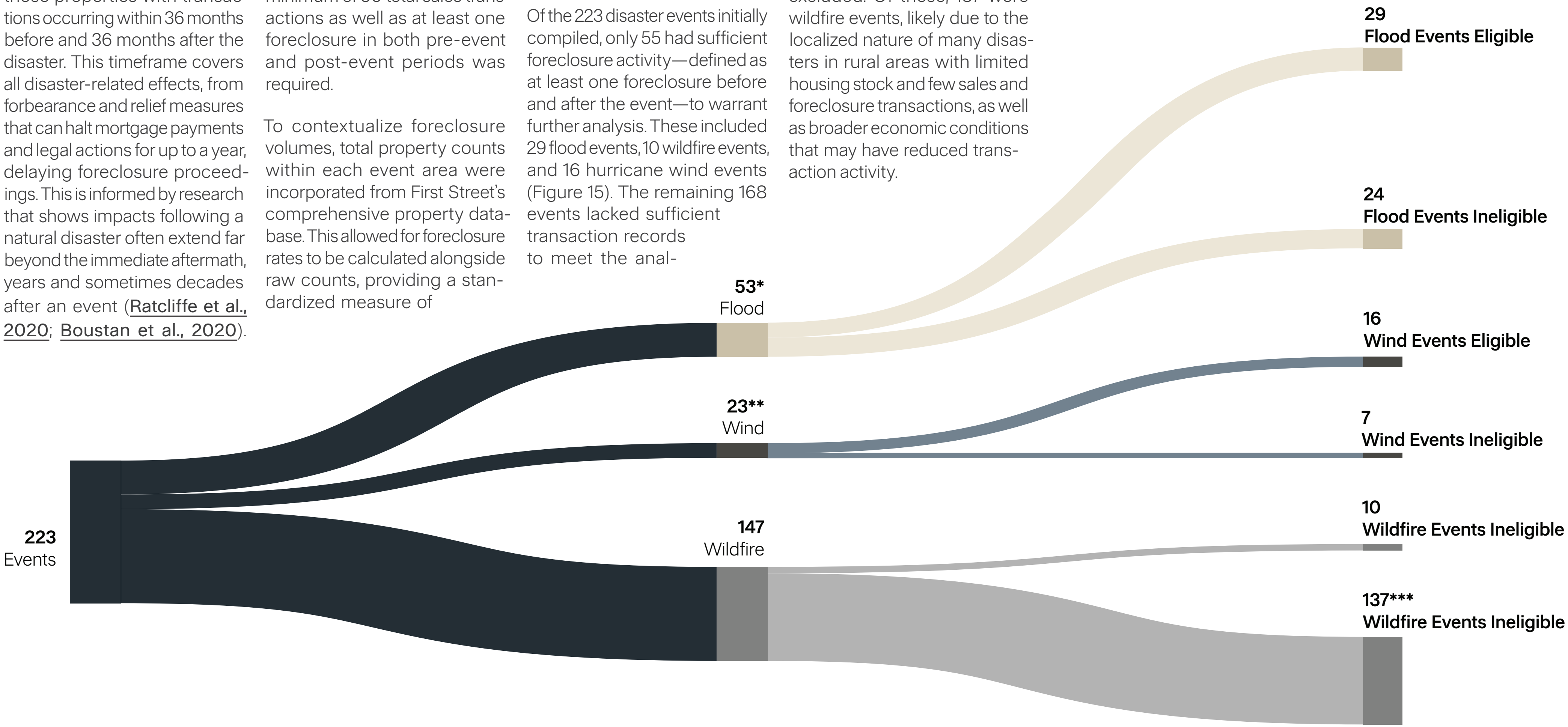


FIGURE 15. Event Selection and Merging Process
*Flood events included riverine and hurricane floods. **Hurricane wind events were disentangled from flood events by excluding events with residential properties significantly impacted by coastal storm surge or pluvial (rainfall) flooding. ***A significant number of wildfire events were excluded as they did not meet the criteria of at least 30 transactions, likely due to the rural nature of these events.

Methodology

SORTING PROPERTIES

As the next step in the analysis, properties were classified based on their level of exposure to a disaster event. This included both directly impacted properties and those in nearby areas not directly affected. A spatial buffering approach was used to assign properties to these categories based on each hazard type's specific qualities and property-level observed or simulated estimates of impact or damage, creating a quasi-experimental framework that leverages variation in impact within the same geographic area. This design enables a more precise assessment of how exposure to extreme weather influences foreclosure risk, while also capturing potential spillover effects on surrounding properties.

FLOODING

For flood events, properties were sorted based on simulated, property-level physical impacts, including flood depth and associated damage estimates. To account for spillover effects from flooded or damaged infrastructure that may impact unflooded properties indirectly through job disruption or other dynamics, all properties within census tracts affected by a flood event were incorporated. Because flooding varies at a hyper-local level due to factors such as elevation and drainage, including entire census tracts helps capture both direct and indirect impacts on foreclosure risk.

Property sorting began by identifying properties exposed to flooding.

As shown in Figure 16 above, a 1.5-mile buffer was generated for each of these units to include neighboring properties within the vicinity of flooded properties, accounting for localized heterogeneity in flood impact. This radius selection reflects a balance: it is large enough to incorporate microgeographic variation in exposure (e.g., elevation, proximity to water bodies, basement presence), yet small enough to minimize the inclusion of households affected indirectly by broader community-wide disruptions such as job losses or infrastructure failure.

Individual buffers around foreclosed units are dissolved into a single event-level buffer to streamline computation. All residential parcels within the unified buffer are extracted to construct the analytic sample.

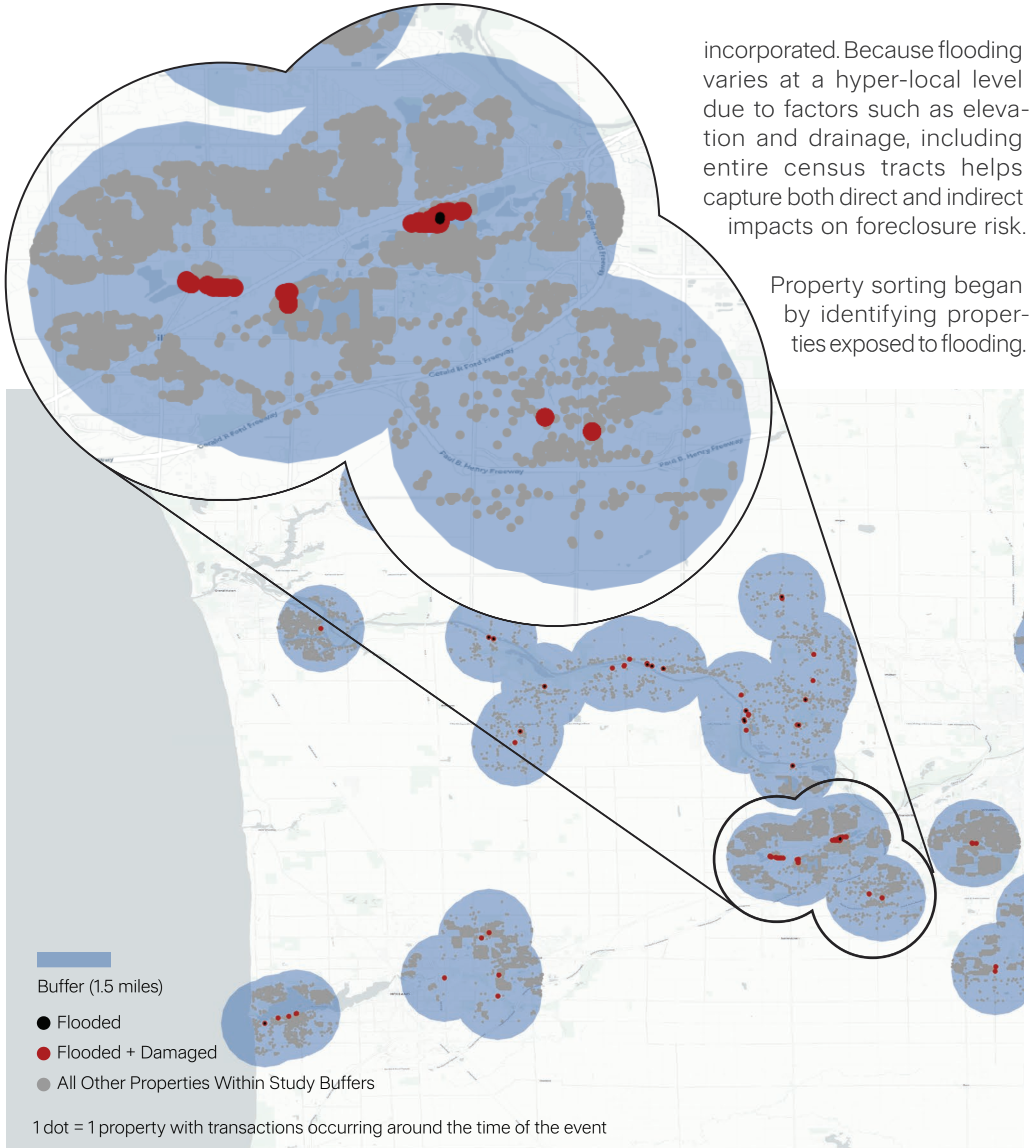


FIGURE 16. Property Selection - River Flood Near Grand Rapids, MI

PROPERTIES ARE THEN CATEGORIZED INTO THREE MUTUALLY EXCLUSIVE EXPOSURE GROUPS:

FLOODED + DAMAGED
Properties with modeled flood depths greater than zero and associated structural damage estimates exceeding zero.

FLOODED ONLY
Properties with modeled flood depths greater than zero but without any structural damage recorded.

NOT FLOODED (NEARBY)
Properties located within the flood model's spatial extent and within the 1.5-mile buffer but with a modeled flood depth of 0—potentially subject to indirect or neighborhood-level effects, but not directly inundated.

Methodology

WIND

Properties affected by hurricane windstorms were categorized based on wind severity and potential damage, as defined by the Saffir-Simpson Wind Scale (NOAA). This scale categorizes storms into five hurricane levels, with an additional classification for tropical storms:

Tropical Storm (39–73 mph): Strong winds can cause minor damage to trees, power lines, and weak structures.

Category 1 (74–95 mph): Some damage to roofs, siding, and trees; power outages likely.

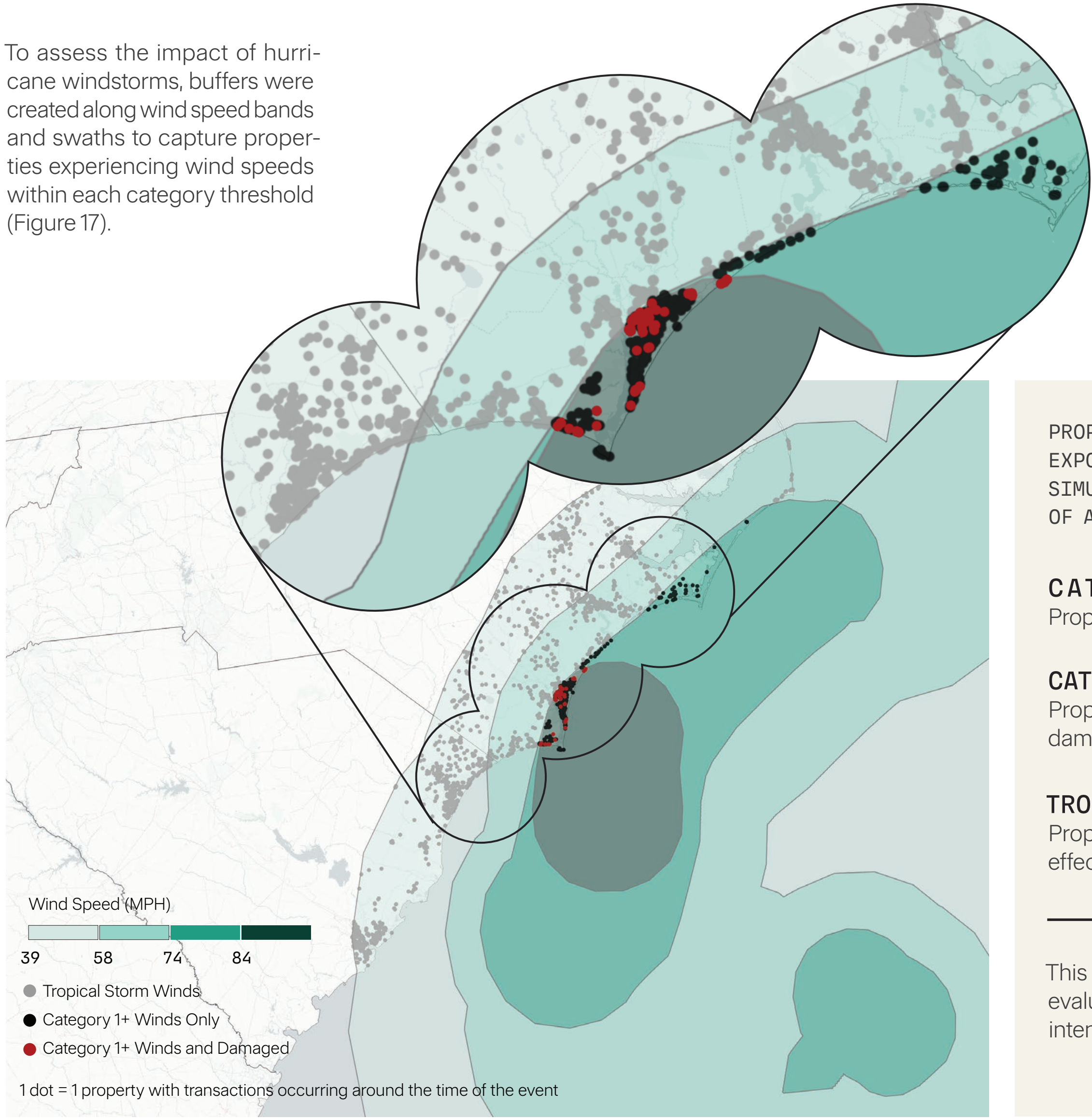
Category 2 (96–110 mph): Extensive damage to homes; near-total power loss for days.

Category 3 (111–129 mph): Devastating damage; roofs and walls may fail; electricity and water unavailable for days to weeks.

Category 4 (130–156 mph): Catastrophic damage; most trees and power poles down; months-long power outages.

Category 5 (157+ mph): Total structural failure of many buildings; uninhabitable areas for weeks to months.

To assess the impact of hurricane windstorms, buffers were created along wind speed bands and swaths to capture properties experiencing wind speeds within each category threshold (Figure 17).



PROPERTIES WERE THEN GROUPED INTO THREE MAIN EXPOSURE CATEGORIES BASED ON BOTH WIND SPEED AND SIMULATED DAMAGE FROM FIRST STREET'S APPLICATION OF ARUP FRAGILITY CURVES:

CATEGORY 1+ WINDS & DAMAGED
Properties with wind speeds ≥ 74 mph and simulated damage.

CATEGORY 1+ WINDS ONLY
Properties with wind speeds ≥ 74 mph but no simulated damage.

TROPICAL STORM WINDS
Properties with wind speeds < 74 mph, where indirect effects may still be present.

This classification approach provides a structured way to evaluate hurricane wind impacts by integrating both wind intensity and modeled structural vulnerability.

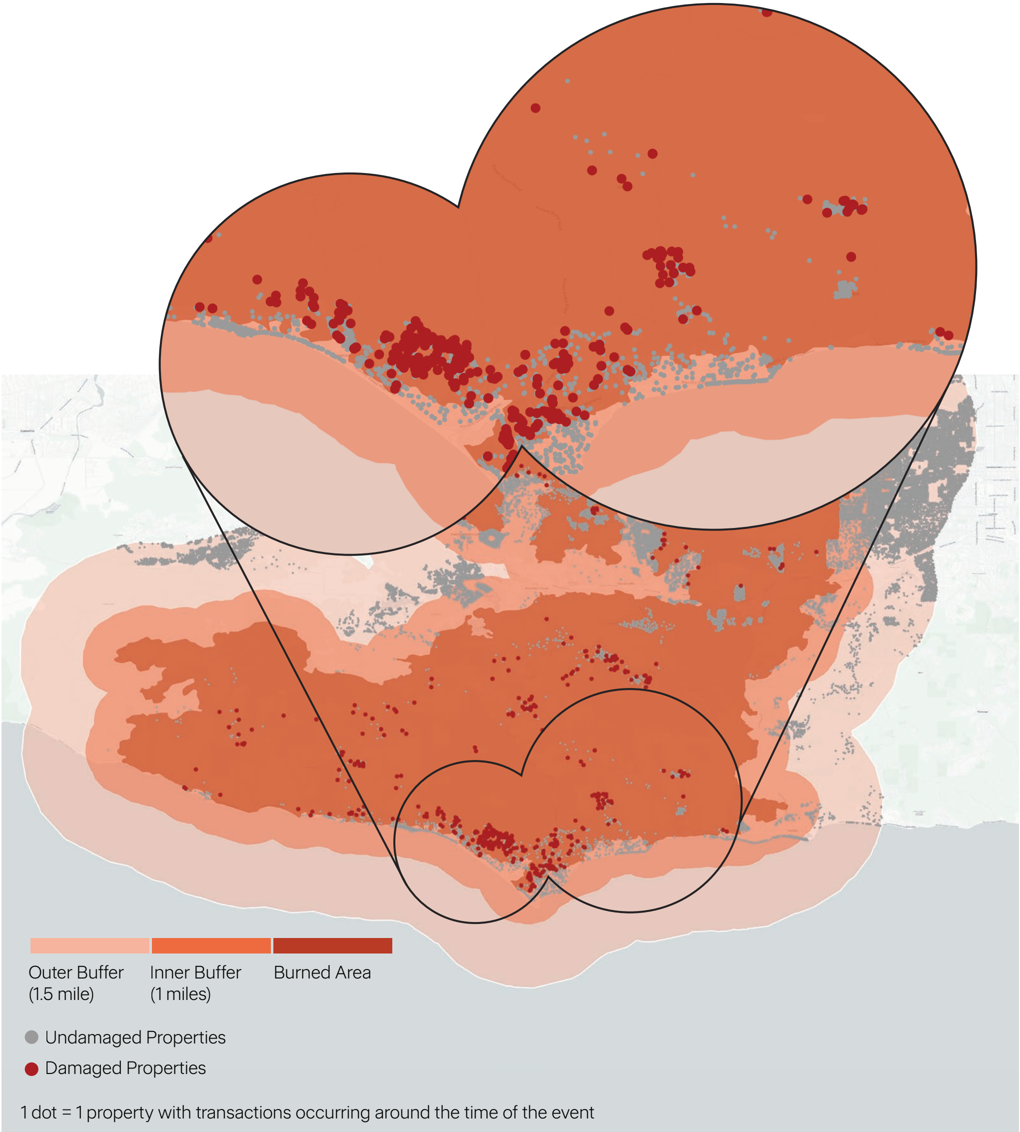
FIGURE 17. Property Selection for Hurricane Ophelia

Methodology

WILDFIRE

Analysis of wildfire exposure and foreclosure risk employs a spatial design closely modeled by Biswas et al. (2023), who implement a quasi-experimental strategy to measure the impact of wildfire damage on mortgage outcomes. The unit of analysis is the individual wildfire event. For each event, a dataset of properties within the official burn perimeter was constructed, drawing on the California Fire Damage Inspection (DINS) dataset, which provides parcel-level damage assessments.

