

AUGUST 2025

# Managing Climate Risk: Implications for Local Governments

Susan Crawford and Daevan Mangalmurti



---

# **Managing Climate Risk: Implications for Local Governments**

Susan Crawford and Daevan Mangalmurti

© 2025 Carnegie Endowment for International Peace. All rights reserved.

Carnegie does not take institutional positions on public policy issues; the views represented herein are those of the author(s) and do not necessarily reflect the views of Carnegie, its staff, or its trustees.

No part of this publication may be reproduced or transmitted in any form or by any means without permission in writing from the Carnegie Endowment for International Peace. Please direct inquiries to:

Carnegie Endowment for International Peace  
Publications Department  
1779 Massachusetts Avenue NW  
Washington, DC 20036  
P: + 1 202 483 7600  
F: + 1 202 483 1840  
[CarnegieEndowment.org](https://CarnegieEndowment.org)

This publication can be downloaded at no cost at [CarnegieEndowment.org](https://CarnegieEndowment.org).

## Contents

Introduction	1
Data Transparency and Metrics	3
Risk Reduction and Transfer	5
Adaptation Governance	8
A Call for Research	10
Appendix A: Examples of Granular Data Collection	13
Appendix B: Examples of Consolidated Climate Governance	15
Appendix C: Attendees to the April 2025 Meeting on “Insurance Solutions for Escalating Climate Extremes in U.S. Cities”	17
About the Authors	19
Notes	21
Carnegie Endowment for International Peace	25



## Introduction

In April 2025, more than thirty local government officials, academics, and private and nonprofit sector stakeholders convened in Cambridge, Massachusetts to discuss new and growing risks posed by climate change. The effects of climate change include rising sea levels and chronic flooding, heat waves and drought, and an expanding range of extreme weather. From Westernport, Maryland, to Miami-Dade County, Florida, and Carlsbad, California, these increasingly predictable events will subject infrastructure to stressors it was not built for and pull resources away from—or worsen—other pressing issues.<sup>1</sup>

The burden of responding will fall mostly on local governments that are already responsible for the majority of the country's infrastructure spending as well as everything from garbage pickup to policing and schooling.<sup>2</sup> Perhaps because they experience local governments' work every day, Americans trust their local governments. In a 2023 poll, just 22 percent of respondents reported a favorable view of the federal government, and only 50 percent had a favorable view of their state's government. But 61 percent of respondents held a favorable opinion of their local government.<sup>3</sup>

At the convening in Cambridge, which was co-organized by the Carnegie Endowment for International Peace and Insurance for Good, local government representatives spoke about the obstacles that must be overcome to manage risk. Much of the conversation concerned money. Adapting to climate change and managing climate risk are costly endeavors, especially for local governments with limited capacity. In many jurisdictions, fiscal challenges are already putting infrastructure and services under increasing stress.<sup>4</sup>

Resources are already limited as governments work to cover pension payments, police salaries, and pothole repairs. To pay for public services, local governments rely on taxes and transfers from state and federal governments (which in turn finance debt).<sup>5</sup> At more than 66 percent of local general revenues, local taxes are by far the biggest source of local government funding, and 72 percent of those revenues are generated from property taxes.<sup>6</sup> The difficulties local governments face will increase as their revenue streams grow less reliable and federal assistance more uncertain.

Areas that face high climate risk (for example, from flooding or hurricanes) are beginning to experience declines in property values.<sup>7</sup> These will hurt property tax revenues.<sup>8</sup> Higher maintenance expenses and costs from natural disasters will also affect the attractiveness of municipal bonds, another crucial layer of funding for local governments.<sup>9</sup> If and when climate risk is fully priced into bond ratings, issuing debt will become more expensive. At the same time, the federal government is drawing back from supporting both climate adaptation and disaster aid, leaving gaps local governments may not have the capacity to fill.<sup>10</sup>

Ultimately, climate risk may change the demographic map. Communities that become less livable—from chronic inundation by high tide floods, for example—will see some residents leave. Some homes may be salvageable through investments that only the wealthy will be able to bear, while in other areas, insurers' inability to offer insurance at marketable prices will create economic pressures on property values even before the physical effects of climate change are fully felt.

Some homes may be salvageable through investments that only the wealthy will be able to bear, while in other areas, insurers' inability to offer insurance at marketable prices will create economic pressures before the physical effects of climate change are fully felt.

**Some homes may be salvageable through investments that only the wealthy will be able to bear, while in other areas, insurers' inability to offer insurance at marketable prices will create economic pressures before the physical effects of climate change are fully felt.**

Local governments need to plan how they will respond to physical climate risks and their effects on insurance, property markets, and fiscal capacity. At the core of successful responses will be politically difficult decisions about which communities should be prioritized for investment in resilience and adaptation. To make these decisions and offer high-quality public services and support to lower-income citizens, local governments need comprehensive frameworks for managing climate risk.

Our conversations with municipal and state leaders, nonprofits, insurers, and academics have emphasized the need for guiding principles to enable local governments without adaptation plans—the vast majority—to manage their climate risk.<sup>11</sup> In this piece, we draw on those conversations to make three recommendations.



- **Data transparency and metrics:** Local governments should prioritize understanding granular climate risk within their jurisdictions, seek more transparency from insurers to understand how physical climate risks affect consumers financially, and set standards for measuring progress on adaptation.
- **Risk reduction and transfer:** Local governments should work with credit rating agencies to support investments in risk reduction, partner with insurers to incentivize household-level risk mitigation, and ask insurance regulators to expand the range of property and casualty insurance products that are available.
- **Adaptation governance:** Local governments should consolidate adaptation governance to provide for clear lines of authority and establish an investment priorities framework guided by the data and metrics they have established.

The last section of this paper lists outstanding research questions local governments may need answers to in order to manage climate risk. These questions can prompt researchers to study how physical climate risk affects economic and social systems. The results of this research will aid local governments.

