

# HOW STATE GOVERNMENTS CAN HELP COMMUNITIES INVEST IN CLIMATE RESILIENCE

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# EXECUTIVE SUMMARY

This report presents recommendations for how state governments can develop climate-resilience financial systems that help local communities invest in protecting residents, businesses, public infrastructure, private property, and natural resources from climate-driven stresses and shocks.

To help states consider and act on the recommendations, we developed a State Climate Resilience Action Checklist (page 50) that identifies the essential actions that states need to take to build a comprehensive approach to resilience, including a financial system.

By “financial system” for states we mean a set of aligned state actions that fund and finance climate-resilience investment, revenue-generating mechanisms for shifting existing revenue or generating new revenue for resilience building, provision of basic state services related to climate resilience, and the administration of federal funding flows that can be used for resilience purposes. Taken together, these support local communities in developing the capacities and actions they need to strengthen their climate resilience in the short- and long-term.

A focus on resilience finance emerged from our earlier reports about local governments that were leading the way on resilience building, which found that lack of money and other capacities for planning and managing complex resilience projects were significant barriers to progress. Communities across the nation need to have in place a large-scale, enduring, “plug-and-play” system for organizing and delivering public and private capital for resilience. This conclusion pointed to the importance of having state governments bring their leadership, authority, and resources to the new process of building climate resilience.

A few states have started down the climate-resilience road. Their governors and legislatures have been proactive, conducting state-level planning, creating funding mechanisms, embedding climate-resilience standards into infrastructure investments and market regulations, appointing resilience leadership, and more. Other states are taking initial steps, establishing interdepartmental and cross-sector study commissions. Most states, however, have done very little and no state has done nearly enough to help communities effectively meet their crucial climate-resilience needs.

The jumble of state responses and non-responses reflects the diverse political conditions—philosophical and partisan differences—in state capitals, the absence of a field-tested roadmap that lays out the most effective pathways that states can pursue for resilience building, and the relative newness of the need for climate resilience action.

## **Pressure for state action on climate resilience is growing.**

Public concern about climate change is rising—and the Covid pandemic has spiked awareness of just how quickly disaster can strike and cause massive economic and social disruption. The number and impact of climate-driven disasters is increasing and spreading, with government emergency relief and insurance claims totaling hundreds of billions of dollars annually. Local demand for state support for climate-resilience strengthening is rising as more and more communities undertake resilience planning, realize that implementing plans may take many years, and experience or observe the damage suffered by places unready to cope with extreme climate events.

**Resilience building is about more than environmental protection; it is an important factor in the economic well-being and public health of communities and states.**

When climate-resilience projects are well crafted, investments in them can generate multiple “co-benefits”—creating jobs and preventing economic disruption, reducing citizens’ vulnerability to extreme weather conditions, reducing social inequities, and more. Because resilience actions are designed to prevent damage, rather than provide emergency relief after the damage, their value is measured in lives, property, and money saved in the future.

**Effective resilience building requires state-local collaboration.**

When it comes to building climate resilience, state and local governments are interdependent. A state government cannot succeed if it just takes care of its own assets (e.g., highways) and ignores local needs. A local government doesn’t have the authority and resources to entirely succeed on its own.

Intergovernmental relations between state and local governments vary substantially among and within states, of course. But some form of local-state partnering—preferably a co-development approach that starts with local communities’ needs and enables local action—is necessary to plan, prioritize, implement, and pay for climate-resilience solutions.

**States already have many of the tools and authority they need to build climate-resilience financial systems.**

Every state has in place policies and structures to collect revenue and invest in public infrastructure, support local governments, incentivize private investment, and take advantage of federal funding opportunities. But in most states these mechanisms have not yet been revamped to support the new purpose of climate resilience strengthening, nor have they been bolstered with additional revenue that will be needed. In addition, there are some notable gaps due to some unprecedented necessities of resilience building.



## States can lay the foundation of a comprehensive and long-term system for climate-resilience investment by undertaking 6 recommended actions.

Each of the recommendations below for state government action could be enacted separately, but when advanced together they lay the foundation for a systemic approach to the challenge of paying for local climate resilience.

### **1 PROVIDE BASIC SERVICES AND TOOLS FOR LOCAL RESILIENCE STRENGTHENING.**

State governments should provide local governments with the services—climate data and risk analysis, technical guidance and assistance, and communications assets for resilience—that are key to building local resilience capacities.