Properties are categorized as damaged or undamaged based on DINS classifications. Importantly, the sample includes both foreclosed and non-foreclosed properties to allow for subsequent matching and comparative analyses. All identified parcels are overlaid with the wildfire burn perimeter to define the "core impact area." From this perimeter, a "donut-style" buffer design was applied to delineate indirect exposure zones.



TWO CONCENTRIC BUFFERS WERE GENERATED AROUND THE WILDFIRE PERIMETER TO INCLUDE ADDITIONAL PROPERTIES IN THE SURROUNDING AREA:

INNER BUFFER

1 mile surrounding the fire perimeter is excluded from the analysis to mitigate spillover effects and behavioral responses caused by immediate visual or environmental exposure.

OUTER BUFFER

Spanning from **1 to 2.5 miles** from the fire perimeter is retained and labeled as the "outside perimeter." Properties in this zone serve as controls in subsequent analyses and help identify potential indirect effects from the disaster (e.g., infrastructure disruption or evacuation spillovers) while limiting contamination from direct damage.

The final sample allows for an analysis across varying levels of impact intensity, with damaged properties considered the highest exposure group.

FIGURE 17. Property Selection - Woolsey Fire

Methodology

ANALYSIS

After properties were categorized by impact severity, changes in foreclosures could be analyzed by comparing pre- and post-event timeframes. Although impact levels were defined using post-event data, pre-event transactions were retroactively assigned to these categories by matching them to the impact outcomes of properties. This approach enabled direct, one-to-one comparisons of foreclosure outcomes within each impact group before and after the disaster. Quantification of the change in foreclosure trends were conducted using three methods:

1. Change in overall count of foreclosures across impact categories
2. Change in rate of foreclosures relative to the total number of mortgaged properties across impact categories
3. Econometric difference-in-difference (DiD) approach to control for preexisting differences and differences over time

Basic approaches for estimating the overall change in count of foreclosures involved a simple summation of the count of foreclosures over the pre (36 months prior to the event date) and post (36 months after the event date) time periods. Absolute difference and percent change were estimated across these periods. To standardize the change and allow for comparison across events, a foreclosure rate was constructed by dividing counts of foreclosures by the overall number of mortgaged properties in the affected areas, defined by the spatial buffer approaches used for each peril type and event.

The above two approaches allow for an understanding of foreclosure outcomes within the context of each event's timing and location, with local market conditions baked into the changes estimated. However, to more rigorously isolate the effect of a natural disaster on foreclosure outcomes—beyond simple pre- and post-event comparisons—a difference-in-differences (DiD) approach was employed. This method statistically controls for both time-invariant differences between impacted and non-impacted properties and for broader trends over time that may affect all properties regardless of exposure. By comparing changes in foreclosure rates before and after the event across both groups, the DiD model estimates the causal effect of the disaster itself, accounting for underlying baseline differences and shared temporal influences. This allows for a more precise attribution of foreclosure changes to the disaster shock rather than to unrelated economic or housing market shifts.

Separate DiD models were estimated for each hazard type—flood, wildfire, and hurricane wind—resulting in three distinct models. In all cases, the foreclosure outcome served as the dependent variable, while impact level (e.g., directly impacted, nearby, or unaffected) was the key explanatory variable, also known as treatment group. The models were run at the transaction level, allowing for the estimation of how exposure to a physical hazard affected the likelihood that a property transaction would result in foreclosure. Specifically, the flood model used flooded properties as the treatment group, the wildfire model used properties identified as damaged, and the wind model used properties exposed to Category 1 or higher hurricane winds to capture the effect of each hazard on foreclosure risk.

The resulting coefficient from each model can be interpreted as the estimated effect of the disaster on foreclosure risk for impacted properties, after accounting for underlying differences between impacted and non-impacted areas and overall trends over time. In other words, it reflects how much more (or less) likely a property was to foreclose after a disaster, specifically due to the physical impact of that event.

ADDITIONAL SUBSETTING

While the physical impact of an event on properties was differentiated across properties that were in the vicinity of an event, those with some physical impact, and those with enough of an impact to inflict damage, further subsetting of results was conducted to explore the underlying drivers of foreclosures.

Hurricane Matthew Aftermath
Greenville, NC Flooding

These included assessing:

1. The timing of the event relative to the financial crisis
2. Positive versus negative changes in home value leading up to the event and foreclosures
3. Socioeconomic status for the borrower as defined by LMI versus non-LMI status
4. Flood insurance coverage proxied by a property existing within or outside of an SFHA at the time of the event

While the timing of the event was inherent to the existing data in the analysis, additional data was collected to support disaggregating the results into other sub-groupings.

FLOOD INSURANCE COVERAGE

For flood-related events, this analysis aimed to compare foreclosure outcomes between properties located within and outside of Special Flood Hazard Areas (SFHAs). This distinction serves as a proxy for differences in flood insurance coverage. Properties within SFHAs are required to carry flood insurance if they have federally backed mortgages and are often subject to additional lender-imposed requirements, while properties outside of SFHAs are less likely to carry flood insurance, either because it's not mandated or because the perceived flood risk is lower. By distinguishing properties into these groups, the analysis determined whether flood insurance coverage (or lack thereof) influenced foreclosure risk following a disaster.

FEMA updates SFHA boundaries periodically, particularly following acute flooding events. However, not all historical SFHA updates are readily available in digitized, machine-readable formats. Since the historical events analyzed date back to the early 2000s, many SFHAs have since been updated in current records. This analysis used only SFHA boundaries with effective dates preceding each disaster event, assuming that only flood zones in effect at the time would have influenced insurance coverage and borrower awareness. As a result, events for which flood zone updates occurred after the disaster date were excluded, reducing the sample with sufficient SFHA data available from 29 to 15 total flood events.

Methodology

FINANCIAL CRISIS TIMING

Foreclosure patterns in the U.S. experienced significant shifts over the two decades (Figure 19). These shifts can be best understood by dividing the timeline into three distinct periods:

- **PRE-FINANCIAL CRISIS (2000–2005)**: A steady, monotonic increase in foreclosure activity occurred, with total foreclosures rising by 38% between the beginning and end of this period.
- **FINANCIAL CRISIS (2007–2012)**: This period was marked by extreme volatility, reflecting the broader economic instability. Although foreclosure rates fluctuated dramatically during this time, the net change was a modest 4% increase.
- **POST-FINANCIAL CRISIS (2013–2016)**: Foreclosure rates declined sharply and consistently, resulting in a 51% decrease over the period.

These national trends reflect broader economic cycles that may influence local housing market responses to natural disasters. As such, each disaster event in the analysis was categorized according to the period in which it occurred. This period-based classification allows for a more nuanced understanding of how natural disasters affect foreclosure outcomes within the economic contexts of expansion, crisis, and recovery.

HOME VALUE CHANGES

To evaluate how natural disasters impact foreclosures in the context of home value appreciation or depreciation, foreclosure sales were linked to prior property transactions and analyzed alongside local housing market trends using the Housing Price Index (HPI). County-level annual HPI data were obtained from the FHFA, which provides a broad measure of single-family home price movements based on repeat sales and refinances of the same properties.

For each property that was foreclosed after a disaster event, the most recent previous transaction, including a sale or refinance, was identified using a unique property identifier. These transaction records included estimated property values and the dates of the transaction. When an individual property's prior value estimate was missing, it was imputed using the mean home value for that county and year, based on available transaction records. Each property's earlier transaction value was then adjusted to reflect its estimated value at the time of the disaster event by applying the proportional change in HPI between the transaction year and the event year.

This approach allowed us to estimate whether the property had appreciated or depreciated in value leading up to the foreclosure, providing insight into the relationship between home value trends and foreclosure outcomes following a disaster.

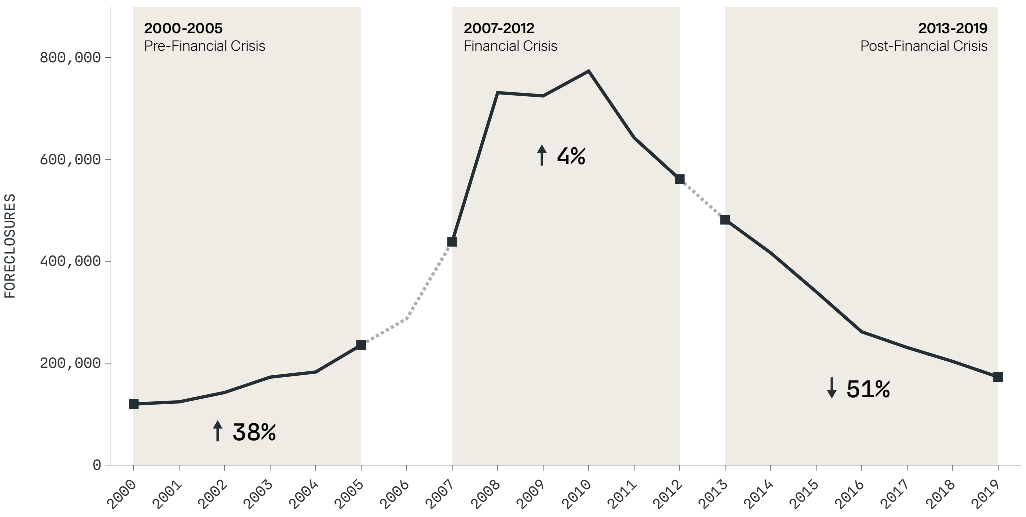


FIGURE 19. National Foreclosure Trends: Pre-Financial Crisis, Crisis, and Post-Crisis

Damage from Hurricane Andrew in Florida in 1992

SOCIOECONOMIC STATUS

Foreclosure outcomes are often closely tied to a borrower's economic profile, with income level playing a central role. Financial institutions commonly assess a borrower's income not only in absolute terms, but relative to the income distribution in their surrounding area. This context-based approach is known as low-to-moderate income (LMI) status, and it is widely used in both banking and housing policy, including by the U.S. Department of Housing and Urban Development (HUD). LMI designations typically apply to geographic areas such as ZIP codes or census tracts. An area is considered LMI if the majority of households earn less than 80% of the median family income for the surrounding metropolitan area or non-metropolitan region.

In this analysis, properties were categorized as LMI or non-LMI based on whether they were located in a LMI census tract according to HUD definitions. This enabled a comparison of post-disaster foreclosure outcomes to assess whether lower-income communities are disproportionately affected by natural disasters in terms of housing stability and foreclosure risk.

Methodology

LOAN PERFORMANCE & PROBABILITY OF FORECLOSURE

In addition to capturing how natural disasters impact changes in foreclosures, the nature of those foreclosures was also assessed. This involved examining the financial condition of borrowers at the time of foreclosure, focusing on key housing finance indicators such as home appreciation, equity position, and LTV ratios.

This analysis began by matching foreclosure sales occurring around the time of an event to their previous transactions and characteristics, including property value, loan amount, loan term, interest rate, and transaction date. These transactions are then matched to annual, county-level HPI data from the FHFA, allowing us to escalate property values forward through time. Using this HPI data, we estimate key benchmarks: the property value at sale (year 0), at the time of the event (defined as event month + 6 months), three years after the event, and, when applicable, at the time of foreclosure. These values are scaled from the transaction price using the ratio of HPI at each future point relative to the HPI at purchase.

To estimate a property's value at purchase (if the market price was missing or below the reported loan), we apply common loan-to-value assumptions: 80% for conventional loans and 95% for FHA or VA loans, consistent with typical down payment thresholds. Loan data and amortization logic are then incorporated to model equity changes over time—calculating the mortgage balance at the event using a standard 30-year loan amortization schedule. This gives results in a dynamic view of LTV at

Florida panhandle following Hurricane Michael

both the point of purchase and event. The combination of value appreciation (or depreciation) and loan payoff provides which homeowners saw their equity increase or erode. Outcomes are summarized by whether the property was damaged, located in a low-to-moderate income (LMI) area, or foreclosed, and fit logistic regression models to predict foreclosure as a function of LTV change and HPI change. This provides a basis for estimating how financial strain—particularly eroding equity—contributes to foreclosure risk across different geographies and household profiles.

Similarly, outstanding balances at the point of foreclosure were estimated by reconstructing each loan's amortization schedule from origination through the assumed foreclosure date. The original principal, interest rate, and term for each loan were used to compute the standard fixed-rate payment, and the remaining principal balance was tracked month-by-month. Because the dataset records foreclosure-sale dates rather than the initial default events, foreclosure was backdated by 12 months and a four-month grace period was added to reflect typical delinquency prior to sale. As a result, the "foreclosure balance" represents the principal outstanding 16 months before the recorded sale date.

INDIRECT-IMPACTS

To assess how external factors such as insurance costs, economic productivity, and home price appreciation influence foreclosure trends, a series of two-variable relationships were developed. These models assess the statistical association between changes in each factor and shifts in foreclosure rates, highlighting both the direction and strength of the relationship. This approach helps reveal how foreclosure risk may intensify in response to evolving economic and environmental conditions.

To conduct this analysis, foreclosure sales were compiled from county assessor data spanning 2000 to 2019, covering 2,059 counties—or 65.5% of all U.S. counties—based on data availability and the presence of foreclosure activity. This resulted in a longitudinal dataset of annual foreclosure counts at the county level. To assess long-term trends, the average annual number of foreclosures from 2001 to 2006 was defined as the "pre-financial crisis" baseline and compared to a "post-crisis" period from 2014 to 2019. These multi-year groupings smooth out short-term volatility and highlight broader shifts in foreclosure activity over time. A simple percent change was derived as the value of (post - pre) / pre.

Changes in foreclosure were also examined at the ZIP code level across 17,593 ZIP Code Tabulation Areas (ZCTAs), representing 53.1% of all ZCTAs. This partial coverage is due to similar data limitations as those affecting county-level analysis. ZIP code-level data were paired with localized insurance premium information, while broader economic indicators—such as gross domestic product (GDP) and housing price index (HPI)—were matched at the county level.

Rising insurance costs can increase the overall cost of homeownership and contribute to foreclosure risk when they exceed a homeowner's ability to pay. Unlike fixed mortgage payments, insurance premiums can fluctuate over time, making them a key driver of escalating housing costs. Thus, the association between changes in homeowners insurance premiums and changes in foreclosures were measured. Homeowners' insurance premium data were collected from county assessor records covering the years 2019 to 2022. Because historical insurance data were unavailable for earlier periods, changes in premiums were calculated over this four-year window. These changes were then compared to longer-term trends in foreclosure activity spanning from the pre- to post-financial crisis periods.

Florida panhandle following Hurricane Michael

Although this introduces a lag between the foreclosure and insurance data, the comparison remains meaningful: insurance premium increases often serve as a forward-looking signal of local risk. Areas experiencing sharper premium hikes tend to reflect rising exposure to hazards or structural vulnerabilities, which may erode homeowners' financial stability and increase foreclosure risk. To contextualize these changes, ZIP codes were grouped by low-to-moderate income (LMI) status using designations from the U.S. Department of Housing and Urban Development (HUD). LMI ZIP codes are defined as areas where the majority of households earn less than 80% of the metro area's median income.

Economic productivity, signifying contractionary or expansionary periods, may be another

Methodology

indirect factor influencing foreclosure outcomes. Times of recessions are associated with higher unemployment and financial hardship, creating an environment when foreclosures are more likely, as exhibited by the trend in foreclosures during the 2008 financial crisis. To formalize this relationship, the association between changes in local GDP and changes in foreclosures were estimated. Data on local GDP were collected at the county-level and obtained from the U.S. Bureau of Economic Analysis (BEA) regional accounts. GDP figures are reported in thousands of chained 2012 dollars, providing inflation-adjusted values for accurate comparison over time. To analyze the long-term relationship between economic conditions and foreclosure activity, county-level GDP was smoothed over the same periods used for foreclosure data: a pre-crisis period (2001–2006) and a post-crisis period (2014–2019). The total GDP over each period was summed, and the change was computed by county.