## Data Transparency and Metrics

To manage climate risk, local governments need two broad categories of data. Granular climate data should be used to understand present and future physical climate risks. Pricing and transaction data from insurance firms and other private companies are necessary to build a picture of how risks are translated into premiums, coverage limits, deductibles, and debt ratings that affect residents and businesses.

### Invest in Granular Climate Risk Datasets and Climate Models

Both local governments and private companies rely on federal climate models and data collection to understand the risks of events from sea level rise to natural disasters. This data is vital, but limited. For example, the Flood Insurance Rate Maps (FIRMs) published by the Federal Emergency Management Agency (FEMA) are well-suited to depicting riverine and coastal flood risk but lack information about risks such as groundwater and interior (when rainfall enters building spaces) flooding.

These gaps matter to local governments and their residents. Interior flooding is less costly than catastrophic flooding, but more common. It is particularly problematic for low-income households, which often lack the cash reserves to cover uninsured damage.<sup>12</sup> When managing fires, poor data coverage can affect whether a home is considered safe enough to insure or vulnerable to wholesale conflagration.<sup>13</sup>

Gaps in data coverage, climate and otherwise, make it more difficult to formulate and implement effective policies.<sup>14</sup> Policymakers end up working with inadequate information. Local governments can help solve this problem by building out granular data about climate risks, from floods to fires, that enable prudent policymaking, inform the public, and improve private-sector decisionmaking. Models based on this data will require both funding and talent. Their development is often best achieved in partnership with other local governments, universities, or nonprofit organizations.<sup>15</sup> But the benefits of spending modestly on developing localized climate risk models dwarf the costs.<sup>16</sup> (In Appendix A, the efforts of three jurisdictions are described to fill gaps in mapping and understanding climate risk.)

## Improve Data Sharing Between Insurers and Local Governments

Understanding the effects of climate change requires more than information about physical risks. It also requires assessing how climate risks affect private-sector decisions that matter to consumers. Insurance costs are affected by climate change; insurance costs are, in turn, crucial to property transactions and development.<sup>17</sup> Local and state governments are called on to manage the fallout when consumers lose coverage or face price hikes. As of now, though, they know very little about how climate risk is factored into changes in insurance pricing, terms, or offerings. This stymies collaboration that might otherwise incentivize risk reduction and preserve insurable communities.

To manage climate risk, local governments need to understand local insurance markets and how they are likely to change.

Local governments and insurers should work toward more transparent data sharing. To manage climate risk, local governments need to understand local insurance markets and how they are likely to change. Property and casualty insurers should educate local governments about how insurance policies are formulated, what data is used to calculate risk, and where price increases and nonrenewals are taking place. By encouraging transparency in real-time data, both sides can work toward safeguarding insurable markets and lowering and communicating risk.

**To manage climate risk, local governments need to understand local insurance markets and how they are likely to change.**

This need not be done on a one-to-one basis. When dealing with smaller local governments, it may be more useful to communicate through regional planning associations that make recommendations for large-scale public systems such as water resources or public services.<sup>18</sup> This can reduce the barriers to transparent communication and put information in the hands of government bodies with the capacity to make use of it. Where insurers are reluctant to share data, state insurance commissioners may need to set rules for data sharing that protect insurers' trade secrets while still making sufficiently detailed information available to local governments in need of it.

## Set Metrics to Track Adaptation Progress

Tracking the progress of adaptation efforts and translating them into intelligible terms is challenging.<sup>19</sup> There is no one metric to measure adaptation that can be used the way carbon emissions are used to measure climate mitigation.<sup>20</sup> Adaptation can be social, economic, infrastructural, or environmental.<sup>21</sup> Local governments need to set standards for tracking adaptation that are well-suited to their geographies but also broadly communicate how much more resilient a community could be after investments in adaptation. In a flood-prone community, such a metric could be the increase in thousands of gallons of stormwater captured by green infrastructure after an adaptation investment.<sup>22</sup> The purpose of metrics is to show consumers, from residents to credit rating agencies, the measurable impact of adaptation on their lives. Adaptation planning and projects should be prioritized based on such metrics.

## Risk Reduction and Transfer

Insurance allows us to shift the costs of risk away from people and entities—risk transfer—to an insurer. Insurance works only in a given pool of policyholders where risks are uncorrelated and of the right size. If a risk is too predictable and frequent, it no longer makes sense to pay an insurer to bear it. The risk-exposed party is better off handling the risk themselves by saving money to pay for the cost of recovery—and avoiding the transaction costs of insurance—or reducing their risk. If risks are too small, transaction costs will likely be greater than the value of being protected against the risk. If a risk is highly correlated across policyholders, insureds may be unwilling to pay enough to insurers to justify covering that risk. And if a risk is too large and too uncertain, it is likely uninsurable. Insurers will be unwilling to bear the risk because the premiums they collect may not be enough to make a profit.

Collectively, climate risks fall into all of these categories and shrink the insurable market. Sunny-day flooding is uninsurable because of its predictability and frequency, as well as its relatively low cost. Wildfires are a highly correlated risk: if a house burns, a neighborhood may go with it. Hurricanes that devastate expensive cities may be too damaging to protect against.

There are two viable strategies for creating insurable markets. One is to explore innovative approaches to risk transfer. The other is to make hard choices that reduce physical climate risk, lowering the size of the risks that need to be insured.

## Work With Credit Rating Agencies to Prioritize Investments in Risk Reduction

For more than a decade, credit rating agencies have been asking jurisdictions that are obviously exposed to climate risk—like Hoboken, a New Jersey city devastated by Hurricane Sandy in 2012—how they are reducing their risks.<sup>23</sup> Some municipalities, such as Seaside Heights and Toms River, also in New Jersey, have seen their credit ratings downgraded as a consequence of disasters that highlighted high risk and low preparedness.<sup>24</sup> More prepared communities, such as those in the Hampton Roads area of Virginia, have been spared downgrades after clearly communicating their risk management plans.<sup>25</sup>

In the near future, more local governments will see their resilience to physical climate risks affect their credit ratings, and therefore limit their access to the municipal bond market.

