POLICY BRIEF

Rebuilding Insurance for a Climate Future

A Policy Guide to Understand Tools, Address Inequities, and Find Solutions

Woodwell Climate Research Center

Jamie Cummings
Dominick Dusseau

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EXECUTIVE SUMMARY

- As the frequency and severity of extreme weather events increase, insurance companies are raising premiums or abandoning high-risk markets, leaving many communities-especially highly vulnerable ones-without reliable coverage.
- Catastrophe models simulate rare but very costly disasters, such as floods and hurricanes, to estimate how much damage would occur. While commonly used by insurers, there is limited public information on how catastrophe models are created and validated, and loss estimates vary widely across models.
- Parametric insurance, unlike traditional insurance, issues a payment based on a specific trigger or metric, such as wind speed, rather than assessed monetary damages. The parametric framework offers a faster and more transparent process but is best suited for balance sheet, rather than asset, protection. For example, a hotel hit by a hurricane could use a parametric policy to transfer the risk of revenue loss to an insurer.
- Disadvantaged communities face a heightened challenge: they are disproportionately located in high-risk areas—often due to long-standing structural barriers—and consequently suffer from expensive premiums or a complete lack of insurance coverage.
- Our recommendations aim to increase insurance literacy, the availability of parametric and community-led insurance, and federal oversight of insurance premiums.

Aerial view of Ponte Vedra Beach in Jacksonville, Florida. / photo by Trace Rouda

1. Grow consumer insurance literacy through regulators enacting rules to increase the transparency of rate making and develop educational resources for consumers to fully understand their insurance policies.
2. Increase incentives for, and research into, the adoption of parametric insurance, community insurance, and means-based insurance assistance by Congress.
3. Establish an Optional Federal Charter for insurers to reduce regulatory compliance costs, prevent non-actuarially sound cross-subsidization between states, and allow for greater risk pooling.
4. Create a standard national catastrophe model, in partnership with states, through federal legislation to be used for evaluating private catastrophe models and insurers' rates as well as hazard mitigation planning.

INSURANCE LITERACY IN A CLIMATE CONTEXT

When extreme weather strikes, insurance can be the difference between a resilient recovery and financial ruin for a community. As extreme weather events become more frequent and severe, insurance companies are raising rates to unsustainable levels or abandoning high-risk areas entirely. In California, major insurers have stopped providing home insurance policies in areas prone to wildfire risk.[1] In Florida, thousands of homeowners have seen their premiums double or triple in recent years.[2] These developments aren't just insurance problems—they're signals of how climate change—the driver of more extreme weather events—is reshaping responses to and preparedness for disasters.

While federal disaster aid provides emergency relief after catastrophes, private insurance remains a primary mechanism for long-term financial recovery and resilience building. Yet, the tools insurers use to evaluate and price risk, like catastrophe models, and new insurance products, like parametric insurance, remain opaque to most people. To address the changing risk landscape in the insurance industry, there needs to be a better shared knowledge of how climate impacts shape the insurance market. This policy brief specifically addresses the gap in insurance literacy among community leaders and policymakers working to navigate the evolving challenges.

Woodwell Climate Research Center's Risk Program scientists bring extensive expertise in modeling and predicting climate hazards that directly impact insurance markets, while our policy team has experience translating complex climate data into actionable recommendations for policy action. This interdisciplinary approach uniquely positions Woodwell to bridge the gap between climate science, risk assessment, and insurance policy literacy and solutions.

This brief provides a comprehensive look at the evolving landscape of climate risk and insurance. We begin by examining catastrophe models—the complex tools insurers use to predict and price risk—and explore how they shape coverage and premium decisions. We then investigate parametric insurance, an innovative

[1] Wood, S., & Quackenbush, J. (2024, March 21). State Farm dropping 72,000 California home, apartment insurance policies. *The North Bay Business Journal*. https://www.northbaybusinessjournal.com/article/article/state-farm-dropping-72000-california-home-apartment-insurance-policies/

[2] Federal Insurance Office, U.S. Department of the Treasury. (2025). *Analyses of U.S. Homeowners Insurance Markets, 2018-2022: Climate-Related Risks and Other Factors.* https://home.treasury.gov/system/files/311/Analyses_of_US_Homeowners_Insurance_Markets_2018-2022_Climate-Related_Risks_and_Other_Factors_0.pdf

but somewhat limited approach that could help fill coverage gaps. The brief also tackles questions about equity, examining how changes in the insurance market disproportionately affect vulnerable communities and ways to enhance their community resilience. We conclude with policy recommendations to help ensure insurance is accessible, understandable, and effective in an increasing era of climate disasters.