Home appreciation and depreciation significantly influence the likelihood of foreclosure. As previously discussed in this report, when homes appreciate, owners gain equity since their outstanding loan amount decreases in relation to their property's rising value. Conversely, when a home depreciates, the owner's equity diminishes, rendering the remaining loan more burdensome compared to the home's lower value. This latter scenario poses a considerable risk of foreclosure. Accordingly, the trends in home prices, whether increasing or decreasing, are evaluated using the Housing Price Index (HPI) gathered from the Federal Housing Finance Authority. Like GDP, HPI was averaged over the 2001–2006 and 2014–2019 periods to assess long-term appreciation or depreciation and changes were computed across those two periods for each county.

To explore how each of these three factors—insurance premiums, GDP, and HPI—relate to changes in foreclosures, a series of simple single-variable linear regressions were conducted. Each regression estimates the direction and magnitude of the relationship between a single explanatory variable and foreclosure change. This bivariate approach isolates the marginal effect of each factor without the confounding influence of additional covariates, allowing for a clearer interpretation of each variable's role.

View of flooded New Orleans, Louisiana in the aftermath of Hurricane Katrina

Results

FIRST STREET'S ANALYSIS SET OUT TO ANSWER TWO CRITICAL QUESTIONS NOT YET EXPLORED AT A NATIONAL SCALE:

1

To what extent do extreme-weather damages—compounded by insurance coverage gaps and indirect climate pressures (rising insurance premiums, home-value fluctuations, and broader economic strain)—drive foreclosures and bank credit losses?

2

How can climate risk be incorporated into traditional credit-risk frameworks to help banks anticipate and mitigate those losses?

To answer these questions, foreclosure trends from 55 matched flood, wildfire, and hurricane-wind events were examined alongside indirect pathways—rising insurance premiums, home-equity losses from property-value declines, and broader economic strain.

KEY FINDINGS INCLUDE:

- MULTI-HAZARD PATTERNS: Approximately half of all events were followed by elevated foreclosure rates, with varied impact depending on peril type, timing, and local context.
- FLOODS AS PRIMARY TRIGGERS: Flood events—particularly uninsured losses in low-income areas—consistently drove increases in foreclosures. Wildfire and wind impacts tended to be weaker or more localized, reflecting broader insurance coverage and stronger housing markets.
- HIDDEN CREDIT LOSSES: Reconstruction of outstanding loan balances and application of standard loss-given-default assumptions (notably for Hurricane Sandy) uncovered substantial exposures overlooked by conventional models that omit flood risk.
- INDIRECT PRESSURES: Rising homeowners' insurance costs, home-price declines, and economic contractions further amplify foreclosure risk when combined with direct hazard impacts.
- FUTURE VULNERABILITY: County-level projections—integrating historical disaster impacts with ongoing insurance, home-value, and economic trends—point to growing mortgage risk as natural disasters intensify and indirect climate pressures mount.

Together, these insights underscore both the direct and indirect pathways through which climate change threatens mortgage performance and demonstrate the need to integrate climate risk into credit-risk frameworks.

Results

OVERALL RESULTS ACROSS PERILS

Of the 55 disaster events linked to foreclosure records, roughly half (27 events) were followed by a noticeable increase in foreclosure rates for properties that experienced physical impacts from floods, wildfires, or hurricane winds relative to nearby properties that were not directly impacted (Figure 20). While examining the results from this perspective may suggest that natural disasters have weak effects on foreclosure outcomes, it is crucial to examine these results more closely by the peril type and underlying factors specific to each historical event. Specifically, flood disasters emerged as the most significant driver of foreclosures, with 20 out of 29 flood events (over two-thirds) showing increased foreclosure rates among affected properties. By contrast, hurricane wind events saw an increase in foreclosures in only 6 out of 16 cases (a little over one-third), and wildfires saw an increase in foreclosures only once in 10 events (10%).

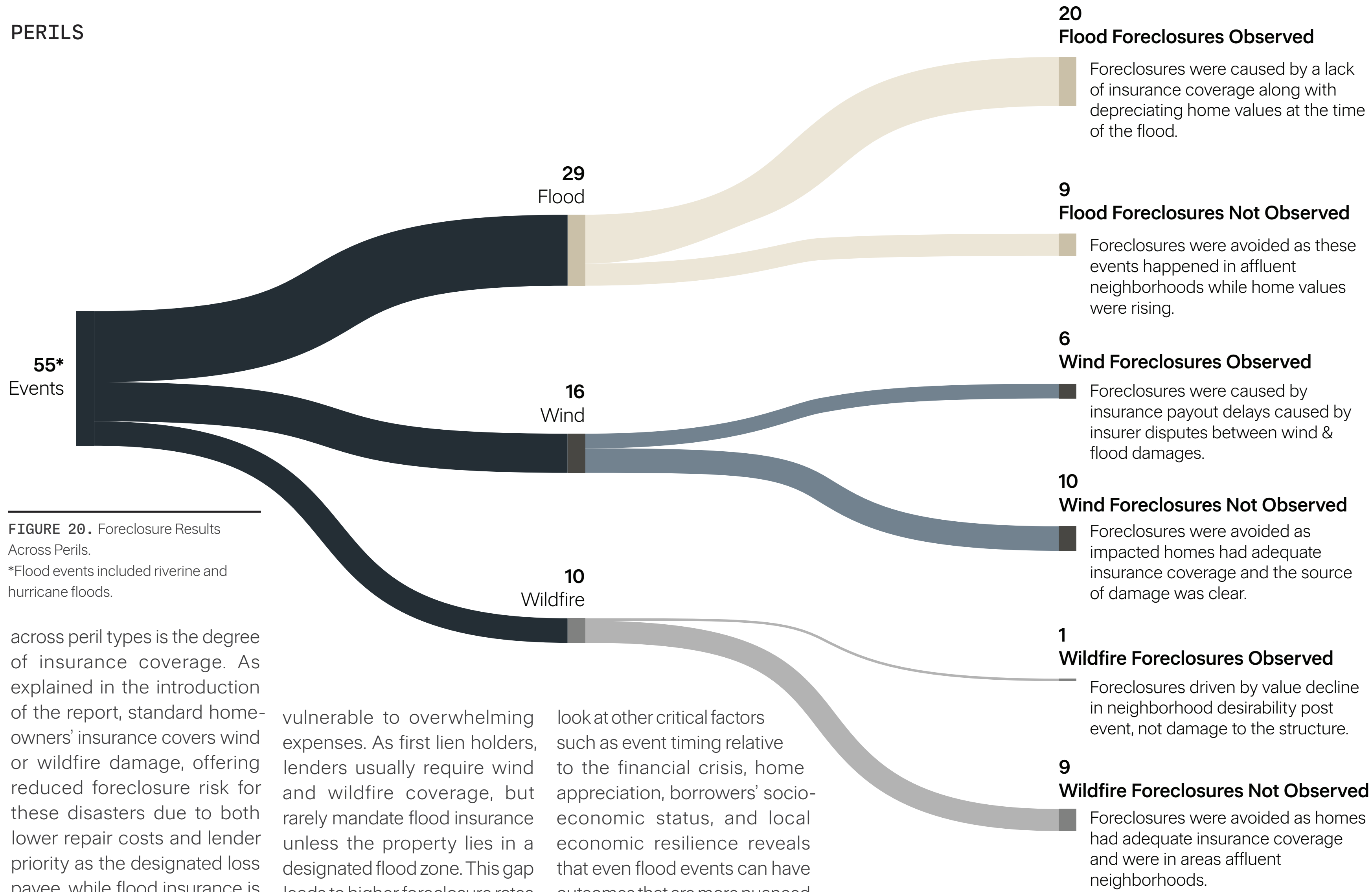


FIGURE 20. Foreclosure Results Across Perils.
*Flood events included riverine and hurricane floods.

A key factor behind these variations in foreclosure outcomes across peril types is the degree of insurance coverage. As explained in the introduction of the report, standard homeowners' insurance covers wind or wildfire damage, offering reduced foreclosure risk for these disasters due to both lower repair costs and lender priority as the designated loss payee, while flood insurance is optional or costly, leaving many homeowners unprotected and vulnerable to overwhelming expenses. As first lien holders, lenders usually require wind and wildfire coverage, but rarely mandate flood insurance unless the property lies in a designated flood zone. This gap leads to higher foreclosure rates following flood events compared to other perils. However, a closer look at other critical factors such as event timing relative to the financial crisis, home appreciation, borrowers' socioeconomic status, and local economic resilience reveals that even flood events can have outcomes that are more nuanced than they initially appear.

Results

WILDFIRE EVENTS

Of the 10 wildfire events analyzed, 9 were associated with a decrease in foreclosure counts across all properties, including those within the wildfire perimeter and those that were burned or damaged. The only exception was the Erskine Fire, which ignited on June 23, 2016, in Kern County, California. This fire led to an increase in foreclosures but only among properties located within the wildfire perimeter that were not directly burned, suggesting spillover effects from nearby damage. Burned properties, by contrast, saw no change in foreclosure rates, with the same number of foreclosures recorded before and after the event.

The Erskine Fire stands out due to its destruction of over 280 homes and displacement of hundreds of residents in a rural, high-poverty area already facing housing instability. Unlike larger fires in more affluent areas, Erskine's impact fell heavily on vulnerable households, which may have contributed to the rise in spillover foreclosures even among undamaged homes.

Otherwise, burned properties across all wildfire events tended to show a sharper decline in foreclosures compared to properties outside the wildfire perimeter. As shown in Figure 21, foreclosures among burned properties decreased by 87.0%, while properties outside the perimeter declined by 61.9%, and those within the perimeter by 72.7%. These figures suggest that, in most cases, when a home is destroyed by wildfire, the homeowner may receive an insurance payout that substantially or fully covers the outstanding mortgage. Because lenders are typically listed as a loss payee, these proceeds can go directly to the lender, potentially averting foreclosure. While the extent of coverage varies depending on policy limits and deductibles, the protective coverage of homeowners insurance and other specialized wildfire insurance needed to obtain a mortgage generally helps protect against the most extreme cases of delinquency and default, including foreclosure.

> ■ *Properties damaged in a wildfire are **1.46 percentage points less likely** to foreclose than nearby undamaged homes.*

All wildfire events in this analysis occurred after the financial crisis, during a period of national economic recovery when foreclosures declined by an average of 51%—with steeper drops in wildfire-affected areas observed as presented in Figure 19. One possible reason for this localized resilience is California's strong housing market. Even when wildfires destroy structures, the underlying land often retains or gains value, supported by rising home price indices (HPI). From 2012 to 2020, California home prices rose by 76%, compared to a national increase of 47% (FRED, 2025). This appreciation helps many homeowners maintain positive equity even after damage, reducing the likelihood of foreclosure. However, short-term financial strain is still common. Delinquencies and loan modifications often follow such disasters, reflecting temporary hardships. Research by the Federal Reserve Bank of Philadelphia and others finds that while widespread foreclosure spikes are rare after wildfires, many households still face increased delinquencies and mortgage stress (Biswas and Hossain, 2023).

Crucially, statistical analysis using a DiD framework reveals the isolated effect of wildfire damage on foreclosure risk, controlling for pre-existing differences between groups of properties impacted. Elaborating on what was found through the counts and rates analysis, First Street estimates that properties damaged in a wildfire are 1.46 percentage points less likely to foreclose than nearby undamaged homes.

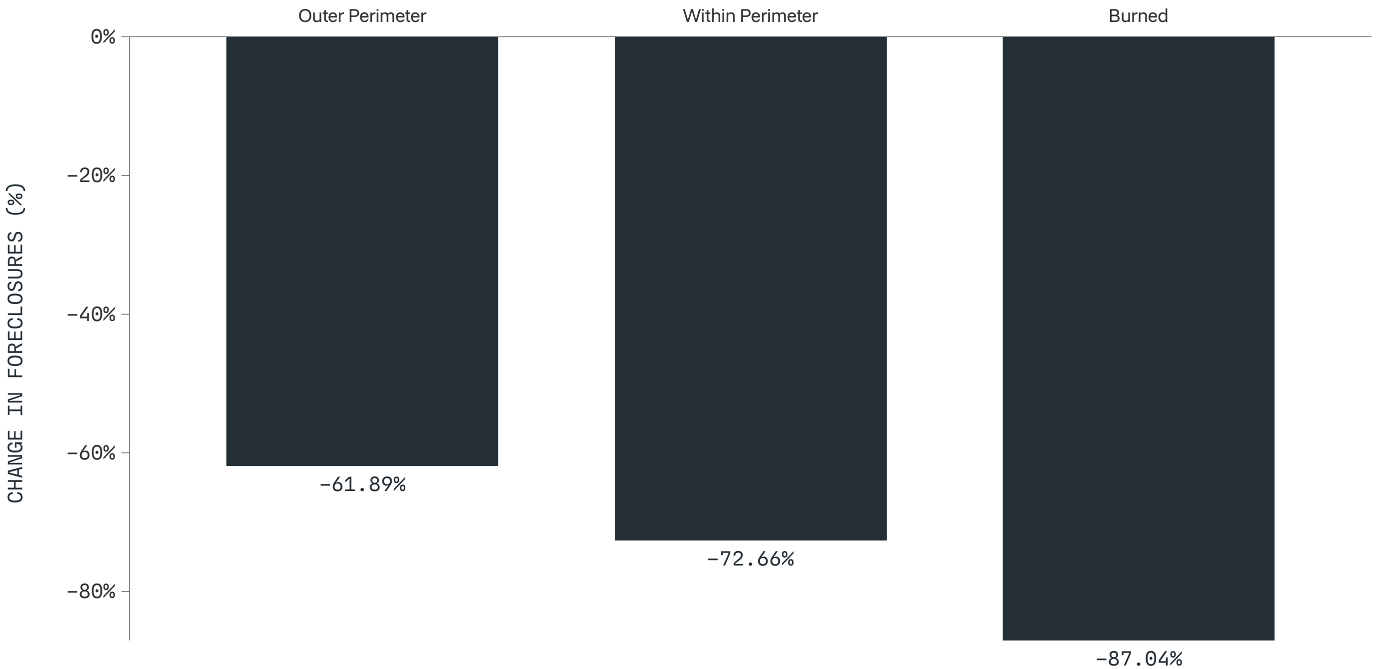


FIGURE 21. Change in Foreclosures By Effect of Wildfire on Property

Methodology

The above implies that the post-disaster period saw a relative improvement in foreclosure outcomes for damaged properties. This relative improvement could be attributed to the strong underlying appreciation of home values in California, allowing homeowners to retain equity despite structural damage. Furthermore, insurance payouts from standard HO3 policies likely played a crucial role in providing financial resources to rebuild or cover mortgage obligations, mitigating the expected increase in foreclosure risk for damaged properties in the aftermath of a wildfire.

HURRICANE WIND EVENTS

Foreclosure outcomes across hurricane wind events analyzed were mixed, with foreclosures increasing after an event 37.5% of the time (6 out of 16 events). These increases were found for events across different periods, including Hurricane Wilma in 2005, Hurricane Ike in 2008, and Hurricane Harvey in 2017. Similar mixed results were seen on the opposite side, with foreclosures decreasing or increasing at a lesser rate than the surrounding area for Hurricane Frances in 2004, Hurricane Gustav in 2008, and Hurricane Florence in 2018. Taken in aggregate, however, foreclosures decreased across the board in the aftermath of hurricane events.

> *...after a hurricane, wind-damaged homes are* ***0.41 percentage points less likely*** *to foreclose than undamaged properties...*

As shown in Figure 22, foreclosure outcomes varied by impact severity, revealing a pattern tied to physical damage and insurance protection's nuances. Damaged properties saw an 11.0% decline in foreclosures—smaller than the 11.5% drop for properties exposed to Category 1 hurricane winds, and notably less than the 20.4% decrease for those impacted only by tropical storm-level winds. These differences suggest that foreclosure risk was highest among the most heavily damaged homes, where gaps in insurance coverage—such as underinsurance or exclusions—as well as disputes between flood versus wind damages, may have led to financial strain despite the presence of some protection. Properties exposed to Category 1 winds, while less likely to be damaged outright, still faced possible uninsured losses and disruptions that elevated foreclosure risk relative to TS-level impacts. Meanwhile, homes exposed only to tropical storm winds generally saw the sharpest drop in foreclosures—likely due to limited physical damage combined with fewer insurance complications. Together, these patterns highlight how insurance coverage's presence and adequacy shape foreclosure outcomes in the wake of hurricane events. Still, the overall drop in foreclosures among damaged properties may reflect the role of insurance payouts—particularly when lenders, as loss payees, receive funds directly following a total or major loss, helping to stave off foreclosure.

A statistical analysis within a DiD framework, controlling for prior foreclosure trends and key property characteristics, indicates that, after a hurricane, wind-damaged homes are 0.41 percentage points less likely to foreclose than undamaged properties within the affected area of a hurricane.