In the near future, more local governments will see their resilience to physical climate risks affect their credit ratings, and therefore limit their access to the municipal bond market. Low resilience will raise concerns about revenue stability, default risk, and an area's long-term vitality. The credible possibility of physical climate risk resulting in credit downgrades should be harnessed to build support for action on adaptation.

In some cases, a credit rating agency may not know enough about a community's risk exposure—because there has been no recent disaster, for example—to ask the right questions. A shortage of informed questions can be a double-edged sword. Insufficient rigor on the part of credit rating agencies can result in capital flight if extreme weather does hit and cause visible damage that undermines investors' trust that they will be paid back.

There are understandable concerns at the local government level about sharing vulnerability assessments with credit rating agencies for fear of credit downgrades. But in a world of rising risk, the news is shifting from the existence of risk—now almost a constant—to how

well local governments are preparing for it. Local governments should focus on educating credit rating agencies about their investments in risk reduction and how they improve long-term creditworthiness.

---

**In the near future, more local governments will see their resilience to physical climate risks affect their credit ratings, and therefore limit their access to the municipal bond market.**

Insurers and catastrophe modelers can contribute to these efforts by providing third-party standards for grading community-level risk reduction investments such as green infrastructure or levees. As catastrophe modelers begin to incorporate community-wide risk reduction into their assessments of climate risk, insurers and credit rating agencies will follow.

## Partner with Insurers to Provide Incentives for Risk Reduction

A problem faced by local governments seeking to incentivize risk reduction at the individual or community level is that there are often high costs and unclear rewards. Some states, such as Alabama, mandate premium discounts for homes with risk reduction features such as roofs pre-certified by the Insurance Institute for Business and Home Safety (IBHS).<sup>26</sup> Many states do not, meaning a homeowner can make the right choices for risk reduction and not see their insurance costs go down.

More states should pass legislation that calls for premium discounts or offers incentives for property owners who invest in a certified risk reduction practice such as IBHS's FORTIFIED roofs or Wildfire Prepared Home standard.<sup>27</sup> State-chartered wind pools and Fair Access to Insurance Requirements (FAIR) plans can encourage the adoption of risk reduction through grants and voluntary premium reductions.<sup>28</sup> In South Carolina, the South Carolina Safe Home Mitigation Grant Program makes upfront grants to homeowners in coastal counties to retrofit their homes for hurricane and wind damage resistance.<sup>29</sup> The grants, which range from \$3,000 to \$7,500, defray the cost of meeting standards such as FORTIFIED.

IBHS and property and casualty insurers can do more themselves to convince property owners to invest in risk reduction. In the wake of the January 2025 Los Angeles fires, IBHS released the Wildfire Prepared Neighborhood Technical Standard.<sup>30</sup> Insurers can and should offer premium reductions to property owners in neighborhoods compliant with certification standards to speed the adoption of risk reduction practices that save lives and lower insurers' costs.

## Ask Regulators to Create Markets for Innovative Property and Casualty Insurance Products

New kinds of insurance are becoming available to consumers. The most well-known is consumer-level parametric insurance, which makes payouts to policyholders based on whether an objective threshold has been crossed, rather than how much damage has been sustained. In Puerto Rico, which created a regulatory environment for (small-dollar) parametric insurance in 2020, products offered by the fintech Raincoat have successfully made payouts following hurricanes.<sup>31</sup> This year, Puerto Rico has also taken out its own parametric insurance policy to protect against hurricanes or earthquakes.<sup>32</sup>

Nonprofits have begun to explore using parametric insurance policies on behalf of entire communities, in what is called community-based catastrophe insurance (CBCI).<sup>33</sup> Policies taken out by a community foundation in Miami and the Center for New York City Neighborhoods in New York City were intended to secure insurance access for smaller nonprofits and low-income homeowners, respectively, who would not have been able to get insurance by themselves.<sup>34</sup> A similar concept is being explored in Norfolk, Virginia, where the city has sought to find reinsurers who will sell it a parametric insurance policy that could be used to keep residents on flood insurance by compensating them for the cost of their deductibles.

In Miami and New York City, the CBCI policies did not ultimately pay out because the policies' trigger conditions were not met. This is a persistent challenge faced by holders of large-scale parametric insurance policies. The Caribbean Catastrophe Risk Insurance Facility (CCRIF) has explored novel triggers that kick in when multiple events combine to produce adverse environmental conditions.<sup>35</sup> CCRIF's example can serve as a model for parametric insurance policy design in the United States.

Local governments need their state insurance commissioners to innovate, as Puerto Rico has done. By creating regulatory sandboxes for insurance products or by publishing new regulations that permit innovative insurance products, states can make immediate liquidity available to more of their residents and support local governments seeking to adapt to climate change.<sup>36</sup>

## Adaptation Governance

Climate change is leading to risks that run the gamut of local governments' responsibilities, revenues, and obligations. For local governments to effectively manage these risks, there must be coordination between government agencies and a clear framework for balancing the trade-offs of managing climate risk. Appendix B shows examples of how cities are navigating this process.

### Consolidate Adaptation Governance and Establish an Investment Priorities Framework

Local governments are already responsible for the vast majority of infrastructure investment. They should streamline how they manage climate risk and funding for adaptation into those decisions. There should be a single point of contact within the local government with responsibility for adaptation and authority over sufficient budget and staff to carry out adaptation projects. In many cities, planning and finance officials do not coordinate. Because such an office would need to set investment (and disinvestment) priorities, it should be situated in a finance or budget agency rather than a planning or environment agency. The adaptation investment office should have staff members with the capacity to make clear-eyed assessments of the costs of various climate risks and the costs of adaptation. The office should have authority over other departments' decisions where appropriate.