CATASTROPHE MODELS: THEIR ROLE IN INSURANCE

August 24, 1992 was a defining moment in the insurance world. Hurricane Andrew made landfall in southern Miami-Dade County, Florida and caused $27 billion in damages.[3] Seven insurance companies became insolvent after the event, and several others required fund transfers from parent companies to remain afloat.[4] The downfall of these insurance providers was their failure to account for catastrophic risk—the risk associated with events that are rare yet cause a huge amount of damage. Ideally, insurers would have information on all possible events but historical records are largely limited to the past 125 years and exposure levels have changed dramatically over that timeframe. For example, the economic loss from a Category 5 hurricane would be extremely different for Miami in 1925 compared to Miami in 2025. There are simply more buildings and people in harm's way. If an insurer only used the economic loss data for the previous 100 years, it would not account for the most damaging events in its computations, leading to an incorrect pricing of risk. Hurricane Andrew demonstrated the consequences of making this miscalculation—insurers incorrectly estimated the impact of a Category 5 hurricane hitting Miami in 1992. Adding to the difficulty of calculating the true probability of loss is climate change. Shifts in climate have led to greater uncertainty in near-future events, and research has shown that there is less predictability in a warmer climate as the present and near-future distributions of extreme events become distinct from historical distributions.[5]

To analyze and price risk from events that have yet to happen, insurers use catastrophe models that simulate disasters, such as floods and hurricanes, to estimate how much damage would occur.[6] By simulating thousands of years-worth of storms or wildfires, including rare and destructive events, catastrophe models theoretically capture the entire range of possible damages that could statistically occur. This thousands of years-long event catalog is combined with property or asset data to estimate average annual losses or exceedance probabilities for various levels of loss.[7] Insurance premiums are derived from the outputs, such as average annual loss, of catastrophe models.[8]

While catastrophe models are simulations of reality, the results from these models need to be validated. Despite their limitations, historical records are the gold standard as a benchmark[9] for verifying the accuracy of catastrophe models, known as validation analysis. Such analysis is vital as these models have a significant influence on society through the insurance, financial, and real estate systems.[10] Yet, loss estimates can vary significantly across climate perils and modeling companies. In 2023, Cotality (previously CoreLogic) estimated California's average annual building losses from wildfires at $1.21 billion, while First Street Foundation's

[3] National Weather Service. (2022, August 22). *Hurricane Andrew's 30th anniversary*. U.S. Department of Commerce. https://www.weather.gov/news/220822-hurricane-andrews

[4] McChristian, L. (2012, August). *Hurricane Andrew and insurance: The enduring impact of an historic storm*. Insurance Information Institute. https://www.iii.org/sites/default/files/paper_HurricaneAndrew_final.pdf

[5] Sheshadri, A., Borrus, M., Yoder, M., & Robinson, T. (2021). Midlatitude Error Growth in Atmospheric GCMs: The Role of Eddy Growth Rate. *Geophysical Research Letters*, 48(23), e2021GL096126. https://doi.org/10.1029/2021GL096126

[6] State Farm states in its 2022 Task Force for Climate Disclosure report that "catastrophe models are the primary tools used to help set underwriting guidelines." State Farm. (2023). *2022 Task Force on Climate-Related Financial Disclosures Report*. State Farm. https://impact.statefarm.com/data/docs/2022/2022_TCFD_Report_08_2023.pdf

[7] For additional details on the inner workings of catastrophe models see Dietzen, G., & Chamberlain, M. (2022, July 25). *Taking catastrophe models out of the black box: Understanding, evaluating, and using the best tools available for predicting risk from natural disasters*. Milliman. https://www.milliman.com/en/insight/taking-catastrophe-models-out-of-the-black-box and Jones, M. (2024, October 1). *Introduction to catastrophe modeling. Fathom*. https://www.fathom.global/insight/introduction-to-catastrophe-modeling/

[8] American Academy of Actuaries, Extreme Events and Property Lines Committee. (2018, July 25). *Uses of catastrophe model output*. https://www.actuary.org/sites/default/files/files/publications/Catastrophe_Modeling_Monograph_07.25.2018.pdf

[9] Even though historical records do not inherently reflect climate change, they can be adjusted to represent present-day exposure levels. Given a lack of acceptable alternatives, historical records are the best benchmark for validating modeled results even when accounting for their imperfections.