This negative effect of wind damage aligns with the expectation that, after filtering out properties at risk of flood damage (where insurance coverage can be complex and sometimes lacking), the remaining damaged properties primarily faced wind-related losses. Since standard homeowner's insurance policies (like the HO3 form) typically cover wind damage, the insurance payouts received by homeowners or directly by lenders as loss payees likely provided financial relief, helping

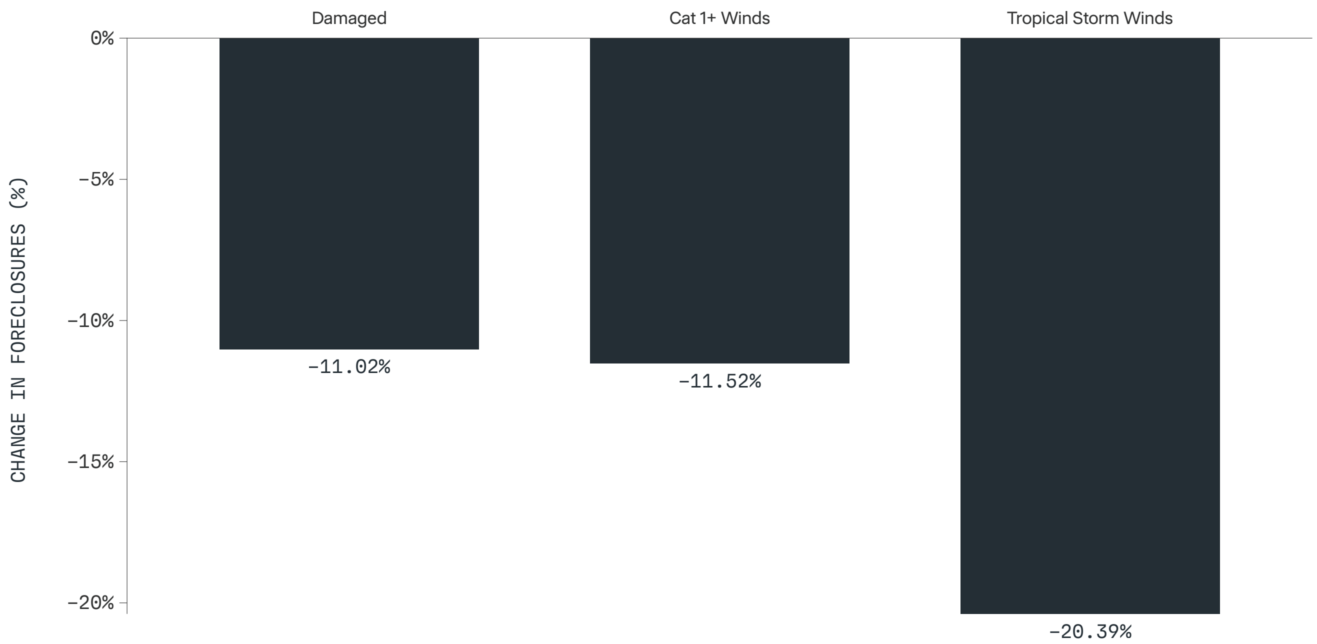


FIGURE 22. Change in Foreclosures By Wind Category

Results

to mitigate foreclosure risk in the aftermath of the hurricane. This supports the hypothesis that insurance coverage for wind damage played a role in stabilizing housing outcomes for damaged properties not susceptible to flood-related insurance complications.

FLOOD EVENTS

The change in foreclosure rates related to a flood event is assessed across three exposure levels: (1) properties in the affected area that did not flood, (2) properties with minor, non-damaging flooding, and (3) properties with flood damage inside the home. Across all contexts, damaged properties consistently experienced the most severe changes in foreclosure rates.

Among the flood events analyzed, two primary categories emerged: hurricane-driven flooding—typically caused by coastal storm surges and intense rainfall in low-lying areas—and river flooding, where heavy rainfall or seasonal changes lead rivers to overflow their banks. Both types of floods resulted in higher foreclosure rates, but river floods had a particularly strong impact: damaged properties saw a 62.8% increase in foreclosures, compared to 24.5% for hurricane-driven flooding (Figure 23).

Several factors help explain this disparity. Inland areas affected by river floods often lie outside designated Special Flood Hazard Areas (SFHAs) and lack mandatory flood insurance requirements, leaving homeowners financially vulnerable when riverine flooding occurs. Similarly, despite their growing severity, most smaller-scale river floods fail to meet federal disaster declaration thresholds, limiting access to federal recovery assistance such as FEMA grants, Small Business Administration (SBA) loans, or mortgage forbearance programs offered during officially declared disasters. Moreover, media and public attention tend to focus on large hurricanes, overshadowing these local river flood events and curtailing philanthropic or community-based support. As a result, property owners in river flood zones face greater challenges in recovering from storm damage, often incurring significant financial strain with minimal aid, leading to higher risks of delinquency and foreclosure. By contrast, hurricane-affected communities typically trigger formal disaster declarations, faster insurance payouts, and substantial media, philanthropic, and federal support—factors that help buffer homeowners from extreme financial hardship and curb post-storm foreclosure rates.

> *...properties that experience flooding following an extreme weather event are* ***0.29 percentage points more likely*** *to foreclose than those not flooded.*

Results from a DiD analysis indicate that flood exposure significantly increases foreclosure risk. Properties that experience flooding following an extreme weather event are 0.29 percentage points more likely to foreclose than those not flooded. This suggests that properties impacted by floods see a notable increase in foreclosure outcomes during the post-disaster period. This finding aligns with previous observations that foreclosures increase after floods, especially river floods. The positive DiD result may reflect the financial difficulties faced by homeowners in flood-prone areas, particularly those without proper insurance or federal disaster assistance. The greater increase in foreclosures related to river floods, as noted earlier, compared to hurricane floods, could clarify the overall positive impact seen in this DiD model, which includes both flood types: the limited aid and insurance for river flood victims likely add to their financial struggles, raising their risk of foreclosure afterward.

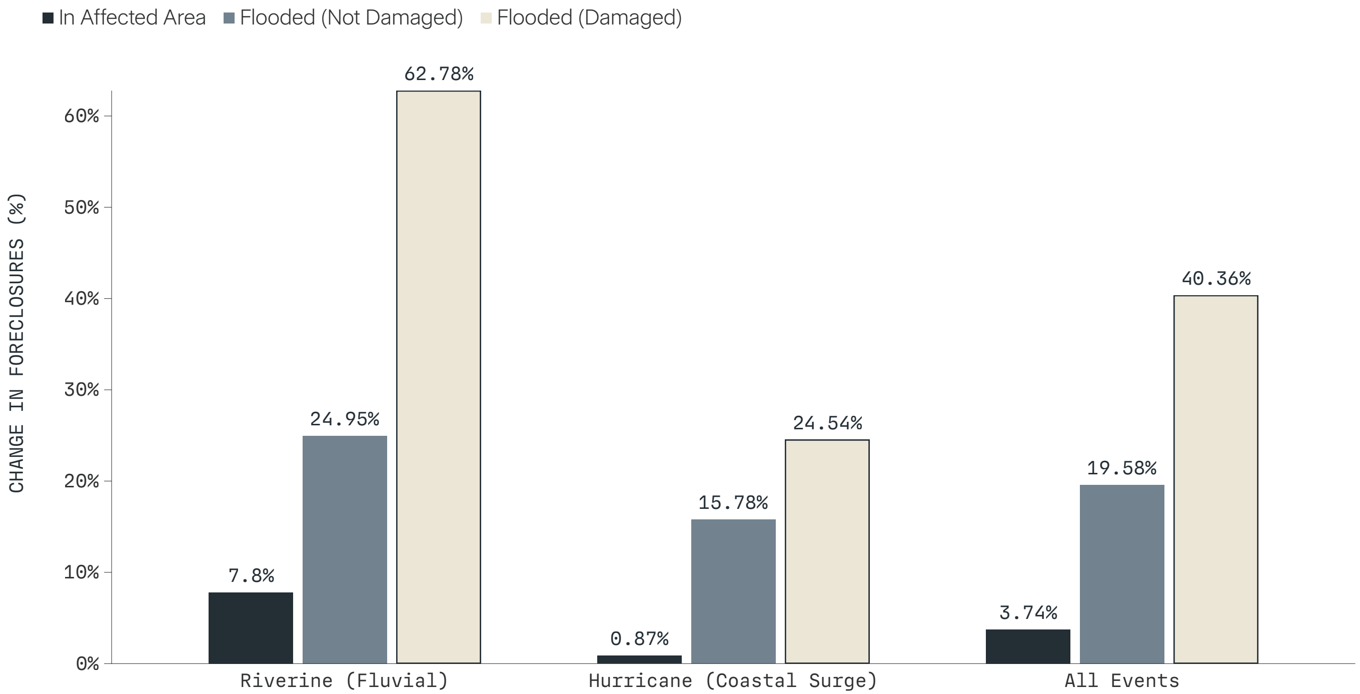


FIGURE 23. Change in Foreclosures By Effect of Flood on Property by Event Type

Hurricane vs. River Flooding Case Study: Hurricane Sandy vs. River Flood Through Central Pennsylvania

Hurricane Sandy in 2012 struck during a period of economic recovery following the financial crisis, leading to elevated foreclosure rates among flood-damaged properties. However, a less-publicized 2011 inland river flood in central Pennsylvania revealed an even greater foreclosure impact. Properties with severe damage (over 25% of the structural value affected) from the Pennsylvania flood experienced a foreclosure rate of 2.93%, compared to just 1.13% for similarly damaged properties following Sandy. As previously discussed, this disparity is largely attributed to gaps in insurance coverage, particularly the limited mapping and low penetration of inland flood insurance. Damaged properties in both events consistently showed higher foreclosure rates than surrounding areas: 2.93% versus 0.80% in central Pennsylvania, and 1.13% versus 0.58% after Hurricane Sandy. This stark contrast underscores the strong association between disaster-related property damage and increased foreclosure risk relative to nearby, unaffected communities.

HURRICANE SANDY

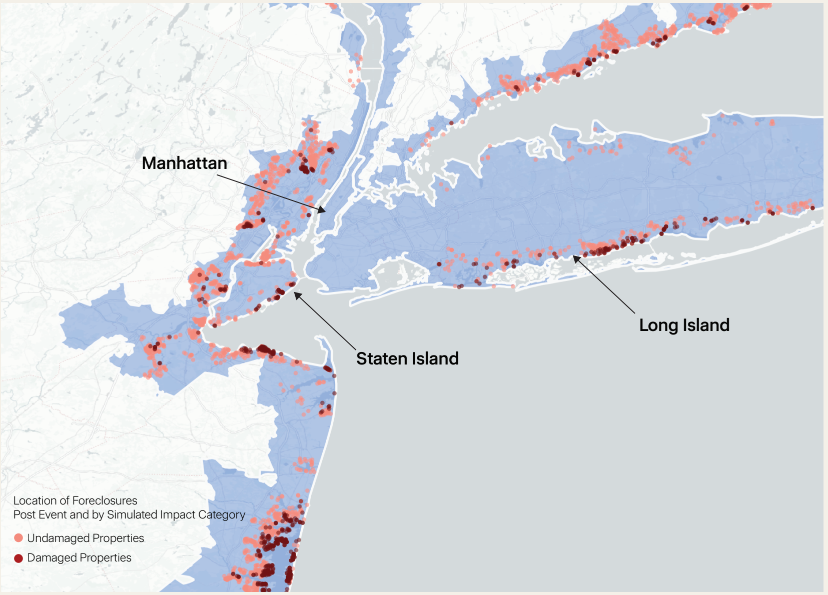
CATEGORY	TOTAL PROPERTIES	PRE-EVENT FORECLOSURES	POST-EVENT FORECLOSURES	CHANGE
Surrounding Area	4,380,132	29,151 (0.67%)	25,540 (0.58%)	-3,611 (-0.08 pp)
Not Damaged	57,549	137 (0.24%)	133 (0.23%)	-4 (-0.01 pp)
Damaged (< 10%)	18,020	135 (0.75%)	167 (0.93%)	32 (0.18 pp)
Damaged (10 - 25%)	53,528	395 (0.74%)	552 (1.03%)	157 (0.29 pp)
Damaged (> 25%)	25,269	184 (0.73%)	286 (1.13%)	102 (0.40 pp)

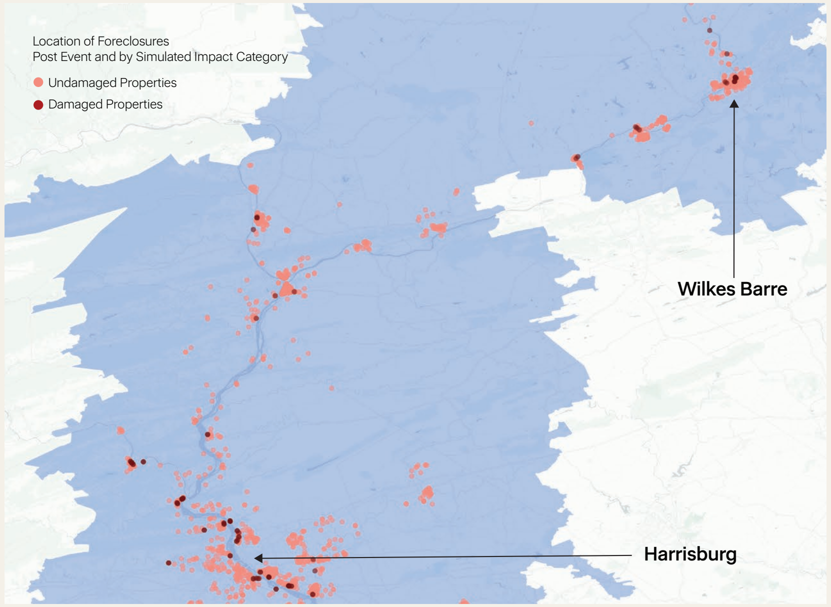
TABLE C1. Change in Foreclosures From Pre- to Post-Sandy Across Impact Categories

RIVER FLOOD THROUGH CENTRAL PENNSYLVANIA

CATEGORY	TOTAL PROPERTIES	PRE-EVENT FORECLOSURES	POST-EVENT FORECLOSURES	CHANGE
Surrounding Area	917,270	5,655 (0.62%)	7,297 (0.80%)	1,642 (0.18 pp)
Not Damaged	2,539	12 (0.47%)	25 (0.98%)	13 (0.51 pp)
Damaged (< 25%)	1,181	26 (2.20%)	29 (2.46%)	3 (0.25 pp)
Damaged (>= 25%)	1,570	21 (1.34%)	46 (2.93%)	25 (1.59 pp)

TABLE C2. Change in Foreclosures From Pre- to Post-PA Flood Event Across Impact Categories





Tables present counts of foreclosures along with the rate of foreclosure expressed as a percentage of total housing units in parentheses, including the differences in percentage points (pp). Damaged buckets display groupings of damaged properties in relation to their rebuilding costs. Pre-event foreclosures refer to those occurring from October 2009 to October 2012, while post-event foreclosures pertain to those happening from October 2012 to October 2015.

Results

DEEPER DIVE ON FACTORS DRIVING FLOOD FORECLOSURES

Beyond the type of flooding, factors such as flood insurance coverage, the timing of the event relative to the financial crisis, home value appreciation relative to loan value, and borrower socioeconomic status all influence foreclosure outcomes—highlighting which subgroups are most vulnerable.

ADEQUATE INSURANCE COVERAGE: SFHA

Insurance is arguably the most important factor determining the outcome of a mortgage in the aftermath of a natural disaster, serving as the primary buffer that prevents missed mortgage payments from escalating into foreclosure. For flood events in particular, flood insurance plays this role, but coverage has remained limited and largely siloed into SFHAs and non-SFHAs.

To explore the potential protective effect of flood insurance, this analysis uses SFHA designation as a proxy for insurance coverage, assuming full coverage within SFHAs and no coverage outside of them. While an imperfect assumption, this framework aligns with regulatory and behavioral patterns in flood insurance markets. To ensure temporal accuracy, only SFHAs with effective dates prior to the flood event were included in the analysis. This adjustment is important because flood maps are often updated in the aftermath of major flood events, and including post-event designations could misattribute properties as being in a high-risk zone that were not officially mapped as such at the time. As a result, the analysis focused on 15 of the original 29 events where valid pre-event SFHA data was available.

The findings reveal stark differences in foreclosure outcomes between SFHA and non-SFHA areas (Figure 26). Across all events, properties inside SFHAs that were flooded saw a 6.3% decrease in foreclosures after the event, while those with damages saw an even further decline of 10.2%, suggesting flood insurance protections generally worked across flooding events. On the other hand, foreclosures rapidly increased for properties outside of SFHAs, by 18.5% for properties with flooding alone and 41.6% for properties with severe enough flooding to cause damage. This contrast suggests that the presence of insurance can meaningfully reduce the risk of foreclosure after a flood.

When examining these results by flood event type, more interesting trends emerge. River floods show the most striking disparity: a 10% increase in foreclosures for SFHA properties compared to a 40% increase for those outside. This suggests that even within SFHAs, foreclosure pressures remain significant—particularly in inland areas where flood insurance take-up is often lower despite mandatory purchase requirements. However, the much larger impact outside SFHAs reflects the heightened risk when households lack coverage entirely.

Hurricane-driven flood events, by contrast, show foreclosure declines for SFHA properties (down 12.5%), while non-SFHA properties saw a modest 1.0% increase. One explanation for this pattern is the relatively higher flood insurance take-up in coastal SFHAs—where enforcement of mandatory purchase requirements is stronger and lender compliance is more consistent due to increased awareness and oversight.

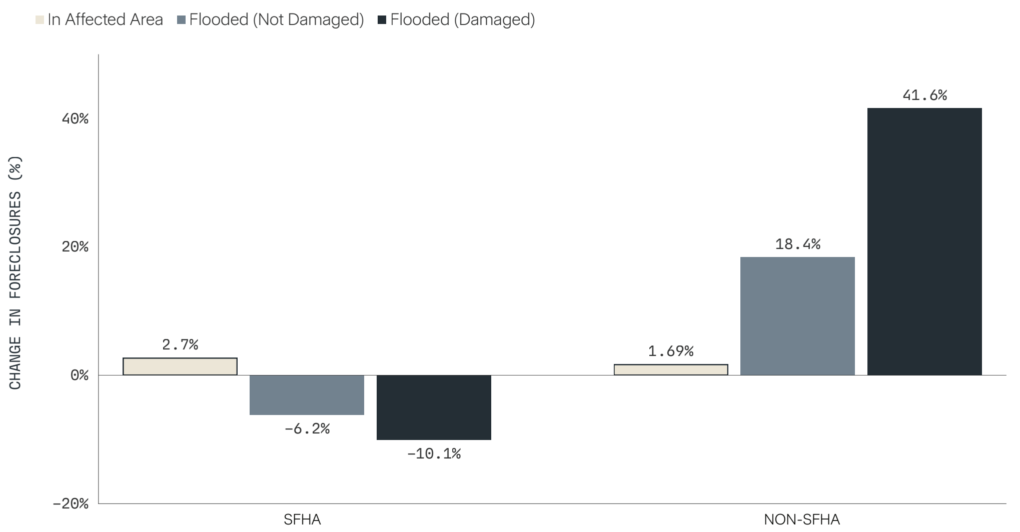


FIGURE 24. Change in Foreclosures Among Flooded Properties by SFHA vs. Non-SFHA

FLOOD INSURANCE CASE STUDY:
River Flood Through Central Pennsylvania

The 2011 flood near Harrisburg, PA drove up foreclosures both inside and outside SFHAs, but far more where insurance isn't required. Inside SFHAs (mandatory insurance for federally backed mortgages), foreclosures rose 13.3%, while outside they surged 80.4%—a 67.1-point gap—demonstrating that even imperfect flood coverage substantially reduces foreclosure risk.