### **2 INCREASE THE STATE'S FINANCIAL RESOURCES FOR RESILIENCE INVESTMENT.**

State government should use various ways of raising revenue for resilience building—tailored to their political situations, fiscal conditions, and legal constraints. Some states are raising resilience funds by bonding against future tax revenue and/or tapping money generated by carbon-pricing markets. Other methods under consideration include surcharges on property insurance.

### **3 SUPPORT DEVELOPMENT OF LOCAL PIPELINES OF “READY TO GO” PROJECTS FOR CLIMATE RESILIENCE.**

State governments should provide resources—expertise and funding—that enable local governments, private sector developers, community organizations, and nonprofit organizations to design numerous resilience projects and get them ready for full-scale implementation and funding.

### **4 ENABLE LOCAL FUNDING FOR IMPLEMENTING PUBLIC INFRASTRUCTURE PROJECTS.**

State governments should provide local governments with an array of tools—an enabling environment—for obtaining and attracting financial resources they need to cover significant costs of retrofitting and building climate resilient infrastructures. These include state grant and loan programs, increased local authority to raise revenue, and state-authorized local financial entities.

### **5 LEVERAGE PRIVATE INVESTMENT IN LOCAL RESILIENCE DEVELOPMENT.**

State governments should stimulate substantial private investment in resilience building for private purposes such as protecting private land, utilities, buildings, and businesses—and this can contribute significantly to a local community's overall resilience. States can use incentives and regulations to accelerate and expand private investment for resilience building in key economic sectors—real estate, insurance, energy, and finance, for example.

### **6 PUSH TO EXPAND AND INCREASE FLEXIBILITY OF FEDERAL FUNDING FOR PRE-DISASTER LOCAL RESILIENCE.**

State governments should press the federal government to more rapidly increase the amount of funding available for resilience building. They can leverage resilience-funding allocations that have been made in several federal funding streams—at the Federal Emergency Management Agency and the Department of Housing and Urban Development—and promote increased and more flexible funding for resilience-relevant traditional federal funds for water, transportation, other infrastructure, and environmental protection.

States have the ability to make a big difference in building local climate resilience. They can reap the rewards of improving quality of life, reducing climate-disaster impacts, and increasing economic stability for their constituents—if they choose to enact their unique role in creating a climate-resilience financial system that local governments can use.

This report offers frameworks, recommendations, and a checklist to help states realize their potential.

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We invite state government staff and officials to contact Joyce Coffee at [joyce@climateresilienceconsulting.com](mailto:joyce@climateresilienceconsulting.com) if they are interested in sharing and learning about best practices in state climate resilience and discussing the framework, checklist, and recommendations in this report.



# INTRODUCTION

Some state governments are beginning to tackle the challenges of protecting their residents, businesses, and communities from climate-change risks. Others are setting aside existing resilience-building plans to cope with the financial stresses of the Covid-19 pandemic emergency. Still others don't yet have preparation for climate risks as a priority.

South Carolina's governor, Henry McMaster, included the new position of chief resilience officer for the state in his executive budget after learning about Florida's creation of a similar post a year earlier.<sup>1</sup> Maryland's legislature authorized local governments to create Resilience Finance Authorities to support funding and financing of local resilience infrastructure.<sup>2</sup> Texas instituted a flood-disclosure law requiring sellers of houses to disclose if the buildings are located in 500-year floodplains and have ever been flooded.<sup>3</sup> North Carolina, driven by a governor's executive order, prepared its first-ever climate resilience plan, the "NC Risk Assessment and Resiliency Plan."<sup>4</sup> In New York, Gov. Andrew Cuomo and the state legislature put before voters a \$3-billion proposal for local infrastructure and environmental restoration, with the bulk of funding to reduce flood risk, conserve open space, and support resilient water infrastructure and green buildings.<sup>5</sup> Connecticut, Virginia, Louisiana, California, and other states have initiated a total of \$1 billion of climate-protection construction projects in communities, using federal grants from the Obama administration.<sup>6</sup> Rhode Island, in 2018, issued new climate-change standards for local community planning.<sup>7</sup>

Meanwhile, California Gov. Gavin Newsom responded to the coronavirus pandemic-driven economic downturn by postponing plans to issue a climate-resilience bond to obtain financing for wildfire, flood, and drought resilience projects across the state.<sup>8</sup> In a May 2020 call with budget stakeholders, the state's secretary for food and agriculture, Jared Blumenfeld, welcomed "solutions and ideas from stakeholders that wouldn't necessarily rely on

state funding but could leverage other sources of funding like private capital."