[10] Condon, M. (2023). Climate services: *The business of physical risk*. Ariz. St. LJ, 55, 147. http://dx.doi.org/10.2139/ssrn.4396826

estimate is nearly triple this amount.[11,12] Depending on which model insurers or banks use, a property's insurance premium could be significantly different, or an investment may, or may not seem profitable. Validation analyses guard against risk being over- or underpriced, aiming to ensure fair insurance rates and that these financial signals motivate market behavior towards risk reduction.

However, catastrophe modelers generally do not account for the impact of climate change on loss estimates. For example, only two modelers out of seven approved by the Florida Commission on Hurricane Loss Projection Methodology (FCHLPM) incorporate how climate change has shifted hurricane distributions over the past 125 years into their simulations.[13] The other modelers rely solely on the historical record, meaning, for example, climate impacts on hurricanes are not reflected, such as intensified wind speeds, occurrence in higher latitudes, maximum intensity closest to land, and rain rates of tropical cyclones.[14,15,16] These transformations in tropical cyclone characteristics can have a profound impact on the loss estimates that catastrophe models generate to inform premiums. Without adjusting the historical event set to compensate for a change in overall climate, the distribution of storms is only reflective of a mid-20th century climate, not our present climate.

Catastrophe modeling companies are not known for their transparency. To protect their business in the current competitive marketplace, many companies provide limited public information on how their models are built or about the outputs from the models themselves.[17,18] First Street is an exception, publishing detailed methodologies and establishing a public-facing website for property-level climate risk scores, but still keeping geospatial and property-specific data behind a paywall. Since catastrophe modelers provide so little data to the public, state regulatory reviews are one of the few opportunities for the public to understand how these complex models function and the validity of their outputs.

Still, the auditing of catastrophe models is extremely limited. The FCHLPM reviews any catastrophe model that in-state insurers are allowed to use for pricing premiums and has been certifying hurricane catastrophe models since 1996, with seven models currently approved.[19] The review process was expanded to flood catastrophe models in 2014, and only three flood model submissions to the FCHLPM have been approved. California began reviewing wildfire catastrophe models for use in the insurance market in February 2025, but no information on the data, methodology, or acceptability has been released publicly as of April 2025.[20] Some states, such as South Carolina and Louisiana, have less intensive processes for reviewing catastrophe models and rely on the FCHLPM or require completed interrogatories (a set of formal written questions) during rate filings.[21,22] However, South Carolina has placed limitations on the use of catastrophe models and requires that they represent a historical climate, not the current one.[23] Other states, such as Colorado, are considering statutes to require some level of transparency from insurers about the models they use to set premiums to policyholders, but there is no technical review of those models.[24]

Researchers have performed model validation and comparison, but with limited scope. One study compared flood and wildfire risk data from risk modeling

[11] CoreLogic. (2023). *Wildfire Risk Report 2023*. https://www.corelogic.com/wp-content/uploads/sites/4/2023/08/corelogic-2023-wildfire-risk-report.pdf

[12] First Street Foundation. (2023, September 20). *The 9th National Risk Assessment: The Climate Insurance Bubble*. https://report.firststreet.org/9th-National-Risk-Assessment-The-Insurance-Issue.pdf

[13] Based on a review of hurricane catastrophe model disclosures from the FCHLPM.

[14] Gilford, D. M., Giguere, J., & Pershing, A. J. (2024). Human-caused ocean warming has intensified recent hurricanes. *Environmental Research: Climate*, 3(4), 045019. https://doi.org/10.1088/2752-5295/ad8d02

[15] Wang, S., & Toumi, R. (2021). Recent migration of tropical cyclones toward coasts. *Science*, 371(6528), 514-517. https://doi.org/10.1126/science.abb9038

[16] Tu, S., Chan, J. C., Xu, J., Zhong, Q., Zhou, W., & Zhang, Y. (2022). Increase in tropical cyclone rain rate with translation speed. *Nature Communications*, 13(1), 7325. https://doi.org/10.1038/s41467-022-35113-8

[17] Risk Management Solutions, Inc. (2012). *Principles of model validation: United States hurricane model*. https://forms2.rms.com/rs/729-DJX-565/images/tc_2012_principles_model_validation_us.pdf