AREA	PRE-EVENT	POST-EVENT	CHANGE IN FORECLOSURES (%)
SFHA	30	34	13.3%
Non-SFHA	51	92	80.4%

TABLE C3. Change in Foreclosures From Pre- to Post-PA Flood Event Across Impact Categories

Results

ECONOMIC CONDITIONS: TIMING AROUND THE FINANCIAL CRISIS

By grouping the flood events analyzed into the three periods around 2005 the financial crisis—pre-financial crisis (2000–2005), during the crisis (2007–2012), and post-crisis recovery (2013–2019)—more concrete results in the change in foreclosures following a flooding event materialize (Figure 24). The extent and direction of foreclosures changes post-event varied significantly by time period, reflecting how flood events interacted with broader economic conditions. During the financial crisis, for example, foreclosures among damaged properties surged by 91.7%—far above national trends—highlighting how disaster shocks can compound existing financial strain. At the time, unemployment nearly doubled to 10% and property values fell by 20%, placing many mortgage holders under pressure (BLS, 2018; Aruoba et al., 2022). The added burden of uninsured flood damage pushed already vulnerable homeowners into foreclosure at rates more than 22 times the national average.

By contrast, in the post-crisis period (2013–2019), properties that sustained flood damage still saw a decline in foreclosure rates—down 40.5% from pre-event levels. While this reflects improved financial resilience due to stronger household balance sheets, rising home equity, and broader economic recovery, the decline was notably smaller than the national average of 51%. This gap suggests that even during periods of economic strength, flood damage continues to exert a measurable drag on household stability and foreclosure risk.

Foreclosure rates also declined among properties in affected areas that did not flood (down 47.4%) and those that experienced minor, non-damaging flooding (down 42.3%)—both smaller declines than the national trend—reinforcing the broader narrative that flood events can continue to impact homeowners and communities, even amid post-crisis recovery and stability.

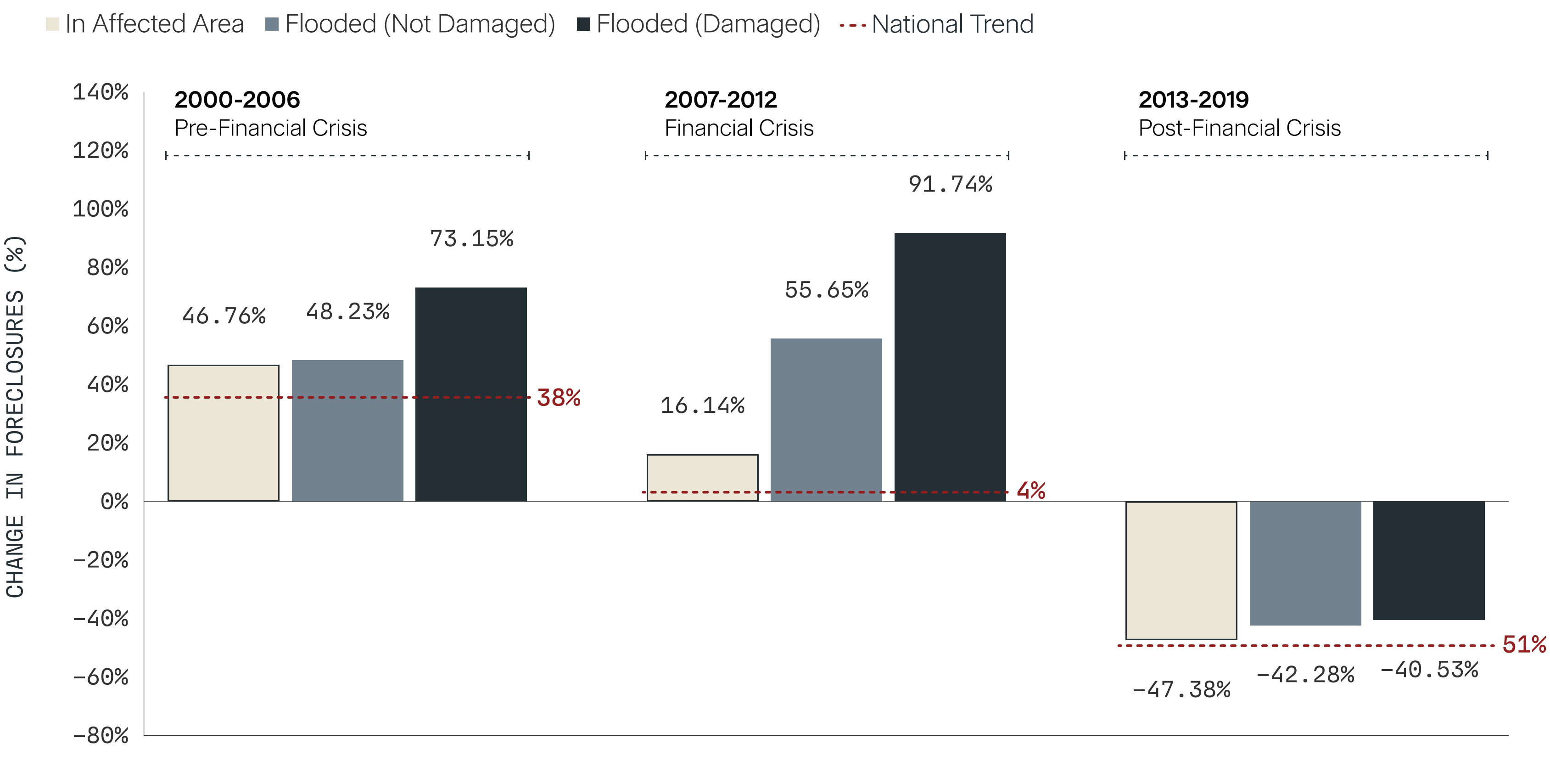


FIGURE 25. Change in Foreclosure Counts Across Properties Impacted by Flooding by Timing Around the Financial Crisis

Recessions and Flood Event Case Study: Hurricane Sandy

In the five years leading up to Hurricane Sandy, the homes that would eventually be damaged saw their value fall by an average of 14% a year over the financial crisis from 2007 to 2012, while Loan-to-Value ratios rose from 70% to 78%. This erosion of equity, combined with higher leverage, left many homeowners financially vulnerable and less able to absorb the costs before the storm hit.

The foreclosure rates rose significantly due to the cumulative impact of pre-event depreciation and damages. Prior to the event, the average rate was 0.019% of total properties, but it increased to 0.039% afterwards, reflecting a 2-4% rise. Beyond this global average, the time series highlights the influence that Sandy had in reversing the trend observed before the event. Even three years later, the foreclosure rate remained high at 0.097%, which is 11 times greater than the rate recorded just before the Hurricane.

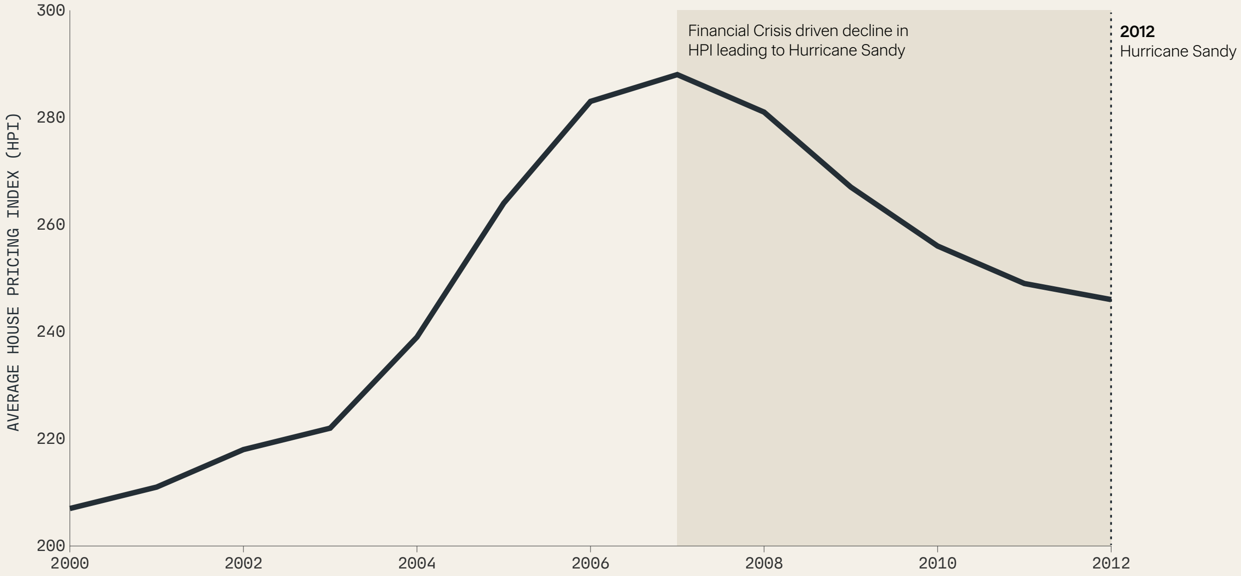


FIGURE C3. Average Housing Price Index (HPI) in Hurricane Sandy-Affected Counties

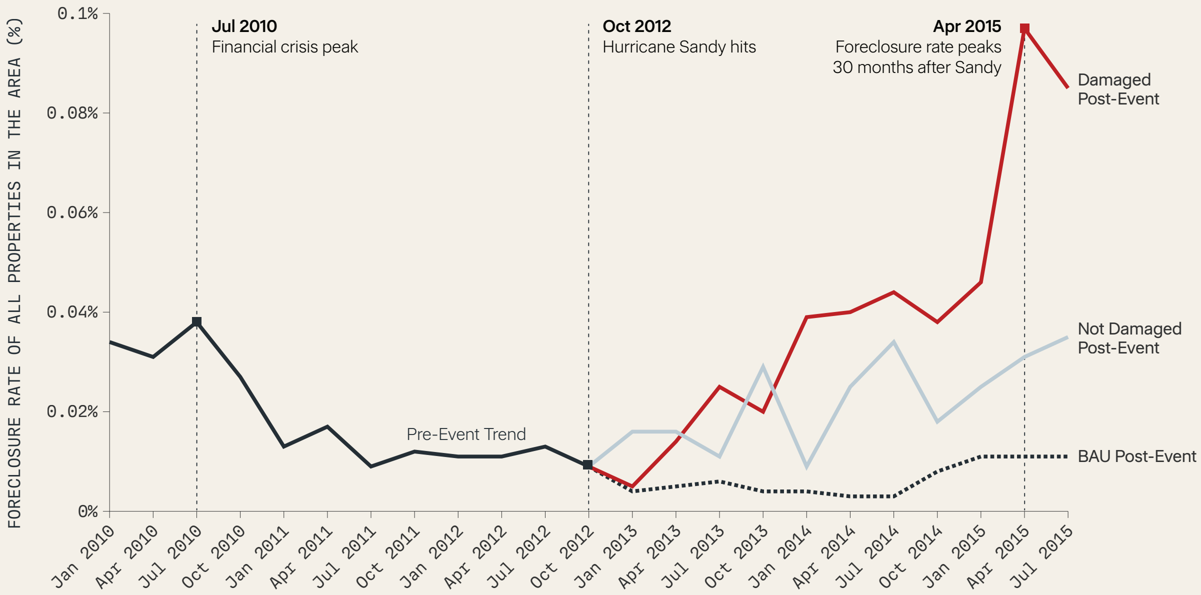


FIGURE C4. Foreclosure Rates Around the Time of Hurricane Sandy (October 2012)

Results

HOME VALUE APPRECIATION

A critical factor in evaluating foreclosure risk is whether homeowners gained or lost equity in the period leading up to a climate disaster. Using county-level HPI data from the FHFA, property value changes were traced from the most recent recorded transaction through the disaster event and into the months that followed. By indexing sale prices to HPI at the time of purchase and projecting forward using subsequent HPI values, dynamic property valuations at multiple time points were estimated, including at the time of the event and six months later. This approach captures whether home values appreciated or depreciated in the interim, offering a clearer picture of financial vulnerability than static pre- or post-disaster valuations alone.

Across all flood events examined, properties experienced an average HPI increase of 7.0% from the time of their last transaction until the disaster. However, this average masks significant variation depending on the specific timing of the event (Figure 26). For example, properties impacted by Hurricane Sandy saw an average price decline of 3.6% from the transaction date to the hurricane's landfall (as detailed in Figure 25 above), followed by a modest gain of 0.6% in the months after. In Hurricane Sandy and other events occurring near the financial crisis, such as Hurricane Isaac, Hurricane Irene, and several river floods, the negative trend in property values created financial vulnerabilities for affected homeowners, particularly for those with high loan-to-value ratios. This aligns with the findings presented in First Street's analysis for events like Hurricane Sandy.

Conversely, examining instances of property value appreciation before a disaster can further illuminate the relationship between pre-event market trends and post-event foreclosure rates. If declining property values increase foreclosure risk, what happens when values are rising? Hurricane Wilma, which significantly impacted Florida in October 2005, provides such a case study. As shown in Table 3 below, the five counties experiencing the highest rates of appreciation in the examined sample were all located in Florida and affected by this powerful hurricane. Notably, the housing market in this region was experiencing a significant boom in the years leading up to Hurricane Wilma, with average appreciation rates around 78% in the three years prior to the event. This rapid growth was fueled by several converging factors characteristic of the mid-2000s housing bubble in the United States. These included speculative investment, where individuals and entities purchased properties with the expectation of quickly reselling them at a higher price, driving up demand and prices. Additionally, low interest rates made mortgages more affordable, further increasing buyer activity and the amount buyers were willing to borrow. Easy access to subprime mortgages and loans offered to borrowers with lower credit ratings further inflated demand by expanding the pool of potential homebuyers. This combination of factors created a highly competitive market with rapidly escalating prices across many parts of Florida, including the counties affected by Hurricane Wilma (Harvard University, 2006).

First Street's analysis confirmed the notion that rising property values typically provide homeowners with a greater capacity to absorb financial losses. Increased equity can facilitate the sale of damaged land or property remnants, allowing homeowners to pay off their loans and avoid foreclosure altogether. This is precisely what data reveals in the aftermath of Hurricane Wilma. Across these Florida counties with high pre-event appreciation, the foreclosure rate decreased by approximately 80% in the period following the hurricane. This significant decline occurred even within a broader national context where foreclosure rates were generally increasing at the time. This stark contrast underscores the protective effect of pre-disaster property value appreciation on foreclosure risk.

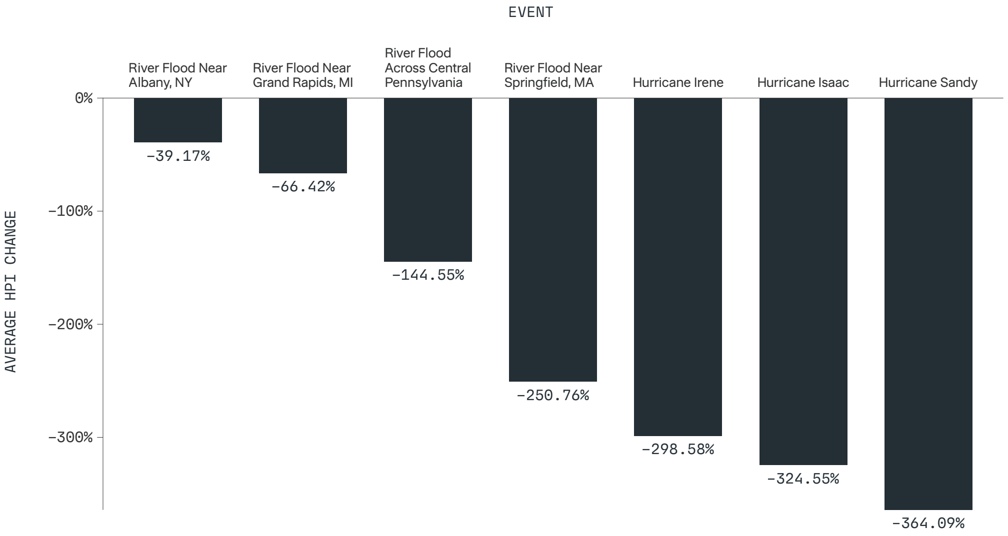


FIGURE 26. Average HPI Changes from Sale to Event (Flood Events Following the Financial Crisis)

COUNTY	STATE	HPI CHANGE PRE-EVENT	HPI CHANGE POST-EVENT	AVG CHANGE IN FORECLOSURE
Monroe	FL	89.03%	-15.04%	-88.06%
Martin	FL	77.93%	-16.70%	-99.47%
Palm Beach	FL	75.07%	-14.45%	-68.33%
Charlotte	FL	73.92%	-25.30%	-91.60%
Lee	FL	73.82%	-26.17%	-81.52%

TABLE 3. HPI Changes for Wilma Affected Counties

Results

Breaking up all event results into categories of home appreciation and depreciation demonstrates that property value trends are closely tied to foreclosure outcomes following a disaster (Figure 27). Across all events, properties in appreciating markets experienced a 20.0% decrease in foreclosures after a disaster event, while those in depreciating markets saw a 9.1% increase. This reversal suggests that strong housing market conditions can offer a protective effect, buffering households from foreclosure risks, perhaps through rising equity, stronger demand, or quicker repair and resale opportunities.