The purpose of adaptation governance is to optimize for reducing both physical climate risk and the costs of risk and adaptation.

The purpose of adaptation governance is to optimize for reducing both physical climate risk and the costs of risk and adaptation. To do this, local governments will need their adaptation coordinators or offices to set priorities for investments in resilience—to choose areas that most need to be protected, to prioritize specific adaptation strategies, and to identify opportunities for aligning adaptation with other public policy priorities.

## **The purpose of adaptation governance is to optimize for reducing both physical climate risk and the costs of risk and adaptation.**

In his new book, *North: The Future of Post-Climate America*, Jesse Keenan identifies several such strategies. In one category are triage-style strategies that focus on making assets that are critical to life and safety resilient. Other local governments have pursued what Keenan describes as “no-regrets adaptation strategies,” which emphasize the creation of assets, such as parks, that have benefits beyond managing climate risk. Still others pursue “flexible adaptation strategies” that delay the decision point for large-scale structural investments.

Once adaptation strategies and investment hierarchies are established, local governments need to ensure investments in adaptation receive consistent funding over time. This should be done by establishing a dedicated funding allocation at the local government level or by securing funding through state bond banks or revolving loan funds.<sup>37</sup> Outside technical specialists, from state government, nonprofits, or the private sector, can help local governments identify sources of funding and how best to use them. The receipt of state-level funds by local governments should be contingent on the presence of an investment framework and rigorous land use and building codes.

The corollary of an investment framework is establishing which areas will face disinvestment over time. These will be places where the costs of maintaining the status quo are too high to justify continued public services—for example, where roads are often swamped by the tides—as well as areas where the risks of continued development are prohibitively expensive from the standpoint of insurance and debt obligations. Local governments will need to move resources and development incentives to areas targeted for prioritization. Adaptation plans should have clear standards for their benefits, costs, and metrics of success to manage public expectations and the political costs of disinvestment decisions. In areas where incremental disinvestment is forecast, relocation plans should be developed for residents who wish to move but are unsure how to navigate the process. The places that see disinvestment should not disproportionately be low-income. For those that are, there will need to be robust and well-resourced pathways and assistance for resettlement to other areas.



## A Call for Research

At the local government level, the conversation about managing climate risk remains fluid. For most local governments, the challenges presented by increasing climate risk are novel and the upfront costs are high. It is difficult for local governments to quantify the benefits of adaptation and convince voters that spending more money now will prevent even greater financial losses in the future.

Efforts are underway to address this gap in messaging. For example, Insurance for Good, which assists communities and policymakers with shared resources, capacity building, and incubation of open-source, innovative policies and programs that reimagine risk transfer to achieve social and environmental goals, is launching a Learning Lab to offer insurance capacity building programs to communities around the country. Much about best practices remains uncertain, however. There is an urgent need for research on three general topics to support local governments as they learn to manage climate risk: effects on revenue, paying for adaptation, and low-income communities.

The literature on the effects of climate risk on revenue streams has only scratched the surface. More research is needed to understand what the distribution of declines in property values will look like and how this will affect property tax revenues. In the municipal bond market, it seems that bond markets do a poor job of pricing in ex ante physical climate risk.<sup>38</sup> The following questions stand out:

- Where will property values decline due to climate risk, and where will premiums related to low climate risk compensate?
- How much will climate risks affect local government budgets and property tax revenues?
- Why do bond markets appear to not price in ex ante climate risk?
- How will the effects of climate change affect local government expenditures, and will it be possible to mitigate these costs through disinvestment or prioritization?

Local governments' investments in resilience will benefit all of the people and companies they protect. But some of the benefits may be asymmetric, with corporations benefiting more than households, and all adaptation comes with a price tag. Local governments may need ways to capture some of the benefits of adaptation to recoup the costs.

- How can the return on investment of adaptation be conceptualized?
- How should the benefits of risk reduction be priced, if at all, and what measures can be used to recoup some of the costs without driving away residents or businesses?



- How do firms respond to insurer fees or selective levies on the beneficiaries of a particular resilience investment?
- Can zoning and development covenants, and similar tools, be used to effectively enlist developers in adaptation projects?

Low-income communities are more likely to have suffered from environmental degradation.<sup>39</sup> When it comes to adaptation, residents of these communities face the possibility of neglect due to lower asset values and an inability to relocate. Local governments where a large share of residents are low-income face constraints on financing adaptation, because tax rates can only be raised so much and still be paid.

- Will investment prioritization frameworks consistently underinvest in low-income communities?
- How can local governments that serve many low-income communities finance adaptation?
- How can low-income households be supported in investing in resilience measures?<sup>40</sup>
- What should the guidelines for community-level resettlement be, and how will communities be preserved?



## Appendix A: Examples of Granular Data Collection

### Washington

As of July 2025, Washington, DC, is nearing completion of its Integrated Flood Model (IFM) project.<sup>41</sup> The IFM is the most granular picture of coastal, riverine, and interior flood risk in the city. By integrating hydrology and sewer system data, the model creates maps of flood risk under multiple scenarios, including which properties have a 1 percent annual interior flood risk, or which properties are flooded when the city gets 2 inches of rain in 6 hours. The model allows the city to consider how those maps change with future climate conditions. Being able to map all the types of flood risk is a benefit to residents, many of whom have the same risk of flooding as those living in a FEMA 100-year floodplain, but do not know that because interior flood risk has never been mapped. The IFM will allow residents to make informed decisions about insurance, home purchase or upgrades, and their own safety.

In addition to mapping, the IFM will help the city choose where and how to build flood-reducing infrastructure. The Department of Energy and Environment will use the IFM to focus investment in the most vulnerable areas and will test proposed designs in the IFM before construction to ensure projects will reduce flood risk as planned. Use of the IFM for these purposes is already underway with the Watts Branch Flood Risk Reduction Project, the Southwest DC Resilience Plan, and the Ivy City Resilience Plan. Information from the IFM will also make it possible for property owners to incorporate floodproofing systems as they prepare construction plans, or inform decisions about floodplain development.