Washington Gov. Jay Inslee stripped \$50 million in climate-resilience funding from the state budget, which is reeling from revenue losses due to the shutdown.<sup>9</sup> A new chief resilience officer in another state warned that shifting funds to support the Covid-19 pandemic emergency had "tapped out" the state's "rainy day" financial reserves: "We're left with no particular risk transfer mechanism for the next crisis."

The next crisis—a climate crisis—descended on some states even while the pandemic raged on. Communities in the southern US evacuated to crowded storm shelters to escape high winds and flooding, but in doing so increased their risk to the virus. Rain-swollen rivers in Michigan burst through two dams and forced evacuation of 10,000 residents, creating similar risks. Storms in other states caused a loss of power for hundreds of thousands of people, but restoration efforts were hampered by requirements of a safe pandemic response.<sup>10</sup> In August, California's wildfires and Hurricane Laura in Louisiana and Texas forced massive evacuations.

***Every state is starting to feel the effects from climate-driven events that disrupt daily life, take lives, reduce economic activity, and generate massive and costly emergency relief efforts.***

These disruptions mark the continuing acceleration and intensification of climate change impacts throughout the US. Every state is starting to feel the effects from climate-driven events that disrupt daily life, take lives, reduce economic activity, and generate massive and costly emergency relief efforts. For instance, Hurricane

Harvey dropped several feet of rain on southeastern Texas, causing extreme flooding in Houston, damage to 100,000 houses in the city and surrounding county, scores of deaths, and \$125 billion in damage. In Louisiana in 2016, rainfall-driven flooding displaced 100,000 people in the Baton Rouge area, while every parish in the state experienced a federally declared flood disaster. In New York State since 2011 every county has had a disaster declaration due to flooding, and half of the counties had been inundated more than five times.<sup>11</sup> Meanwhile, the impacts of climate changes are not evenly felt—with minority and low-income populations bearing the disproportionate brunt of disruption and damage.

This, then, is what the pattern of climate-resilience action looks like in some state capitals: in response to obvious, probable, and mounting dangers, governors and legislators take some steps forward and some steps backward.<sup>12</sup> In many other states, they have taken few steps at all.

But states matter crucially to local climate resilience. State governments have powers and resources that local and federal governments do not have. They control and invest in critical physical infrastructure, especially for transportation, that is vulnerable to climate risks. They

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regulate energy, buildings, insurance and other essential and vulnerable sectors. They control pots of money for water infrastructure, housing, economic development, and energy systems and serve as main conduits for federal funding, including money in response to economic downturns and emergencies. They own and manage natural areas. They organize and maintain emergency capacities and responses to natural disasters and decide what degree of planning and readiness communities must undertake. They shape public opinion and responsiveness to climate risks.

Most local governments are bound by what powers state governments assign to or deny them. They are on the receiving end of state requirements, regulations, and investments. They typically need their local capacities to be enhanced by flows of state and federal funding and programs. This is certainly the case when it comes to strengthening local climate resilience.

## **MOMENTUM IS BUILDING: A 2020 SNAPSHOT OF STATE RESILIENCE EFFORTS**

Our August–September 2020 survey generated a picture of resilience advances in 29 states and the District of Columbia, based on the framework in this report. For most items, the great majority of states were either “planning to do this” or “starting to implement this statewide”—an indication of how little has already occurred, but also of how momentum is increasing. For example:

**16** **of the states** were planning or starting to implement an interdepartmental body to coordinate climate resilience action.

**15** **states** were planning or starting to implement a state climate resilience plan.

**16** **states** were planning or starting to implement resilience standards for state infrastructure.

**8** **states** reported they were planning or starting to generate additional revenue exclusively for resilience.



# PURPOSE OF PROJECT

This report presents recommendations for how state governments can develop climate-resilience financial systems that help local communities invest in protecting residents, businesses, public infrastructure, private property, and natural resources from climate-driven stresses and shocks. To help states act on the recommendations we include a State Climate Resilience Action Checklist (page 50) that identifies the essential actions that states need to take to build a comprehensive approach to resilience, including a financial system.