[18] Wojtkiewicz, R., & Ramanathan, K. (2020, September). *Modeling fundamentals: Evaluating U.S. flood model loss output with historical loss experience*. Verisk. https://www.verisk.com/blog/modeling-fundamentals-evaluating-u-s--flood-model-loss-output-with-historical-loss-experience/

[19] Florida Commission on Hurricane Loss Projection Methodology. (n.d.). *Model submissions*. Florida State Board of Administration. Retrieved April 14, 2025, from https://fchlpm.sbafla.com/model-submissions

[20] California Department of Insurance. (n.d.). *Insurance Model Advisor and Pre-Application Required Information Determination Procedure*. Retrieved April 14, 2025, from https://www.insurance.ca.gov/01-consumers/180-climate-change/DetermineProcedure.cfm

[21] South Carolina Department of Insurance. (n.d.). *Hurricane catastrophe modeling*. Retrieved April 14, 2025, from https://doi.sc.gov/791/Hurricane-Catastrophe-Modeling

[22] Louisiana Department of Insurance. (2013). *Bulletin 2013-04: Catastrophe Model Interrogatories*. Retrieved April 14, 2025, from https://ldi.la.gov/industry/regulatory-forms/bulletin-2013-04-catastrophe-model-interrogatories

[23] South Carolina Department of Insurance. (2014, March). *Hurricane catastrophe models in property rate filings (Bulletin 2014-03)*. https://www.doi.sc.gov/DocumentCenter/View/7478/2014-03-Hurricane-Cat-Models-in-Property-Rate-Filings

[24] Colorado General Assembly. (2025). *HB25-1182: Risk Model Use in Property Insurance Policies*. https://leg.colorado.gov/sites/default/files/documents/2025A/bills/2025a_1182_ren.pdf

companies XDI and Jupiter Intelligence and found that regionally, the model results are similar but can differ significantly at the address-level.[25] Another set of researchers analyzed the results of two flood models, First Street and PRIMo-Drain, in Los Angeles, CA, and found the two models agreed on which properties were at risk only about 25% of the time.[26] Both of these studies demonstrate that models can vary widely in their assessment of asset-level risk. Three catastrophe models used in the National Flood Insurance Program (NFIP) estimate similar average annual losses from coastal flooding, ranging between $2.3 million to $2.4 million for the year 2022, but the 1,000-year event annual loss spread is much wider, $40.9 billion to $56.5 billion.[27] While estimated average aggregate losses of various catastrophe models can be quite similar, estimated property-level and rare event damages can differ substantially. The question remains: are these models appropriate in their level of transparency and accuracy for the public to estimate and subsequently mitigate their property-level risk? At this moment, we argue, they are not. These models are complex, imperfect, and provide wide-ranging loss estimates with opaque methodologies. Greater transparency in terms of methodologies and outputs from modeling firms is necessary to conduct proper validation and inform the public on the limitations of catastrophe models.

PARAMETRIC MODELS: THE OPPORTUNITIES AND LIMITATIONS

Before delving into parametric insurance, it is worth establishing how traditional insurance (also known as indemnity coverage) works. If a natural disaster strikes, a policyholder with indemnity coverage will begin the claims process by notifying their insurer, inventorying lost value, gathering evidence to support the claim, and preparing for a visit from a loss adjuster. This process can lead to long wait times before receiving a payout as the insurance company reviews the claim and tries to minimize profit loss. In parametric insurance, if an index, variable, metric, or parameter reaches a certain value, then a payout is triggered and sent to the policyholder. There is a very limited claims process, and policies emphasize expeditiousness. One example is the Extreme Heat Income Micro-Insurance, which provides income protection to women in India who cannot work when temperatures rise to unsafe levels.[28] In the United States, California municipalities can now get coverage for flooding from atmospheric rivers that could reduce tax revenue and pay for disaster recovery efforts, which are not covered in a traditional insurance policy.[29]

While parametric insurance has increased in uptake over the past five years, indemnity coverage will still play an important role in mitigating climate risk for residential and commercial property owners.[30] This is because parametric insurance is not a substitute for traditional insurance. Parametric insurance shares a few characteristics with traditional insurance, as both have premiums and claims, but the frameworks of each are fundamentally different. Essentially, indemnity coverage is asset protection, and parametric insurance is balance sheet protection. Asset protection refers to safeguarding the value of physical property, such as an apartment building, while balance sheet protection is focused on shielding against loss of revenue (usually generated by that asset, but not always). They