## San Mateo County

The San Mateo County Flood and Sea Level Rise Resiliency District (OneShoreline) has collected flood event data and developed a map of future conditions.<sup>42</sup> The map shows which critical infrastructure, existing or planned housing, and commercial buildings intersect with high flood risk areas or depend on risk-exposed systems in other areas. OneShoreline plans to combine this mapping with county-wide wildfire risk data. Through 2025 and 2026, OneShoreline will examine how reducing risk to people and property could reduce economic vulnerability in the county, including through possible local government-funded insurance programs.

## Jacksonville

Jacksonville is the most populous city in Florida and one of the largest by area in the United States. It has spent \$1.6 million to build a compound flood model in partnership with The Water Institute.<sup>43</sup> The model is running 10,000 probabilistic storm scenarios to see which areas of the city are at persistently high risk for storm and flood damage. This data gives Jacksonville the information to invest in policies that encourage higher-density development in lower-risk parts of the city.

## Appendix B: Examples of Consolidated Climate Governance

### Boston

Boston faces risks related to extreme heat, stormwater flooding, and coastal flooding. Starting in 2016, through an effort called Climate Ready Boston, the City of Boston has developed data-informed, community-driven plans to sharpen its understanding of the nature of these risks and the potential responses to them.<sup>44</sup> Through this effort, Boston has developed a comprehensive plan for its coastline, focused not only on reducing flood risk, but also on preserving waterfront access and on safeguarding local ecologies. To implement this plan, the city anticipates capital outlays totaling multiple billions of dollars over the next several decades. Without this investment, flood risk is projected to result in around \$100 million of annual losses in the 2030s and \$1.3 billion in the 2070s.

To accelerate the transition from a decade of planning to a decade of implementation, Boston has created an Office of Climate Resilience, which leads the all-of-government response to climate risks, and has allocated more funding in its capital budget than any point in its history to resilience projects. Importantly, the city's climate resilience priorities are being integrated with its other obligations—road construction, school refurbishment, and economic development—to combine financing sources. This is an example of what Jesse Keenan describes as a no-regrets strategy.

Boston shows the importance of governmental structures for integrating climate risk management and local government functions. Climate Ready Boston enabled continuity in Boston's conceptualization of climate risk. In its Office of Climate Resilience, Boston has centralized climate risk planning into a single entity that has the authority to work across departments to prioritize financing for projects that can build climate resilience.<sup>45</sup>

## Hoboken

Hoboken has invested in climate-proofing practically its entire area. This effort has been coordinated through the office of the city's business administrator.<sup>46</sup> In another example of a no-regrets strategy, assets such as parks and playgrounds double as levees, stormwater drainage, and seawalls.<sup>47</sup> Risk reduction efforts have contributed to lower costs for property owners in the city. Because of the central position of the business administrator's office in the city's administration, the city has been able to effectively seek funding for and execute adaptation projects simultaneously.

## Appendix C: Attendees to the April 2025 Meeting on “Insurance Solutions for Escalating Climate Extremes in U.S. Cities”

<b>Elizabeth Andrews</b>	Environmental Institute Practitioner Fellow, University of Virginia
<b>Darbi Berry</b>	Director of Climate and Environmental Programs, SDRCC
<b>Nicholas Bonard</b>	Branch Chief, Department of Energy & Environment, City of Washington, DC
<b>Anne Coglianese</b>	Chief Resilience Officer, City of Jacksonville, FL
<b>Susan Crawford</b>	Senior Fellow, Carnegie Endowment for International Peace
<b>Akash Deep</b>	Senior Lecturer in Public Policy, Harvard Kennedy School
<b>Michael Gaughan</b>	Executive Director & Secretary, Vermont Bond Bank
<b>Jonathan Gonzalez</b>	Co-Founder and CEO, Raincoat
<b>Caroline Hays</b>	Senior Policy Advisor, NYC Mayor’s Office of Climate & Environmental Justice
<b>Jacqueline Higgins</b>	North America Head, Public Sector Solutions, Swiss Re

<b>Christine Jiang</b>	Research Assistant, Bloomberg Center for Cities at Harvard University
<b>Juliette Kayyem</b>	Belfer Senior Lecturer in International Security, Harvard Kennedy School
<b>Steven Koller</b>	Postdoctoral Fellow, Harvard University Joint Center for Housing Studies
<b>Carolyn Kousky</b>	Founder, Insurance for Good
<b>John Macomber</b>	Senior Lecturer of Business Administration, Harvard Business School
<b>Carlos Martin</b>	Vice President for Research and Policy Engagement, Resources for the Future
<b>Len Materman</b>	CEO, OneShoreline
<b>Daevan Mangalmurti</b>	Junior Fellow, Carnegie Endowment for International Peace
<b>Andreanecia Morris</b>	Executive Director, HousingNOLA
<b>Chris Osgood</b>	Director of the Office of Climate Resilience, City of Boston, MA
<b>Ann Roberson</b>	Manager, South Carolina Safe Home Mitigation Grant Program
<b>Kyle Spencer</b>	Chief Resilience Officer, City of Norfolk, VA
<b>Caleb Stratton</b>	Chief Resilience Officer, City of Hoboken, NJ
<b>Kate Stillwell</b>	President, Parametric Insurance, Neptune Flood Insurance
<b>Abby Sullivan</b>	Chief Resilience Officer, City of Philadelphia, PA
<b>Galen Treuer</b>	Climate Tech and Economic Innovation Manager, Miami-Dade County, FL
<b>Peter Tufano</b>	Baker Foundation Professor, Harvard Business School
<b>Nikisha Williams</b>	Vice President of Collective Impact, The Miami Foundation
<b>Roy Wright</b>	President & CEO, Insurance Institute for Business and Home Safety



---

## About the Author

**Susan Crawford** is a senior fellow in the Sustainability, Climate, and Geopolitics Program at the Carnegie Endowment for International Peace.