Hurricane events show the clearest contrast and drive the overall results across flooding events, with foreclosure counts falling 21.0% in appreciating markets but rising 8.4% in depreciating ones. River events, on the other hand, saw an increase in foreclosures across both appreciating and depreciating properties, by 5.1% and 66.7%, respectively. The overall increase in foreclosures for river events reflects similar results as seen in the SFHA comparison, suggesting that while property values may be rising in certain markets, flood preparedness in these inland areas remains low.

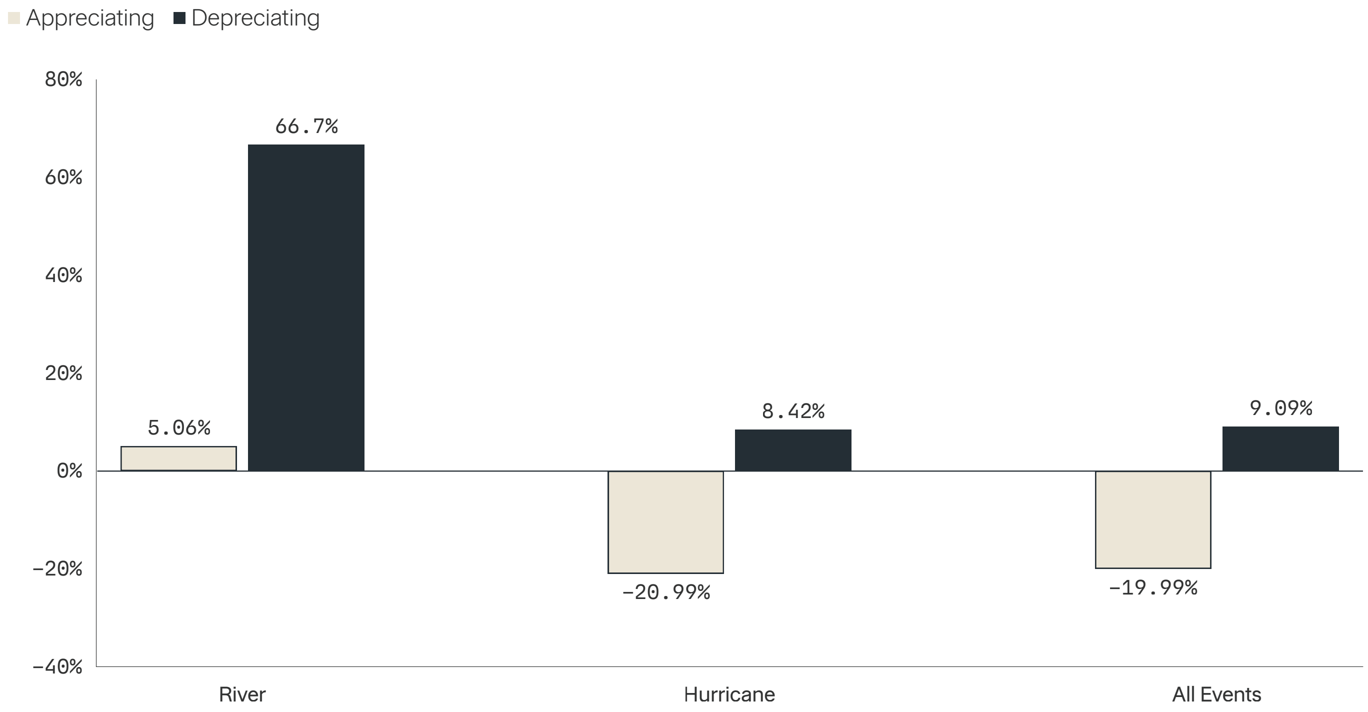


FIGURE 27. Change in Foreclosures Among Damaged Properties by Home Appreciation

Results

HOMEOWNER EQUITY: LOAN-TO-VALUE

To complement market-based home appreciation and depreciation estimates, mortgage amortization schedules were modeled in order to calculate the amount of loan principal repaid by the time of the disaster. Combining the remaining balance with updated property valuations, time-specific loan-to-value (LTV) ratios were constructed at the transaction date, at the event, and three years later. A declining LTV indicates equity building through appreciation and repayment, while a rising LTV reflects equity erosion—suggesting that the home depreciated or that the pace of mortgage repayment was insufficient to offset market trends. Analysis found that 20.3% of foreclosed properties experienced an increase in LTV between purchase and event, compared to just 11.7% of homes that did not enter foreclosure (Figure 28). This pattern was even more pronounced in lower-income areas: among homes located in LMI-designated tracts, 27.8% of foreclosed properties experienced a rise in LTV, compared to 14.9% of non-foreclosed properties in the same areas—making foreclosed homes 86% more likely to have seen equity erosion.

Across multiple flood events, regression analysis confirms that rising LTV ratios are not just symptoms of financial stress but strong predictors of foreclosure. Controlling for changes in home prices, a 10-percentage-point increase in LTV between purchase and event was associated with a 0.69-percentage-point increase in the predicted probability of foreclosure. Given a baseline foreclosure rate of 3.3% of all sale transactions (not just the universe of mortgaged properties), this represents a 21% relative increase in risk. Homes that were both damaged and foreclosed were the most likely to experience equity erosion, with 22.2% showing a rise in LTV—nearly double the rate of damaged homes that did not foreclose (11.6%). Even in the absence of damage, LTV increases were more common among foreclosed properties (17.4%) than those that remained current (11.2%). This translates to a 1.92x relative risk for damaged properties and 1.55x for undamaged ones, underscoring how financial strain—often independent of physical damage—can tip households into default.

These findings suggest that monitoring dynamic equity positions—particularly in vulnerable and under-resourced communities—can serve as a critical signal of mortgage risk in the wake of climate events, even before damage assessments or insurance payouts are complete.

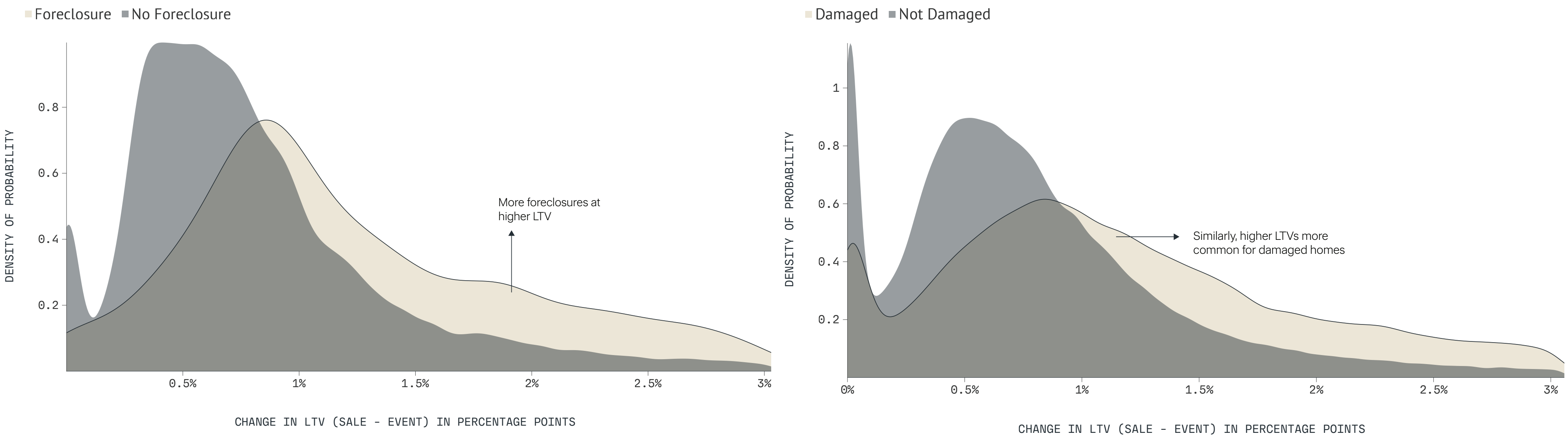


FIGURE 28. Density of Positive LTV Changes by Foreclosure Outcome and Damage Status

LTV and Flood Events Case Study: Hurricane Sandy

The Hurricane Sandy event illustrates how pre-existing financial vulnerabilities and falling home prices can heighten foreclosure risk after a climate disaster. In the counties affected by Sandy, home prices had already been declining prior to the storm. On average, the HPI fell by 3.6% between the time of purchase and the event. Median property values dropped from $265,000 at the time of sale to $254,000 by the event date. At the same time, borrowers had limited room to absorb losses: the average LTV ratio at sale was 70.5%, which increased to 75.3% by the time of the event. This upward shift in LTV reflects the combined effect of home price depreciation and the slow pace of mortgage amortization.

Equity erosion was especially severe among low-income and flood-affected households. In LMI areas, the average LTV at the event rose to 96.4%, compared to 74.2% in non-LMI areas—suggesting that borrowers in LMI tracts had almost no remaining equity buffer. Among all foreclosed properties, 18.9% experienced an increase in LTV between the time of sale and the disaster. That share rose to 27.8% among foreclosed properties in LMI areas and 22.1% among foreclosed properties that were also damaged during the storm. These overlapping patterns of structural risk—low income, home damage, and financial exposure—reveal how equity erosion contributes to foreclosure in more than one dimension.

To quantify these risks, a logistic regression model was estimated to predict foreclosure using changes in LTV and HPI as predictors. The effect is meaningful when placed in context: with a baseline foreclosure rate of 2.5% across all properties affected by Sandy, a 10-percentage-point increase in LTV was associated with a 0.76 percentage point rise in foreclosure probability—a 30% increase relative to the baseline. In other words, even modest erosion in home equity significantly elevated the likelihood of default. Homeowners who entered the storm with already thin equity margins and rising LTVs were substantially more likely to foreclose, regardless of whether their properties were physically damaged. These findings underscore how climate shocks can compound existing financial vulnerabilities, amplifying mortgage distress through both market and personal exposure.

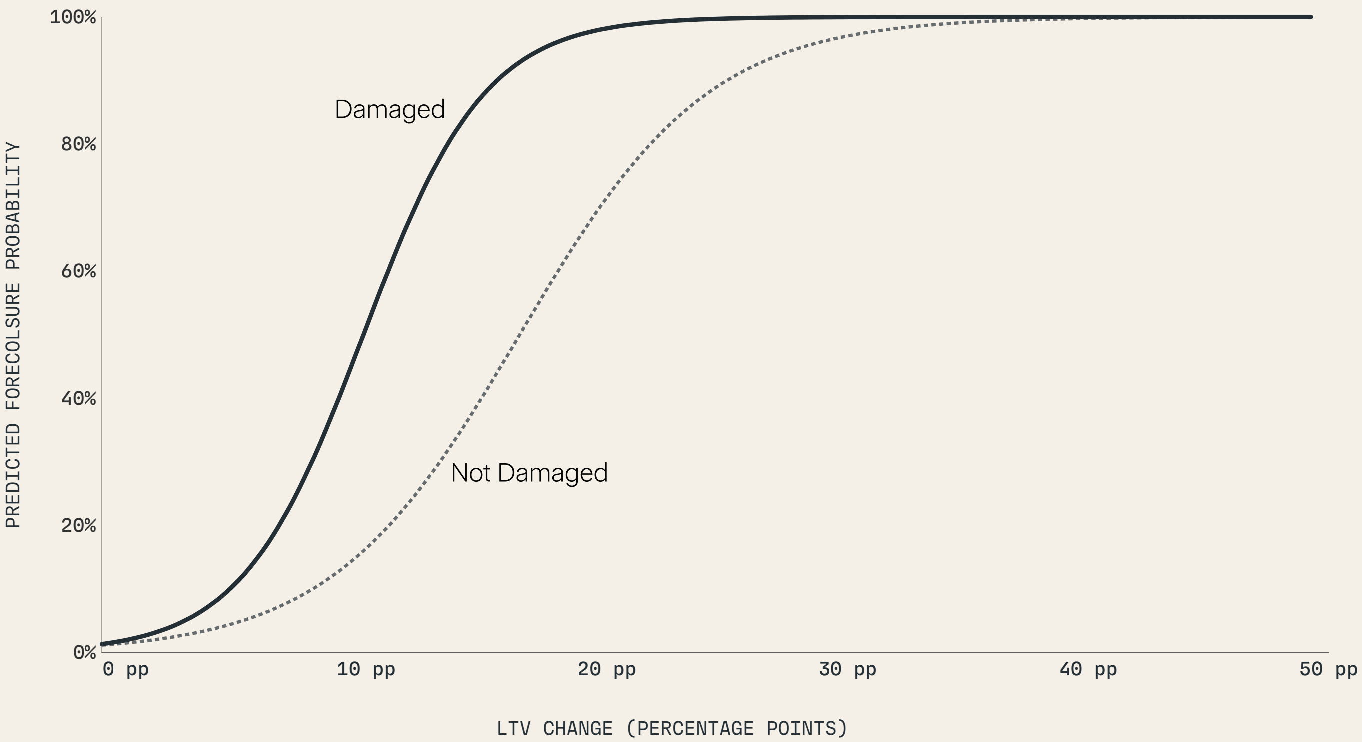


FIGURE C5. Foreclosure Probability as a Function of LTV Change by Damage Status

Results

BORROWER SOCIOECONOMIC CHARACTERISTICS: LMI HOUSEHOLDS

A key driver of foreclosure risk is a borrower's financial standing. LMI households and communities are particularly vulnerable, as they typically have less financial cushion, limited access to credit, and fewer resources to manage disruptions such as job loss, unexpected expenses, or disaster-related damages. In the context of flood events, this vulnerability is amplified.

LMI households that experienced flooding and property damage saw significantly higher increases in foreclosure rates than their non-LMI counterparts, across both hurricane-driven and riverine flood events. Specifically, following river floods, LMI households saw a 38.1% increase in foreclosures—14.1 percentage points higher than non-LMI households affected by the same events. After hurricane-related flooding, foreclosures among LMI households rose by 30.6%, 15.7 percentage points higher than similarly affected non-LMI households (Figure 29).

These disparities reflect broader patterns of financial instability. LMI households are more likely to be cost-burdened, lack savings, and have limited access to adequate insurance coverage. When disasters strike, these households face a heightened risk of delinquency and foreclosure, as they are often unable to absorb the resulting financial shock. An analysis of Loan-to-Value (LTV) ratios at the time flood disasters struck illustrates this point. In LMI areas, foreclosed properties were 90% more likely to have experienced a positive LTV change than non-foreclosed ones — a sign of eroding equity. By contrast, in non-LMI areas, that risk was 49% higher, revealing a disparity in financial resilience after debt burdens increased (Figure 30).

■

LMI AND FLOOD EVENTS CASE STUDY:

River Flood near Beaumont, TX

In 2016, a Beaumont, TX river flood exposed stark disparities across neighborhoods with differing socioeconomic status. Even amid broader economic recovery following the financial crisis—a period during which foreclosure rates generally declined—LMI neighborhoods saw an 11.7% rise in foreclosures while they fell by 8.8% in non-LMI areas—a 20.5-point gap. This underscores the uneven pace of recovery and the structural vulnerabilities embedded in socioeconomic status.