[25] Chegwidden, O., Koerth, M., & Freeman J. (2024). *Climate risk companies don't always agree*. CarbonPlan. https://carbonplan.org/research/climate-risk-comparison

[26] Schubert, J. E., Mach, K. J., & Sanders, B. F. (2024). National-scale flood hazard data unfit for urban risk management. *Earth's Future*, 12(7), e2024EF004549. https://doi.org/10.1029/2024EF004549

[27] Federal Emergency Management Agency. (2023, September 27). *National Flood Insurance Program (NFIP) Reinsurance Placement Information*. FEMA.gov. https://www.fema.gov/about/openfema/data-sets/national-flood-insurance-program-nfip-reinsurance-placement-information

[28] Dabrowski, J. (2023, March 7). *Fighting extreme heat with parametric insurance: protecting the livelihoods of women in India's informal economy sector*. One Billion Resilient. https://onebillionresilient.org/2023/03/07/fighting-extreme-heat-with-parametric-insurance/

[29] Amwins. (n.d.). *Atmospheric River Flood Insurance Program*. Retrieved April 15, 2025, from https://www.amwins.com/products/atmospheric-river-flood-insurance-program

[30] European Union Agency for the Space Programme. (2024). *EUSPA EO and GNSS Market Report 2024 (Issue 2)*. https://www.euspa.europa.eu/sites/default/files/documents/EUSPA%20Market%20Report%202024.pdf

serve different functions and should not be used interchangeably without careful consideration. One important reason for their difference in application is basis risk. Basis risk is the mismatch between the loss a policyholder experiences and the final payout from an insurer. Basis risk exists in traditional insurance, but it plays a larger role in parametric insurance. If a payout from a parametric policy is triggered when daily rainfall exceeds two inches, any flood damage that occurs when it rains less than two inches is not covered. This makes parametric policies ill-suited for compensating asset losses, such as a homeowner for flood damage to their house, and more appropriate for covering potential interruptions to revenue. For example, a hotel in Florida would likely suffer a loss of revenue after a hurricane event—a parametric policy can be used to transfer that risk to the financial sector.

At the same time, basis risk can also affect the insurer negatively. A policyholder could not experience any damage or loss of revenue but still receive a payout if the parametric policy is triggered. Such a net gain for a policyholder can enter a legal gray zone in the U.S. because current insurance regulation requires documentation that damage has occurred and is known as "proof-of-loss."[31] A 2024 ruling by the Tenth Circuit Court of Appeals has upheld that standard and declared a net gain for a policyholder in an insurance contract to be unlawful.[32] This ruling creates a fundamental incompatibility with the nature of parametric insurance products. While parametric policies are not designed for a policyholder to experience a net gain, the lack of statutory codification for parametric insurance is a barrier to the wider adoption of parametric policies. Policymakers in many U.S. jurisdictions have not addressed whether parametric policies even fall within the purview of insurance commissioners, leaving insurers and policyholders to face the risk of costly litigation on issues surrounding indemnification, insurable interest, and parametric trigger mechanisms.

While proof-of-loss can be as simple as a text message confirming a loss has occurred, this method breaks down when parametric insurance is used for forecast-based financing. A payout before an event has occurred can be highly beneficial to a policyholder as the funds can be used for immediate risk-reducing measures, but this framework conflicts with current insurance regulations since no damage has occurred. This issue of legality becomes even more salient when considering that litigation of claims has become a persistent source of social inflation[33] in the insurance sector.[34] Litigation costs raise premiums for all and prevent insurers from offering policies that might be vulnerable to lawsuits. The lack of regulation around parametric insurance is visible with just a few U.S. jurisdictions explicitly mentioning parametric insurance in statutes, one being Puerto Rico.[35] The state of New York has codified parametric insurance into state law, but the requirement for proof-of-loss under parametric policies in the state has not been fully addressed.[36]

While parametric policies cannot replace standard indemnity coverage and face their own limitations, they provide a few key advantages in recovery efforts. Previous research has cited 1) speed, 2) flexibility, and 3) transparency as benefits of parametric tools to build financial resilience, particularly in marginalized communities.[37] Payments based on predetermined triggers rather than assessed damages allow for rapid disbursement of funds when they are most needed. Low-

[31] One example of proof-of-loss in state law is Florida Statute § 627.612. https://www.flsenate.gov/laws/statutes/2021/627.612

[32] Curtis Park Group v. Allied World Specialty Ins. 124 F. 4th 826 (10th Cir. 2024). https://www.ca10.uscourts.gov/sites/ca10/files/opinions/010111164371.pdf

[33] Social inflation is the increase in insurance claim costs, and therefore premiums, that is not part of economic inflation, driven by factors like changes in tort law and increased litigation funding.