**Daevan Mangalmurti** was a James C. Gaither Junior Fellow in the Sustainability, Climate and Geopolitics Program.

## Acknowledgments

This paper was supported in part by the Bloomberg Center for Cities at Harvard University, which unites multidisciplinary expertise focused on cities to produce research, train leaders, and develop resources for global use.



## Notes

- 1 Aman Azhar, “Flooding Caused by Atmospheric River Over Maryland Shows How Climate Change Is Stressing Inland Communities,” Inside Climate News, May 21, 2025, <https://insideclimatenews.org/news/21052025/maryland-atmospheric-river-flooding-climate-change-stressing-inland-communities/>; “Sea Level Rise and Flooding,” Miami-Dade County, 2025, <https://www.miamidade.gov/global/economy/resilience/sea-level-rise-flooding.page>; Daniel C. Vock, “As Coastline Erodes, One California City Considers ‘Retreat Now’,” Bloomberg, May 13, 2025, <https://www.bloomberg.com/news/features/2025-05-13/carlsbad-california-devises-plan-to-move-highway-away-from-eroding-coast?sref=79i9aXlC>; “Climate Change Impacts on the Built Environment,” United States Environmental Protection Agency, March 25, 2025, <https://www.epa.gov/climateimpacts/climate-change-impacts-built-environment>.
- 2 “State and Local Expenditures,” Urban Institute, n.d., <https://www.urban.org/policy-centers/cross-center-initiatives/state-and-local-finance-initiative/state-and-local-backgrounders/state-and-local-expenditures>.
- 3 Joseph Copeland, “Americans rate their federal, state and local governments less positively than a few years ago,” Pew Research Center, April 11, 2024, <https://www.pewresearch.org/short-reads/2024/04/11/americans-rate-their-federal-state-and-local-governments-less-positively-than-a-few-years-ago/>.
- 4 Christian Unterberger, “How Flood Damages to Public Infrastructure Affect Municipal Budget Indicators,” *Economics of Disasters and Climate Change* 2 (2018): 5-20, <https://doi.org/10.1007/s41885-017-0015-0>; Yanjun (Penny) Liao and Carolyn Kousky, “The Fiscal Impacts of Wildfires on California Municipalities,” *Journal of the Association of Environmental and Resource Economists* 9 (2022): <https://doi.org/10.1086/717492>.
- 5 Katherine Loughead, Jared Walczak, and Eddie Koranyi, “Unpacking the State and Local Tax Toolkit: Sources of State and Local Tax Collections (FY 2020),” Tax Foundation, Fiscal Fact no. 797, August 2022, <https://files.taxfoundation.org/20220825103108/Unpacking-the-State-and-Local-Tax-Toolkit-Sources-of-State-and-Local-Tax-Collections-FY-2020.pdf>; “How Much Funding Do State and Local Governments Receive from Federal Government?,” Peter G. Peterson Foundation, April 11, 2024, <https://www.pgpf.org/article/how-much-funding-do-state-and-local-governments-receive-from-the-federal-government/>.
- 6 Rita Jefferson and Galen Hendricks, “How Local Governments Raise Revenue — and What it Means for Tax Equity,” Institute on Taxation and Economic Policy, December 5, 2024, <https://itep.org/how-local-governments-raise-revenue-2024/>.

- 7 Linda Shi et al., “Can Florida’s Coast Survive Its Reliance on Development?,” *Journal of the American Planning Association* 90 (2024): 367-383, <https://doi.org/10.1080/01944363.2023.2249866>; Miyuki Hino and Marshall Burke, “Does Information About Climate Risk Affect Property Values?,” National Bureau of Economic Research, Working Paper 26807, February 2020, <https://www.nber.org/papers/w26807>; Benjamin J. Keys and Philip Mulder, “Neglected No More: Housing Markets, Mortgage Lending, and Sea Level Rise,” National Bureau of Economic Research, Working Paper 27930, October 2020, <https://www.nber.org/papers/w27930>.
- 8 Jesse D. Gourevitch et al., “Unpriced climate risk and the potential consequences of overvaluation in US housing markets,” *Nature Climate Change* 13 (2023): 250-257, <https://doi.org/10.1038/s41558-023-01594-8>.
- 9 Steven Malanga, “The Indebted States of America,” *City Journal*, Summer 2013, <https://www.city-journal.org/article/the-indebted-states-of-america>.
- 10 Vanessa Colón Almenas, “Puerto Rico Loses FEMA Funds for Climate Adaptation,” *Centro de Periodismo Investigativo*, April 8, 2025, <https://periodismoinvestigativo.com/2025/04/puerto-rico-fema-climate-funding-cuts/>; Thomas Frank, “‘No alternative funding sources’: Trump’s stifling of disaster aid leaves cities adrift,” *Politico*, June 30, 2025, <https://www.politico.com/news/2025/06/30/cities-lose-hope-restarting-disaster-projects-killed-by-trump-00414928>; Sarah Labowitz, Leonardo Martinez-Diaz, and Debbra Goh, “Trump’s Plan to Push FEMA’s Role to the States Will Be a Fiscal Disaster,” *Carnegie Endowment for International Peace*, June 25, 2025, <https://carnegieendowment.org/emissary/2025/06/trump-abolish-fema-states-fiscal-disaster?lang=en>.
- 11 Linda Shi, Eric Chu, and Jessica Debats, “Explaining Progress in Climate Adaptation Planning Across 156 U.S. Municipalities,” *Journal of the American Planning Association*, 81 (2015): 191-202, <https://doi.org/10.1080/01944363.2015.1074526>.
- 12 Marcelo Jauregui-Volpe, “The Hidden Costs of Flooding in D.C.’s Poorest Wards,” *Washington City Paper*, August 18, 2023, <https://washingtoncitypaper.com/article/619983/the-hidden-costs-of-flooding-in-d-c-s-poorest-wards/>.
- 13 Tammy Nichols Schwartz, “How risk models and data can help insurers after LA wildfires,” *PropertyCasualty360*, March 5, 2025, <https://www.propertycasualty360.com/2025/03/05/how-risk-models-and-data-can-help-insurers-after-la-wildfires/>.
- 14 Sarah Giest and Annemarie Samuels, “‘For good measure’: data gaps in a big data world,” *Policy Sciences* 53 (2020): 559-569, <https://doi.org/10.1007/s11077-020-09384-1>; Christa Hasenkopf et al., “The Case for Closing Global Air Quality Data Gaps with Local Actors: A Golden Opportunity for the Philanthropic Community,” *Energy Policy Institute at the University of Chicago, White Paper*, December 12, 2023, <https://epic.uchicago.edu/research/the-case-for-closing-global-air-quality-data-gaps-with-local-actors-a-golden-opportunity-for-the-philanthropic-community/>.
- 15 “City of Jacksonville Compound Flooding Analysis,” *Water Institute*, n.d., <https://water-institute.files.svdcn.com/production/Projects/Jacksonville-CompoundFloodingAnalysis.pdf?dm=1729788834>.
- 16 “DC Flood Task Force Report,” *DC Flood Task Force*, June 2023, <https://dcfloodtaskforce.org/wp-content/uploads/2023/08/DC-Flood-Task-Force-Report-Final-2023-08-22.pdf>.
- 17 Benjamin J. Keys and Philip Mulder, “Property Insurance and Disaster Risk: New Evidence from Mortgage Escrow Data,” *National Bureau of Economic Research, Working Paper* 32579, June 2024, <https://www.nber.org/papers/w32579>.
- 18 “NCARCOG Services,” *North Carolina Association of Regional Councils of Governments*, 2024, <https://ncarcog.org/services/>; “What is Metro?,” *Metro*, n.d., <https://www.oregonmetro.gov/regional-leadership/what-metro>.
- 19 Emanuele Massetti and Robert Mendelsohn, “Measuring Climate Adaptation: Methods and Evidence,” *Review of Environmental Economics and Policy* 12 (2018): <https://doi.org/10.1093/reep/rey007>.
- 20 Organisation for Economic Co-operation and Development, *Measuring Progress in Adapting to a Changing Climate: Insights from OECD Countries* (OECD Publishing, 2024), <https://doi.org/10.1787/8cfe45af-en>.