AREA	PRE-EVENT	POST-EVENT	CHANGE IN FORECLOSURES (%)
LMI	231	258	11.7%
NON-LMI	51	271	-8.8%

TABLE C4. Change in Foreclosures Among Flooded or Damaged Properties in LMI and Non-LMI Communities

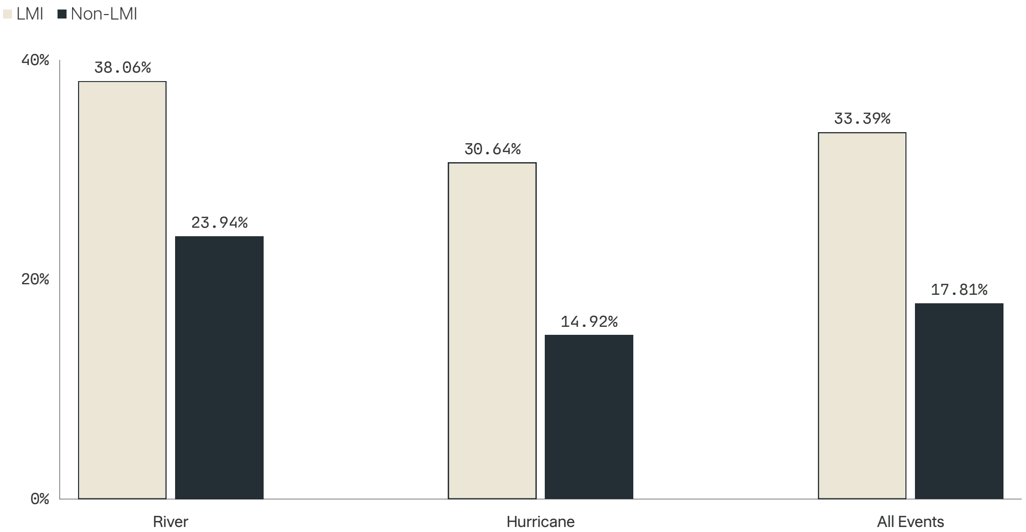


FIGURE 29. Change in Foreclosures Among Flooded Properties by Socioeconomic Status

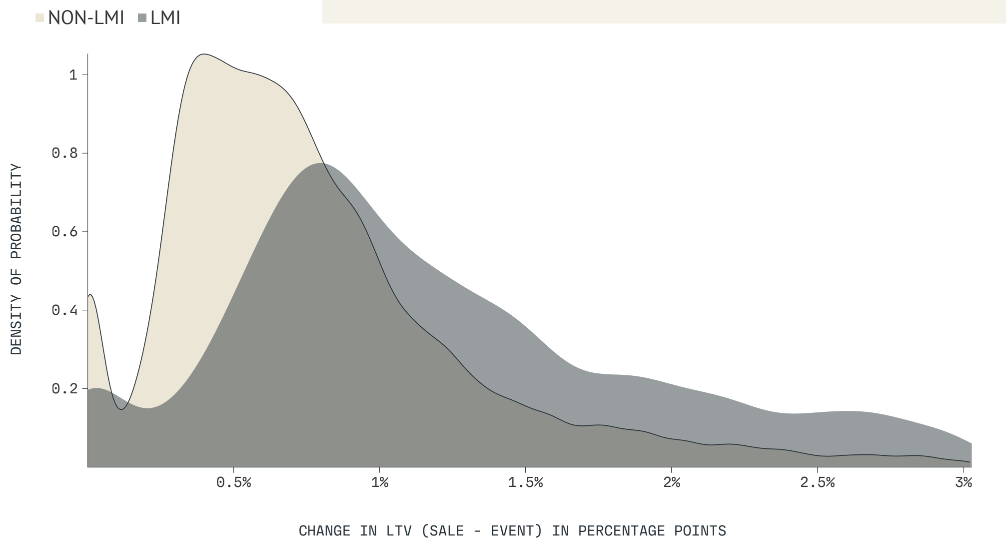


FIGURE 30. Density of Positive LTV Changes by LMI Status

Results

ESTIMATING CREDIT LOSSES FOLLOWING A FLOOD EVENT

To evaluate the potential benefit of including climate risk data in a bank's credit risk modeling framework, a loan-level what-if analysis was performed for all properties with transaction data around the timing of Sandy in the New York metropolitan area and adjacent coastal regions of New Jersey, Connecticut, Rhode Island, and Massachusetts. Apart from the effects of the event, banks would have sought to capture the performance of loans through internal credit risk frameworks based on a combination of borrower/loan characteristics (e.g., credit scores, loan-to-value ratios, debt-to-income metrics) and macroeconomic variables (e.g., unemployment rate, GDP). For this evaluation, First Street assumed risk modeling frameworks that do not include climate risk variables were able to accurately capture the overall trend in foreclosures (as a proxy for defaults) for properties not impacted by Sandy, predicting a 12.4% decline in foreclosures from 29,151 to 25,540.

Under this hypothetical scenario, because these credit risk models do not include climate risk variables, they would not have the ability to segment across various levels of exposure across loans. In other words, the models would estimate the same overall trend (decline) in foreclosures/defaults for every loan in the portfolio, implicitly treating flood-affected loans as if they faced the same decrease in probability of default (PD) as loans that were not impacted by Sandy. In reality, loans for properties that experienced flooding or structural damage exhibited a pronounced PD uptick, resulting in an underestimation of 393 foreclosures/defaults that could have been anticipated if proper climate risk information were incorporated in their models (Table 4).

Hurricane Sandy Aftermath - Howard Beach - October 30th,2012

To translate these unexpected foreclosures into dollar losses, the outstanding balance on each foreclosed mortgage was reconstructed via standard amortization of the original balance, interest rate, and term through a presumed foreclosure start date (assumed to be 16 months before the foreclosure sale, reflecting an average 12-month foreclosure-to-sale period plus four months of missed payments (CFPB, 2025)). The average outstanding balance was estimated for each grouping of properties by flooding or damage impact and was applied and summed to the count of loans that foreclosed, amounting to $68.1 million in unpaid principal and accrued interest that banks failed to anticipate (Table 5). Applying a conventional loss-given-default (LGD) rate of 50 percent, which reflects typical recovery assumptions after liquidation costs and resale discounts, produces an estimated $34.1 million in net credit losses–a direct hit to the banks' earnings.

CATEGORY	PRE-SANDY	MODELED (-12.4%)	ACTUAL POST-SANDY	UNEXPECTED FORECLOSURES
Surrounding Area	29,151	25,540	25,540	0
Flooded (Not Damaged)	137	120	133	13
Damaged < 10%	135	118	167	49
Damaged 10–25%	395	346	552	206
Damaged > 25%	184	161	286	125

TABLE 4. Modeled vs. Actual Foreclosures Following Hurricane Sandy by Damage Category

CATEGORY	UNEXPECTED FORECLOSURES	EXPOSURE AT DEFAULT	UNEXPECTED LOSSES (ASSUME 50% LOSS GIVEN DEFAULT)
Surrounding Area	0	$0	$0
Flooded (Not Damaged)	13	$2.4 M	$1.2 M
Damaged (< 10 %)	49	$15.0 M	$7.5 M
Damaged (10–25 %)	206	$33.0 M	$16.5 M
Damaged (> 25 %)	125	$17.8 M	$8.9 M
Total	**393**	**$68.2 M**	**$34.1 M**

TABLE 5. Hidden Credit Losses from Excess Foreclosures by Flood-Damage Category

Results

INDIRECT FACTORS CONTRIBUTING TO FORECLOSURE RISK

In addition to direct property-level impacts, climate risk can influence foreclosure outcomes through various indirect pathways. These include rising insurance premiums, declining home values, and broader macroeconomic disruptions that reduce household financial stability and regional economic productivity. This analysis examines historical bivariate relationships between changes in key indirect climate stressors and changes in foreclosure activity over time to evaluate the potential role of these climate-related indirect effects on foreclosure rates.

The rising cost of property insurance is one of the strongest indirect pathways through which climate risk affects housing stability. A linear regression model was used to quantify this relationship to estimate the effect of year-over-year changes in average insurance costs on local foreclosure rates from 2019 to 2022. The results show a statistically significant association: for every 1% increase in insurance costs within a given area, there was a corresponding 1.05 percentage point increase in the foreclosure rate (Figure 31).

This relationship suggests that as homeowners face higher out-of-pocket costs to maintain insurance coverage—often due to increasing exposure to natural hazards like floods, wildfires, and hurricanes—they may be more likely to fall behind on mortgage payments, particularly if increases in income or property values do not offset these rising costs. These findings highlight how climate-driven financial strain, even in the absence of a physical disaster, can contribute to housing instability in vulnerable areas.

Broader economic conditions are critical in shaping foreclosure patterns, particularly when intertwined with climate-related pressures. Two key indicators—HPI and GDP—offer insight into the housing market dynamics and macroeconomic strength of a given area. Areas with rising home values and growing economies tend to experience greater financial stability among homeowners, resulting in lower foreclosure rates.

Linear regression models analyzing data since 2000 reveal that a 1% increase in HPI was associated with a 0.54 percentage point reduction in foreclosures (Figure 32). Similarly, for every 1% increase in local GDP, foreclosure rates declined by approximately 0.83 percentage points(Figure 33). These trends underscore how housing market appreciation and local economic vitality can act as buffers against foreclosure risk.

Climate risk, however, introduces strain on both fronts. In high-risk areas, rising insurance premiums and increasing frequency of disasters can drive up the total cost of homeownership, making properties both less affordable and attractive to prospective buyers. Over time, this reduces housing demand and slows price appreciation—or in some cases, leads to outright price declines. In parallel, physical damages from events like floods or wildfires can immediately devalue homes, leaving property owners underwater on their mortgages and more vulnerable to default.

At the macroeconomic level, climate impacts can disrupt local economies by damaging infrastructure, halting business operations, and leading to job losses. These disruptions weaken overall economic output and household incomes, further amplifying foreclosure risks. The strong historical link between macroeconomic indicators and foreclosure activity suggests that as climate risk depresses property values and disrupts economic productivity, foreclosure rates may rise accordingly—particularly if current housing, insurance, and financial policies remain unchanged.

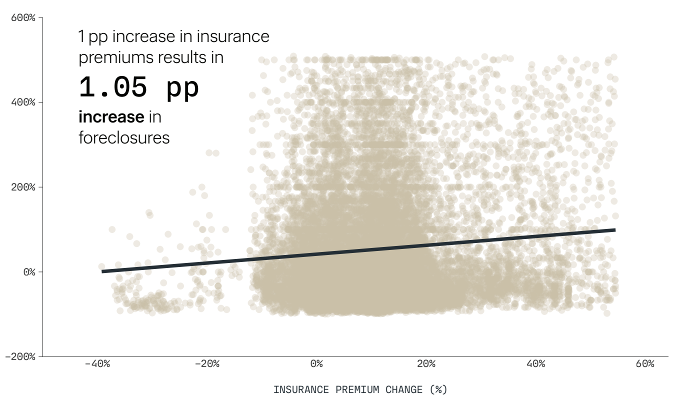


FIGURE 31. Bivariate Relationship Between Homeowners Insurance Premium Changes and Foreclosure Count Changes

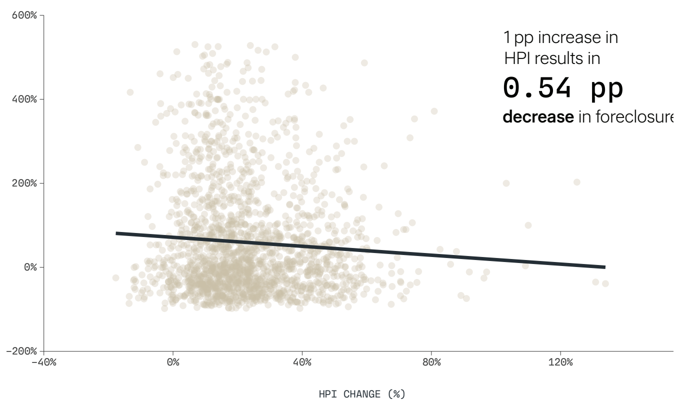


FIGURE 32. Bivariate Relationship Between HPI Changes and Foreclosure Count Changes

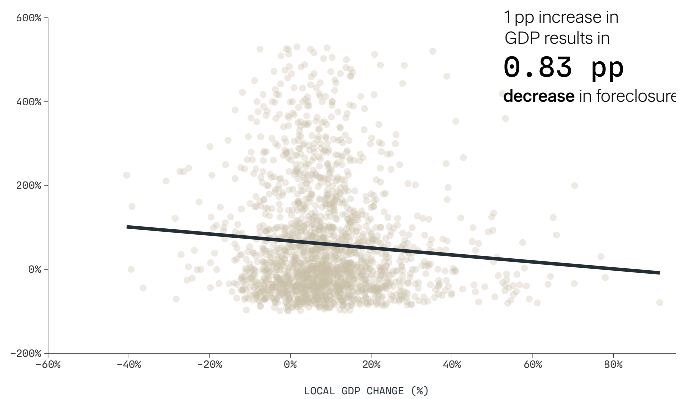


FIGURE 33. Bivariate Relationship Between Local GDP Changes and Foreclosure Count Changes

Results

FORECASTING CREDIT RISK OVER THE NEXT DECADE

Analyzing past flood events alongside observed links between insurance-premium shifts, home-value appreciation, economic growth, and foreclosure rates makes clear that climate risk affects mortgage outcomes both directly (through flood damage) and indirectly (via market and economic pressures). To anticipate how mortgage performance may evolve as these risks intensify, First Street merged projections of future flood exposure from their Flood Model (FS-FM) and climate-adjusted economic outcomes from their Macroeconomic Implications Model (FS-MIM) with the empirically established direct and indirect pathways to forecast forthcoming climate-driven credit losses at the county-level.

County-level counts of mortgaged properties and their median home values were sourced from the 2022 five-year American Community Survey (ACS). For each county, the median value of mortgaged homes was extracted and inflation-adjusted to 2024 dollars using the Bureau of Labor Statistics CPI series. Outstanding balances were then estimated by applying the FHFA's mark-to-market loan-to-value (LTV) ratio—defined as the outstanding principal balance divided by the current market value of the property—to each county's inflation-adjusted median home value. The most recent mark-to-market LTV of 46.9% from the National Mortgage Database (NMDB®) Outstanding Residential Mortgage Statistics indicates that outstanding mortgage balances equal on average 46.9% of present-day home values (FHFA, 2025). This approach yields a county-level snapshot of outstanding residential mortgage balances, totaling approximately $8.70 trillion nationwide.

Projections of future flood- and macro-driven foreclosure rates relied on the marginal effects estimated from both the difference-in-differences (DiD) analysis of past flood events and the bivariate relationships between economic indicators and foreclosure outcomes. From the flood event DiD, flooded properties exhibited a 0.29 percentage-point higher foreclosure probability than non-flooded properties in the aftermath of an event. From the indirect pathways analysis, each one-percentage-point change in insurance premiums, home-price appreciation (HPI), and GDP corresponded to 1.05, 0.54, and 0.83 percentage-point changes in county-level foreclosure rates, respectively. These marginal probabilities function as scaling factors: when applied to projected changes in flood exposure and climate-adjusted macroeconomic variables, they yield forecasts of incremental foreclosure rates attributable to climate risk.

For flood-driven projections, the annual probability of a 1-in-100-year flood—drawn from the FS-FM—was used to estimate each county's share of residential properties at risk of flooding in a given year from 2022 to 2035. That risk proportion was further narrowed to the 1 percent of properties, and therefore loans, that would actually flood each year along the projection. The 0.29-percentage-point marginal foreclosure probability from the DiD analysis was scaled by this evolving flood incidence on loans in each county to produce a time series of flood-driven foreclosure rates.

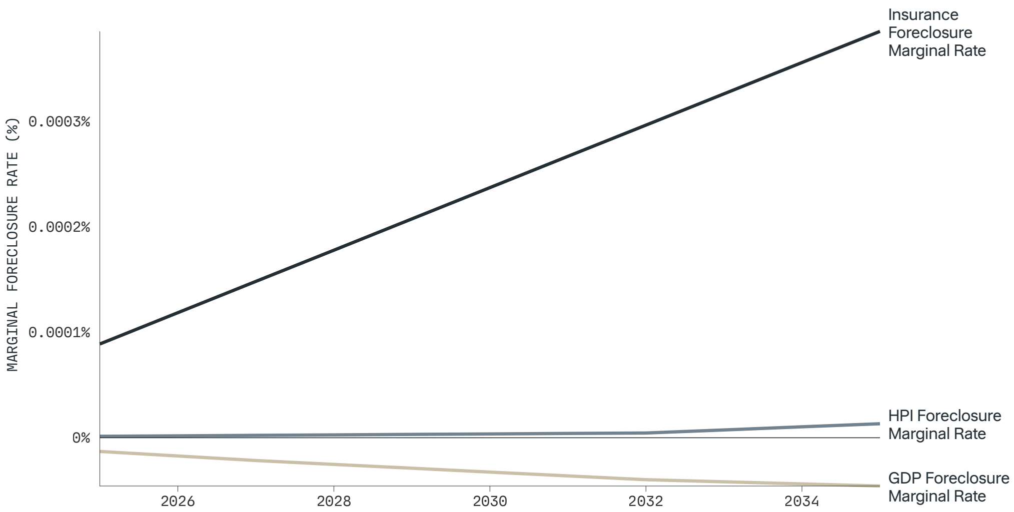


FIGURE 34. Projected Marginal Foreclosure Rates from Climate-Adjusted Macro Factors

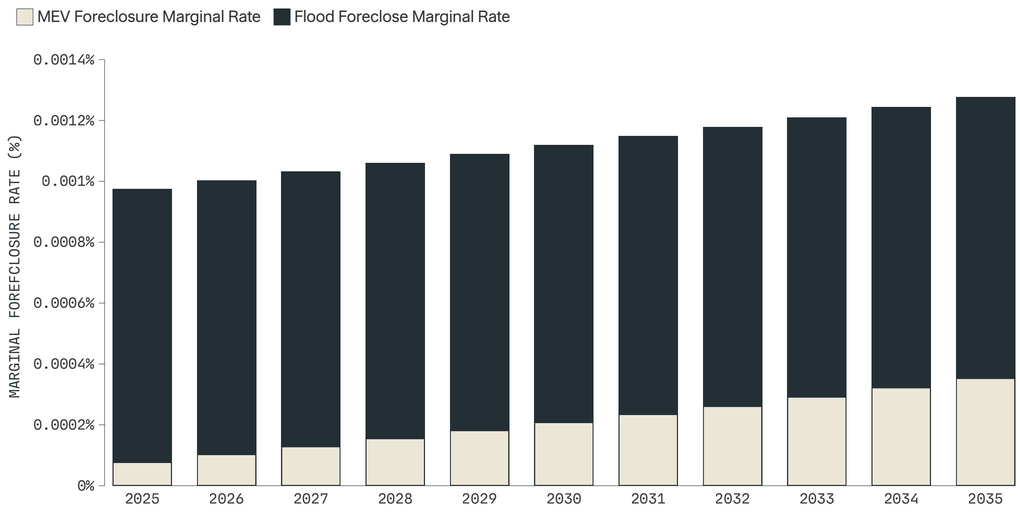


FIGURE 35. Climate-Driven Projected Marginal Foreclosure Rates

Results

For macro-driven projections, county-level changes in HPI and GDP from the FS-MIM along defined climate-migration trajectories were combined with projected insurance-premium increases derived from First Street's Wind (FS-WM), Wildfire (FS-WFM), and Hail (FS-HM) models. Beginning in 2022, as the year housing data was collected from the Census, each one-percentage-point rise in insurance cost and one-percentage-point decrease in HPI or GDP was translated into the corresponding 1.05, 0.54, or 0.83-percentage-point foreclosure increase, respectively, from the bivariate analyses.