[34] Swiss Re Institute. (2024). *Litigation costs drive claims inflation: Indexing liability loss trends (Sigma No. 4/2024)*. https://www.swissre.com/dam/jcr:6bc7d3b7-0f42-4209-a01a-e22787b98685/sri-sigma4-2024-litigation-costs-claims-inflation-final.pdf

[35] Puerto Rico Office of the Commissioner of Insurance. (2020). *Rule No. 105 of the Regulations of the Insurance Code of Puerto Rico: Requirements for filing and processing parametric insurance*. https://docs.pr.gov/files/OCS/English/Legal%20Affairs/Regulations/Insurance%20Code%20Regulations/Reglas-Rule_20105_20.pdf

[36] Eomilson, R. (2025, January 7). *New York enacts parametric insurance law*. Clark Hill PLC. https://www.clarkhill.com/news-events/news/new-york-enacts-parametric-insurance-law/

[37] French, K., & Kousky, C. (2023, January 24). *Inclusive insurance: Promoting the post-flood financial resiliency of low- and moderate-income households*. Environmental Defense Fund. https://blogs.edf.org/markets/wp-content/blogs.dir/32/files/2023/01/Inclusive-Insurance-Report.pdf

income households experienced disproportionate losses to incomes after Hurricane Katrina.[38] Payment speed can be crucial for vulnerable households without significant savings to fall back on during disaster recovery as a sort of first line of defense. Parametric products also offer flexible coverage that might not be included in traditional property indemnity policies and provide the opportunity for risk transfer in many spaces where traditional insurance is not willing or equipped to participate. Non-conventional policies can be issued, such as coverage for coral reefs, which are relied upon by the tourism and fisheries industries.[39] Finally, the payout method is based on a metric—such as publicly available weather data like wind speed or temperature—that is fully transparent and independent, eliminating room for biases that often follow underserved groups and reducing opportunities for fraud.

INEQUITY AND STATE FRAGMENTATION IN INSURANCE

Vulnerable communities face a double burden: disproportionate exposure to climate-induced disasters and limited access to affordable, comprehensive insurance coverage. This pattern follows historical patterns of racial and socioeconomic inequality, with underresourced communities often concentrated in high-risk geographies, such as certain areas of the U.S. South. The fragmented state-by-state nature of insurance regulation exacerbates these disparities, resulting in deeply inequitable disaster recovery outcomes. Historically marginalized communities experience greater financial hardship due to insurance coverage gaps stemming from two key factors.

1. Premiums continue to escalate in high-risk areas, forcing many low to middle-income households to go without adequate protection.

2. Many historically underserved communities that are highly exposed to risk face a complete lack of coverage options as insurers withdraw from markets they no longer view as profitable. For example, future increased flood risk will "disproportionately impact Black communities, while remaining concentrated on the Atlantic and Gulf coasts,"[40] which will make it more difficult for insurance markets to offer policies that are not at a loss. This coverage gap leaves precisely those communities with the fewest resources available to self-insure and face the greatest hardships from climate risk.

As previously outlined, the development of catastrophe models has allowed for high-resolution projection of future weather risk.[41] However, the increasing sophistication of catastrophe models presents both opportunities and risks for equity concerns. As these models incorporate more granular data, there is a real danger that more communities could be deemed uninsurable, as a result of the ever-increasing scale and frequency of extreme weather events causing damage.