- 21 Marshall Burke et al., “Are We Adapting to Climate Change?,” National Bureau of Economic Research, Working Paper 32985, September 2024, <http://www.nber.org/papers/w32985>.
- 22 Kate Boicourt et al., “Measuring resilience: community-informed and evidence-based resilience metrics in New York City,” Environmental Defense Fund, February 2024, [https://blogs.edf.org/growingreturns/wp-content/blogs.dir/52/files/UPDATED-Measuring-Resilience-Draft-Report\\_2.22-v2-1.pdf](https://blogs.edf.org/growingreturns/wp-content/blogs.dir/52/files/UPDATED-Measuring-Resilience-Draft-Report_2.22-v2-1.pdf).
- 23 Travis Fain, “Ratings agency turns attention to Hampton Roads flooding,” Daily Press, May 16, 2015, <https://www.dailypress.com/2015/05/16/ratings-agency-turns-attention-to-hampton-roads-flooding/>.
- 24 Ed Beeson and Eugene Paik, “Seaside Heights has credit rating downgraded, making post-Sandy borrowing more costly,” The Star-Ledger, December 20, 2012, [https://www.nj.com/news/2012/12/seaside\\_heights\\_has\\_credit\\_rat.html](https://www.nj.com/news/2012/12/seaside_heights_has_credit_rat.html); John A. Miller, “Credit Downgrade Threat as a Non-regulatory Driver for Flood Risk Mitigation and Sea Level Rise Adaptation,” University of Pennsylvania, May 2018, <https://repository.upenn.edu/server/api/core/bitstreams/aac2a19e-6d42-4212-99f9-071bf10d640c/content>.
- 25 John A. Miller, “Credit Downgrade Threat as a Non-regulatory Driver for Flood Risk Mitigation and Sea Level Rise Adaptation,” University of Pennsylvania, May 2018, <https://repository.upenn.edu/server/api/core/bitstreams/aac2a19e-6d42-4212-99f9-071bf10d640c/content>.
- 26 Gabriela Aoun Angueira, “Alabama Study Shows Fortified Homes Paying Off for Insurers, Homeowners,” Insurance Journal, May 28, 2025, <https://www.insurancejournal.com/news/southeast/2025/05/28/825141.htm>.
- 27 “Financial Incentives,” FORTIFIED, 2025, <https://fortifiedhome.org/incentives/>; “IBHS releases updated Wildfire Prepared Home Standard,” Insurance Institute for Business and Home Safety, June 17, 2025, <https://ibhs.org/ibhs-news-releases/ibhs-releases-updated-wildfire-prepared-home-standard/>.
- 28 Carolyn Kousky and Hannah K. Friedrich, “What is the Future of State-Created Insurance Programmes?,” Journal of Catastrophe Risk and Resilience 3 (2025): <https://doi.org/10.63024/dark-46q8>.
- 29 “SC Safe Home Mitigation Grant Program,” South Carolina Department of Insurance, n.d., <https://www.doi.sc.gov/605/SC-Safe-Home>.
- 30 Insurance Institute for Business and Home Safety, Wildfire Prepared Neighborhood Technical Standard (IBHS, 2025), <https://wildfireprepared.org/wp-content/uploads/Wildfire-Prepared-Neighborhood-Standard-2025.pdf>.
- 31 Carolyn Kousky, Helen Wiley, and Len Shabman, “Can Parametric Microinsurance Improve the Financial Resilience of Low-Income Households in the United States?,” Wharton Risk Management and Decision Processes Center, September 2020, <https://esg.wharton.upenn.edu/wp-content/uploads/2023/07/Proof-of-Concept-report-2020.pdf>; Yanin Alfaro, “Puerto Rican Insurance Startup Raincoat Raises \$4.5M Seed Round,” Bloomberg Línea, August 3, 2022, <https://www.bloomberglinea.com/english/puerto-rican-insurance-startup-raincoat-raises-45m-seed-round/>.
- 32 Katie Sabo, “Puerto Rico’s Innovative Use of Parametric Insurance,” Insurance for Good, February 5, 2025, <https://www.insuranceforgood.org/blog/puerto-ricos-innovative-use-of-parametric-insurance>.
- 33 Alex Bernhardt et al., “Community-Based Catastrophe Insurance,” Marsh & McLennan, 2021, <https://www.guycarp.com/insights/community-based-catastrophe-insurance.html>.
- 34 Nikisha Williams, “The climate is changing – Can we change how we insure against disasters?,” Miami Foundation, September 10, 2024, <https://miamifoundation.org/blog/the-climate-is-changing-can-we-change-how-we-insure-against-disasters/>; “Inclusive insurance: Promoting the post-flood financial resilience of low and moderate income households,” Environmental Defense Fund, n.d., <https://www.edf.org/inclusive-insurance>.
- 35 “CCRIF’s New Policy Endorsement – the Wet Season Trigger – Triggers Payment for Belize following Rains in November,” Caribbean Catastrophe Risk Insurance Facility, December 18, 2024, [https://www.ccrif.org/news/ccrif-new-policy-endorsement-wet-season-trigger-triggers-payment-belize-following-rains?language\\_content\\_entity=en](https://www.ccrif.org/news/ccrif-new-policy-endorsement-wet-season-trigger-triggers-payment-belize-following-rains?language_content_entity=en).
- 36 Dan Quan, “A Few Thoughts on Regulatory Sandboxes,” Stanford Center on Philanthropy and Civil Society, 2019, <https://pacscenter.stanford.edu/a-few-thoughts-on-regulatory-sandboxes/>; Phoebe Higgins and Harry Huntley, “Demystifying environmental sandboxes: What are they, and what aren’t they?,” Environmental Policy Innovation Center, October 25, 2024, <https://www.policyinnovation.org/insights/what-arent-sandboxes>.