Figure 34 displays the national-average marginal foreclosure rate path for each macroeconomic driver of foreclosures, weighted by county mortgage volume. The HPI-driven curve trends upward where projected price declines due to climate out-migration increase foreclosure vulnerability, though counties with a predicted influx of population show some price gains and negative foreclosure rate curves. The GDP-driven trajectory likewise rises overall, with exceptions in counties facing economic outflows. Across all scenarios, however, escalating insurance premiums exert the strongest and most consistent upward pressure on projected foreclosure rates over the next decade.

Figure 35 charts the projected aggregate marginal foreclosure rate driven by climate factors over the next decade. In the early period (2025–2028), flood-related foreclosures account for the bulk of the uptick, reflecting the direct impact of extreme-water events on at-risk properties. Although that component only inches upward—adding a few basis points by 2035—it represents an underpriced hazard in many lenders' models today. After 2030, however, the trajectory steepens as indirect economic pressures intensify. Rising insurance premiums, suppressed home-price growth, and broader GDP headwinds combine to push the macro-driven foreclosure rate ever higher, nearly matching the flood-driven rate by 2035. These indirect effects erode homeowners' equity and strain household finances, driving a rapid escalation in credit losses.

Outstanding mortgage balances were held constant at their 2024 level, and the projected marginal foreclosure rates were applied to each county's total to estimate gross loan write-offs from 2025 through 2035. A 50% loss-given-default, reflecting typical net losses after recovery proceeds and liquidation costs, was then applied to those write-offs to derive net credit losses to banks. Under these assumptions, annualized climate-driven credit losses grow from $252.1 million in 2025 to $1.12 billion by 2035.

However, the annualization of these estimates fail to illustrate the full scope of potential losses in a given year. Given that the effects of natural disasters are volatile from year to year, the scale of climate-driven foreclosures can vary drastically. First Street proxied the variance in natural disaster impacts by examining the variance in NFIP Redacted Claims. The 5th and 95th percentile of claims were taken as a proportion of average claims over 1980 to 2024, showcasing that in a year faced with mild weather, claims could be as low as 68% of the average claims experienced in a given year. On the other hand, a year faced with severe weather and devastating natural disaster events could experience claims amounts up to 479% of the average in a given year.

Thus, this extreme variation in outcomes was applied to the forecast of credit losses to show the full scale of losses at stake (Figure 36). Across mild years, where the destruction from extreme weather events is at a minimum, climate-driven foreclosures could cost just

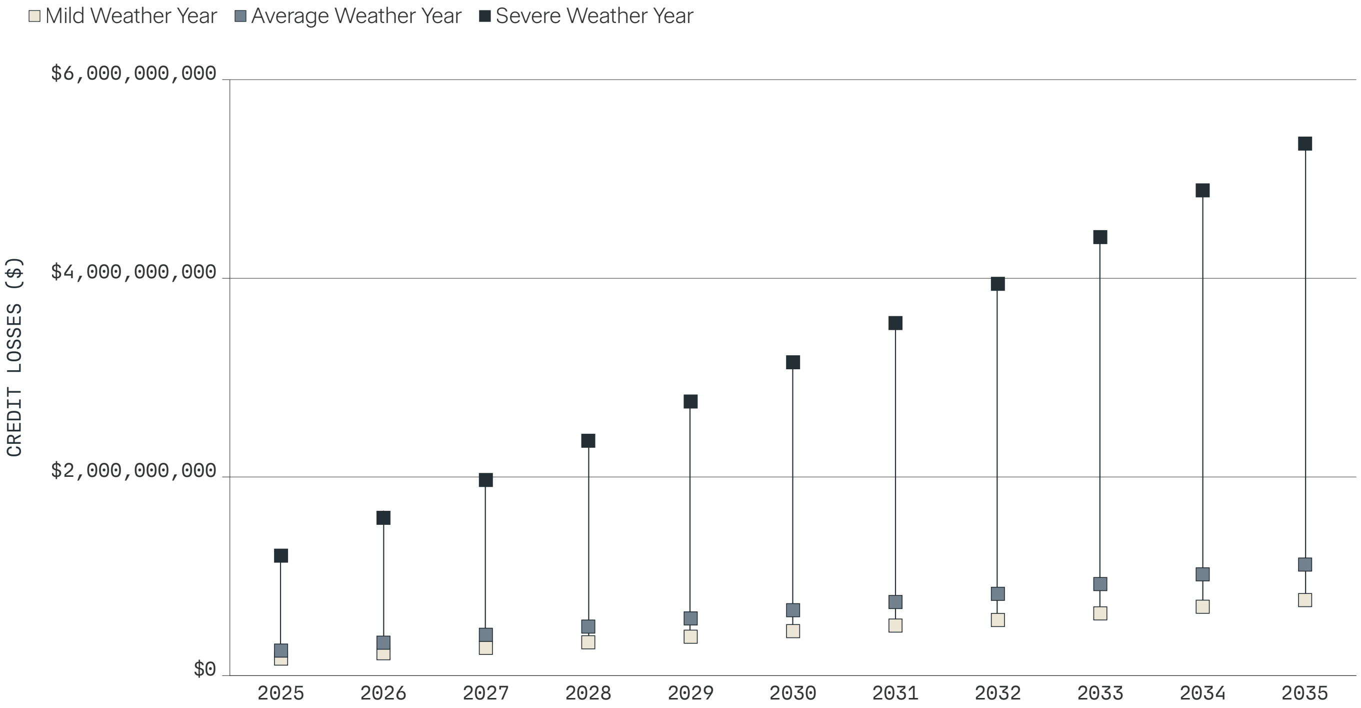


FIGURE 36. Projected Annual Credit Loss Potential From Mild to Severe Weather Years, 2025-2035

Results

over $171.4 million in credit losses today growing to $760.4 million by 2035. However, if faced with a severe year when extreme weather wreaks havoc, credit losses could reach $1.2 billion dollars today growing to $5.4 billion a year by 2035.

To quantify the share of foreclosures and associated credit losses driven by climate factors, a “no-climate” baseline for 2025-2030 is defined. Using county-level foreclosure transaction data from 2018–2022, each county's average foreclosure rate over this period is applied to its outstanding mortgage balance (amounting to a weighted national average foreclosure rate of 0.51 percent). Note a sensitivity analysis was conducted to check whether using an alternate series of historical years would alter the foreclosure rate, and no significant difference was found. Assuming a 50 percent loss-given-default yields a constant baseline of approximately $17.97 billion in annual national foreclosure credit losses throughout the projection period. The three weather-severity scenarios—mild, average, and severe—are overlaid on the baseline to estimate climate-driven foreclosures as a share of total losses in each year. In 2025, climate-driven foreclosures contribute between 0.95% and 6.72% of total foreclosure losses; by 2035, that range expands to 4.23% to 29.80% (Table 6). These growing percentages reflect both direct impacts—more frequent and severe flood events causing uninsured damage tipping into foreclosures—and indirect pressures from rising insurance premiums, diminished property values, and broader economic strain. If lending standards and risk-assessment methodologies remain unchanged, climate exposures will increasingly drive a larger proportion of foreclosure credit losses, and may even elevate the absolute level of total credit losses over time.

When examining the location

YEAR	MILD YEAR CREDIT LOSSES	AVG YEAR CREDIT LOSSES	SEVERE YEAR CREDIT LOSSES	TOTAL BASELINE CREDIT LOSSES	MILD YEAR SHARE OF TOTAL	AVG YEAR SHARE OF TOTAL	SEVERE YEAR SHARE OF TOTAL
2025	$171.4 M	$252.1 M	$1.21 B	$17.97 B	0.95%	1.40%	6.72%
2026	$225.5 M	$331.7 M	$1.59 B	$17.97 B	1.25%	1.85%	8.84%
2027	$279.6 M	$411.2 M	$1.97 B	$17.97 B	1.56%	2.29%	10.96%
2028	$335.7 M	$493.7 M	$2.36 B	$17.97 B	1.87%	2.75%	13.16%
2029	$391.8 M	$576.1 M	$2.76 B	$17.97 B	2.18%	3.21%	15.35%
2030	$447.8 M	$658.6 M	$3.15 B	$17.97 B	2.49%	3.66%	17.55%
2031	$503.9 M	$741.0 M	$3.55 B	$17.97 B	2.80%	4.12%	19.75%
2032	$560.0 M	$823.5 M	$3.94 B	$17.97 B	3.12%	4.58%	21.95%
2033	$626.7 M	$921.7 M	$4.41 B	$17.97 B	3.49%	5.13%	24.57%
2034	$693.5 M	$1.02 B	$4.89 B	$17.97 B	3.86%	5.67%	27.18%
2035	$760.4 M	$1.12 B	$5.36 B	$17.97 B	4.23%	6.22%	29.80%

TABLE 6. Projected Credit Losses and Shares of Total Baseline Credit Losses Across Weather Severity Scenarios

NOTE: Values presented in millions (M) and billions (B) of dollars.

Results

of credit losses anticipated this year, First Street's projections illustrate that credit losses will cluster in flood-prone, under-insured high-value regions (Figure 37). Specifically, counties suffering the largest credit losses span Florida, the coastal Northeast, and the West Coast. On the West Coast, an escalating homeowners-insurance crisis is eroding property values and driving up ownership costs—pushing vulnerable borrowers into foreclosure. In Florida and the Northeast, mounting flood risks coupled with gaps in flood-insurance coverage and low policy take-up are amplifying losses and triggering more foreclosures. In aggregate, states like Florida, Louisiana, and California are projected to represent the majority (53%) of all climate-related mortgage losses anticipated in 2025.

These projections hold lending standards and loan-portfolio compositions constant, effectively assuming that banks do not adjust underwriting criteria, pricing, or capital reserves in response to escalating climate risks. As flood frequency and severity rises and homeowners face mounting insurance and economic pressures, banks will confront sharply higher foreclosure rates and credit-loss outcomes unless they adjust.

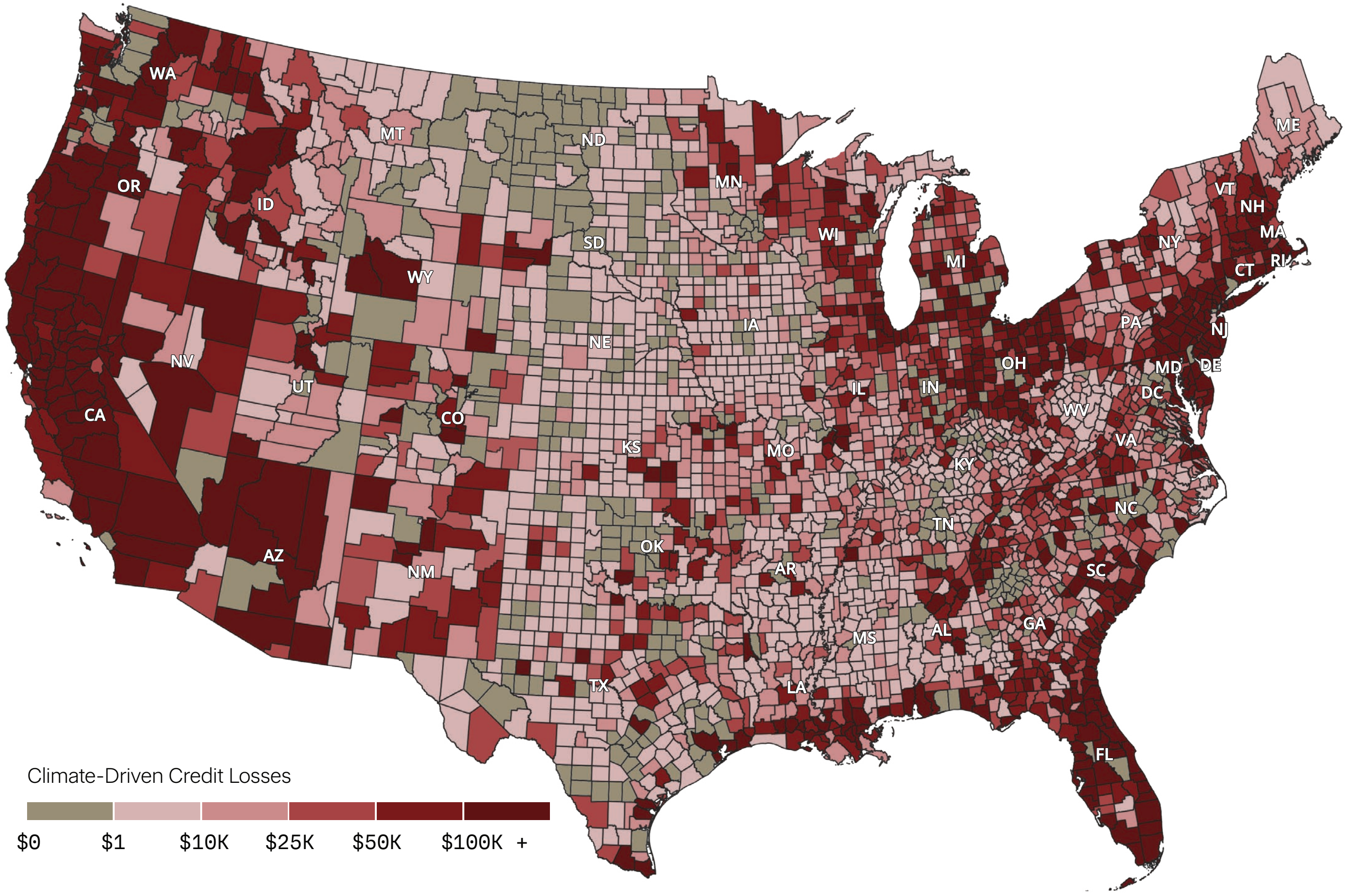


FIGURE 37. Projected County-Level Credit Losses Due to Climate-Driven Foreclosures, 2025

Climate: The 6th "C" of Credit

Natural disasters are accelerating financial losses and fundamentally reshaping the risk landscape for households, financial institutions, and investors. Over the past four decades, the annual cost of climate-related events—such as floods, wildfires, and hurricanes—has surged by 1,580%, challenging the long-standing assumption of geographic and climatic stability underpinning financial systems. This surge is not only damaging properties but also devaluing them, straining the insurance industry, and prompting premium hikes and insurer withdrawals from high-risk areas. As a result, more financial burden is shifting onto homeowners, exposing the limits of existing risk mitigation tools.

With insurance growing costlier and harder to obtain, households–often with limited savings– are left to absorb rising ownership costs and climate-driven costs. This erodes home equity, especially during economic downturns, and increases their vulnerability to future shocks. When homeowners cannot afford repairs, face unaffordable premiums, or lose equity due to declining property values, the likelihood of mortgage default rises sharply. This cascading path to foreclosure, shaped by climate impacts, insurance market retreat, and household fragility, exposes a blind spot in traditional credit risk models and underscores a critical, evolving climate risk for lenders and investors.

Lenders have long evaluated borrower creditworthiness using the Five Cs of credit—character, capacity, capital, collateral, and conditions—but climate risk is rapidly emerging as a critical sixth dimension (Figure 38). Borrowers in areas exposed to both the direct impacts of extreme weather and the indirect pressures of shrinking insurance availability, rising premiums, and declining property values are under mounting financial strain. Because these climate risks are dictated by a property's geography, regardless of a borrower's credit profile, they introduce a new, location-based dimension of asset risk into traditional credit-risk assessments.This means that two borrowers with identical credit scores, histories, and incomes could face substantially different credit risk odds if one lives in a 100-year floodplain and the other does not. Flood exposure can depress a home's market value and burden the owner with uninsured repair costs, simultaneously eroding equity and amplifying financial strain. Even low-risk borrowers may face growing credit risk when faced with the compounding nature of physical climate impacts and indirect effects to homeownership costs in the face of differing economic conditions.

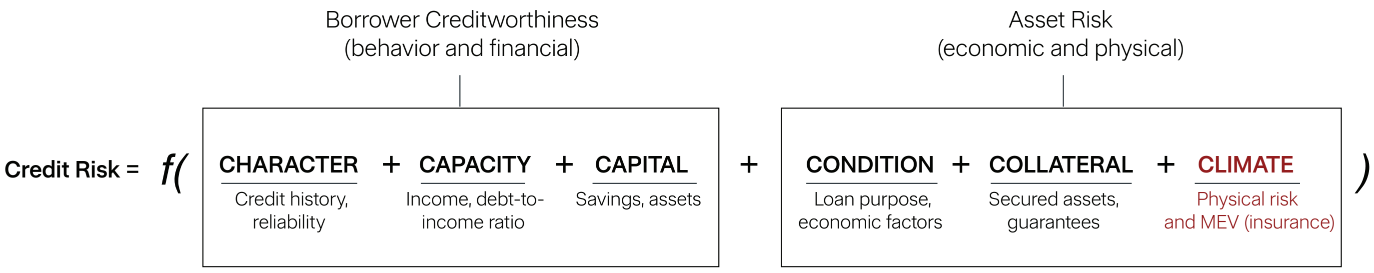


FIGURE 38. Credit Risk Figure

As demonstrated by Hurricane Sandy in 2012, property-level exposure to physical climate impacts can unearth hidden credit losses. These losses will only grow as the severity and frequency of climate-driven disasters escalate. An ancillary analysis on a sample of 1.4 million loan transactions using a loan-level logistic regression model that embeds a property's Flood Factor alongside traditional predictors confirms this: while LTV remains the strongest predictors of foreclosures, Flood Factor is a close second, with each one-point increase in Flood Factor driving roughly a 5% rise in foreclosure odds.

These findings emphasize the need for climate exposure to be evaluated as a sixth "C" in credit-risk frameworks. By integrating high resolution physical climate risk metrics like Flood Factor into underwriting, stress testing, and portfolio management, lenders and investors can more precisely price risk, anticipate future losses, and develop targeted mitigation strategies–fortifying their financial resilience in an era of mounting climate volatility.