The fragmented nature of insurance markets is another concern from an equity standpoint. In the United States, insurance rates are regulated on a state-by-state basis. Each state has its own laws, rules, and methods for approving rate filings. This can lead to varying levels of regulation across state lines for the same

[38] Mansury, Y., Ye, X., & Yoon, D. K. (2021). Structural path analysis of extreme weather events: An application to Hurricane Katrina and Superstorm Sandy. *Applied Geography*, 136, 102561. https://doi.org/10.1016/j.apgeog.2021.102561

[39] Roberts, E. (n.d.). *Insuring Nature to Ensure a Resilient Future*. The Nature Conservancy. Retrieved April 15, 2025, from https://www.nature.org/en-us/what-we-do/our-insights/perspectives/insuring-nature-to-ensure-a-resilient-future/

[40] Wing, O. E., Lehman, W., Bates, P. D., Sampson, C. C., Quinn, N., Smith, A. M., ... & Kousky, C. (2022). Inequitable patterns of US flood risk in the Anthropocene. *Nature Climate Change*, 12(2) 156-162. https://doi.org/10.1038/s41558-021-01265-6

[41] More frequently, artificial intelligence (AI) is being integrated into climate modeling. AI integration is another concern for equity and transparency purposes and should be further studied.

insurance product. Empirical data shows that insurers are cross-subsidizing lower premiums in states with strong insurance rate regulation by charging higher rates in states with lower levels of regulation.[42] This redistribution of insurance costs has been documented previously as an inefficiency of the insurance market.[43] As climate change increases the probability of extreme weather events, risk will be inequitably distributed even more as states with higher climate risk seek to limit premium hikes for their residents.

As a result of premiums becoming unaffordable due to increasing extreme weather events and risk exposure inequities, innovative approaches have emerged that offer more flexible solutions. Community-level insurance models present promising alternatives to conventional individual indemnity coverage. The reality of climate risk is that individual property safety is inherently connected to community-level safety, meaning that one's property is only as safe as their neighbors'. Unlike traditional frameworks that focus on individual properties, a community-level policy recognizes that climate resilience is collective. The community-centered approach has led to growing interest in aggregate insurance models, where an institution, such as a community group, non-profit, or government agency, secures insurance on behalf of a group. Aggregate insurance structures can take the undue affordability burden off of individuals. Even if catastrophe models were appropriate for analyzing property-level risk, the emphasis on individual risk reduction should not overshadow community-level risk mitigation action. Rather than raising individual homes to reduce flood risk, watershed-level adaptation involving both grey and green infrastructure can be more cost-effective and sustainable in the long term. A community-level coverage option could provide an alternative to individual indemnity coverage in areas that are particularly at risk.

Another alternative option to traditional coverage is microinsurance, which adjusts premiums based on a household's financial capacity rather than solely on risk factors. Microinsurance is a type of insurance product specifically developed for financial resource limitations. These frameworks feature affordable premium payments while offering lower coverage amounts, making them accessible to resource-constrained populations. Thus far, case studies have only been presented in emerging economies; however, Puerto Rico's insurance commissioner is expected to launch a trial program.[44] This approach would directly address equity concerns by providing greater protection to those with fewer resources and ensuring that insurance does not become a luxury accessible only to the wealthy.

POLICY RECOMMENDATIONS

There is no silver bullet to solving the insurance problem. A combination of tools, frameworks, and forms of insurance, in addition to reducing risk exposure, will be required to prepare the industry and consumers for the changing climate future. The following recommendations are by no means exhaustive, but rather a few targeted ways to address the problems outlined in this brief by improving insurance literacy across stakeholders, moving beyond traditional indemnity approaches, and enhancing oversight of insurers.

[42] Oh, S. S., Sen, I., & Tenekedjieva, A.-M. K. (2022). Pricing of Climate Risk Insurance: Regulation and Cross-Subsidies. *Finance and Economics Discussion Series*, 2022.0(64), 1–93. https://doi.org/10.17016/feds.2022.064

[43] Harrington, S. E. (2006). *Federal chartering of insurance companies: Options and alternatives for transforming insurance regulation (Networks Financial Institute Policy Brief No. 2006-PB-02)*. Networks Financial Institute. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=923605

[44] Kousky, C., Wiley, H., & Shabman, L. (2021). Can Parametric Microinsurance Improve the Financial Resilience of Low-Income Households in the United States?: A Proof-of-Concept Examination. *Economics of Disasters and Climate Change*, 5(3), 301–327. https://doi.org/10.1007/s41885-021-00088-1