- 37 “Flood Risk = Financial Risk: New Jersey,” Rebuild by Design, May 27, 2025, <https://rebuildbydesign.org/nj-flood-risk/>; “Pooled Loan Program,” Vermont Bond Bank, 2025, <https://www.vtbondbank.org/pooled-loan-program>; Susan Crawford, “As federal funding for climate adaptation dries up, Illinois sets an example for what states can do,” Moving Day (blog), July 16, 2025, <https://susanpcrawford.substack.com/p/as-federal-funding-for-climate-adaptation>.
- 38 Susan Crawford, “With FEMA withdrawing, states will have to fill in the gaps. But how?,” Moving Day (blog), June 18, 2025, <https://susanpcrawford.substack.com/p/with-fema-withdrawing-states-will>.
- 39 “Environmental Justice Factsheet,” University of Michigan Center for Sustainable Systems, Pub. No. CSS17-16, 2024, <https://css.umich.edu/publications/factsheets/sustainability-indicators/environmental-justice-factsheet>.
- 40 “Louisiana Fortify Homes Program – Homeowners A Roof As Resilient As Louisiana,” Louisiana Department of Insurance, n.d., <https://ldi.la.gov/fortifyhomes>.
- 41 “Resilience Focus Area Strategy,” Department of Energy & Environment, 2023, <https://doee.dc.gov/service/resilience-focus-area-strategy>.
- 42 “Our History,” OneShoreline, 2025, <https://oneshoreline.org/our-history/>.
- 43 “City of Jacksonville Compound Flooding Analysis,” Water Institute, n.d., <https://water-institute.files.svdcn.com/production/Projects/Jacksonville-CompoundFloodingAnalysis.pdf?dm=1729788834>.
- 44 “Climate Ready Boston Executive Summary,” Climate Ready Boston, December 2016, [https://www.boston.gov/sites/default/files/file/2023/03/2016\\_climate\\_ready\\_boston\\_executive\\_summary\\_1.pdf](https://www.boston.gov/sites/default/files/file/2023/03/2016_climate_ready_boston_executive_summary_1.pdf).
- 45 “Climate Resilience,” City of Boston, n.d., <https://www.boston.gov/departments/climate-resilience>.
- 46 “Administration,” Hoboken, n.d., <https://www.hobokennj.gov/departments/administration>.
- 47 Michael Kimmelman, “A Climate Change Success Story? Look at Hoboken,” New York Times, November 3, 2023, <https://www.nytimes.com/2023/11/03/headway/hoboken-floods.html>; Victoria St Martin, “A place for kids to play and a place to store water’: the stormwater capture zone that is also a playground,” The Guardian, January 3, 2025, <https://www.theguardian.com/environment/2025/jan/03/hoboken-new-jersey-kids-play-stormwater-capture-zone-playground>.

## Carnegie Endowment for International Peace

In a complex, changing, and increasingly contested world, the Carnegie Endowment generates strategic ideas, supports diplomacy, and trains the next generation of international scholar-practitioners to help countries and institutions take on the most difficult global problems and advance peace. With a global network of more than 170 scholars across twenty countries, Carnegie is renowned for its independent analysis of major global problems and understanding of regional contexts.

### Sustainability, Climate, and Geopolitics Program

The Sustainability, Climate, and Geopolitics Program explores how climate change and the responses to it are changing international politics, global governance, and world security. Our work covers topics from the geopolitical implications of decarbonization and environmental breakdown to the challenge of building out clean energy supply chains, alternative protein options, and other challenges of a warming planet.



[CarnegieEndowment.org](https://CarnegieEndowment.org)