Insurance Literacy: Framing, Education, and Capacity Building

1. **Congress should mandate clear explanations for premium increases from insurers upon request from policyholders.**
   - Washington state provides a model that could be implemented on a larger scale[45]
   - Increases transparency and helps policyholders understand complex factors driving costs
   - Builds trust in the system and prevents inequitable premium distribution
2. **The House Committee on Financial Services should host whole-of-society Congressional hearings and public forums at the federal level focused on solutions.**
   - Follow Alabama's successful example with the Alabama Affordable Homeowners Insurance Commission[46]
   - Bring together policyholders, community leaders, industry representatives, risk scientists, builders, and policymakers
   - Alabama's approach led to the creation of FORTIFIED[47] construction standards that improved resilience
3. **The Federal Insurance Office (FIO) should develop accessible resources demystifying insurance mechanisms.**
   - Create multilingual, user-friendly materials explaining catastrophe models and policy nuances
   - Help communities advocate for equitable solutions to fill protection gaps
   - Support transparency, education, and community engagement

Beyond Traditional Frameworks: Microinsurance, Community, and Parametric Options

4. **The FIO should conduct research on alternative insurance options to demonstrate successful cases and identify gaps.**
   - Focus on aggregate insurance, microinsurance, and parametric approaches
   - Aligns with FIO's mandate to monitor access to affordable insurance for underserved communities[48]
   - Document how these approaches can complement and improve traditional coverage
5. **The FIO should publish parametric insurance guidelines to ensure consumer protection.**
   - Create clear legal guidelines for parametric insurance providers
   - Establish rules at the policy level rather than leaving interpretation of parametric insurance law to courts to support the growth of the parametric market while protecting consumers

[45] Washington State Office of the Insurance Commissioner. (2022). *Rule-making order CR-103P (R 2022-01)*. https://www.insurance.wa.gov/sites/default/files/documents/r2022-01-cr-103.pdf

[46] *Alabama Leaders Celebrate 50,000 FORTIFIED Homes 20 Years After Hurricane Ivan*. Accessed April 15, 2025. https://www.smarthomeamerica.org/news/alabama-leaders-celebrate-50-000-fortified-homes-20-years-after-hurricane-ivan

[47] FORTIFIED Building Standards, skellogg. (2018, February 1). *Construction Standards.* Insurance Institute for Business & Home Safety. https://ibhs.org/guidance/fortified-construction-standards/

[48] *31 U.S.C. §§ 313-14: Federal Insurance Office*. (n.d.). Retrieved April 15, 2025, from https://uscode.house.gov/view.xhtml?req=(title:31%20section:313%20edition:prelim)

The Role of Policymakers: Oversight

6. **Congress should establish an Optional Federal Charter (OFC) for insurance to provide a national regulatory framework.**[49]
   - Create a dual system similar to banking, where insurers can choose state or federal regulation
   - Streamline regulatory processes to reduce premiums and prevent cross-subsidization of rates
   - Standardize coverage while ensuring flexible regulation for innovative products

7. **The federal government should fund and convene a consortium of states to develop a national public catastrophe model.**
   - Build on existing state efforts like Florida's hurricane/flood model and California's wildfire model[50,51]
   - Use the national catastrophe model to ensure insurance premiums are adequate and not excessive
   - Enable use across government agencies for infrastructure planning and financial stress testing

8. **Federal regulators should review catastrophe models at the national level to ensure all states are accurately represented in these models and insurance rates are priced appropriately.**
   - Require catastrophe models to represent current climate conditions, as opposed to the historical climate
   - Address the consistent issue of insurers lacking sufficient capital after severe weather events and reduce premium spikes post-disasters

CONCLUSION

As the changing climate continues to reshape risk, reforming insurance systems requires coordinated action at multiple levels. By improving insurance literacy among all stakeholders, trialing innovative models that go beyond traditional coverage options, and strengthening regulatory oversight, policymakers can create a more resilient and equitable insurance landscape. Such efforts should prioritize community-level protections to ensure that insurance is an accessible tool for adaptation and recovery in an intensified climate future.

[49] Webel, B. (2011, February 3). *Insurance regulation: Federal charter legislation (CRS Report No. RL34286)*. Congressional Research Service. Retrieved April 15, 2025, from https://www.congress.gov/crs-product/RL34286

[50] *FPHLM - Home*. (n.d.). Retrieved April 15, 2025, from https://fphlm.cs.fiu.edu/index.html

[51] *Public Wildfire Catastrophe Model Strategy Group*. (n.d.). Retrieved April 15, 2025, from https://www.insurance.ca.gov/01-consumers/180-climate-change/catmodelgroup.cfm

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