By “financial system” for states we mean a set of aligned state actions that fund and finance climate-resilience investment, revenue-generating mechanisms for shifting existing revenue or generating new revenue for resilience building, provision of basic state services related to climate resilience, and the administration of federal funding flows that can be used for resilience purposes. Taken together, these components support local communities in developing the capacities and actions they need to strengthen their climate resilience in the short- and long-term.

A focus on resilience finance emerged from our [earlier reports](#) about local governments that were leading the way on resilience building, which found that lack of money and other capacities for planning and managing complex resilience projects were significant barriers to progress.<sup>A</sup> Some cities were funding short-term climate-resilience actions by using existing authority and capacity to raise revenues—issuing bonds to borrow private capital long term and increasing rates paid by municipal utility customers. But even these leading-edge communities had insufficient capacity to cover

the substantial longer-term costs of resilience building. They and other communities across the nation need to have in place a large-scale, enduring, “plug-and-play” system for organizing and delivering public and private capital for resilience. This conclusion pointed to the importance of having state governments bring their leadership, authority, and resources to the new process of building climate resilience.

This report presents a framework for state governments seeking to help communities withstand climate stresses and shocks. It describes a set of state-level structures, plans, policies, regulations, and services that promote and support the climate resilience of communities. And it focuses on funding and financing—the development of a resilience-financial system—for enabling efforts of local governments or communities (including cities, counties, tribes, and regions of states) because this is a must-have capacity that is underdeveloped nationwide.

***A few states have started down the climate-resilience road. Their governors and legislatures have been proactive, conducting state-level planning, creating funding mechanisms, embedding climate-resilience standards into infrastructure investments and market regulations, appointing resilience leadership, and more. Other states are taking initial steps, establishing interdepartmental and cross-sector study commissions.***

<sup>A</sup> See “Playbook 1.0: How Cities Are Paying for Climate Resilience” (July 2019), <http://lifeaftercarbon.net/wp-content/uploads/2019/07/Playbook-1.0-How-Cities-Are-Paying-for-Climate-Resilience-July-2019.pdf>, “Toward a Climate Resilience Financial System for US Cities,” (December 2018), <http://lifeaftercarbon.net/wp-content/uploads/2018/12/Climate-Resilience-Financing-Report-Final-12.2.18.pdf> and “Essential Capacities for Urban Adaptation: A Framework for Cities” (March 2017), <http://lifeaftercarbon.net/wp-content/uploads/2017/05/City-Adaptation-Essential-Capacities-March2017.pdf>

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This jumble of state responses and non-responses reflects the diverse political conditions—philosophical and partisan differences—in state capitals, the absence of a field-tested roadmap that lays out the most effective pathways that states can pursue for resilience building, and the relative newness of the need for climate-resilience action. But our research suggests that pressure for state action is building and a far-reaching framework for effective state action is needed and slowly becoming evident.

## DEFINING CLIMATE RISK AND RESILIENCE

Climate risks for physical assets and people emerge from three sources:

- The nature of the climate *hazard* (e.g., extreme heat, river flooding, sea level rise)
- The *exposure* to climate hazards (e.g., buildings in a floodplain, roads along ocean shorelines)
- The *vulnerability* to negative impacts due to exposure (e.g., people's underlying health conditions that are exacerbated by extreme heat, infrastructure built to outdated standards).

Actions to strengthen climate resilience focus on the second and third of these sources of risk. They do not change the climate hazards; only the all-important reduction of greenhouse gas emissions in the atmosphere does that. They can reduce climate exposure by, for instance, moving facilities and people out of flood zones. They can reduce vulnerability by using more resilient materials and designs in construction, for example, or providing cooling centers for residents to escape extreme heat.



# GROWING PRESSURE FOR STATE ACTION ON CLIMATE RESILIENCE

State governments are likely to feel more pressure to support local efforts to build climate resilience. Public concern about climate change is rising—and the Covid pandemic has spiked awareness of just how quickly disaster can strike and cause massive economic and social disruption. The number and impact of climate-driven disasters is increasing and spreading, with government emergency relief and insurance claims totaling hundreds of billions of dollars annually. Local demand for state support for climate-resilience strengthening is rising as more and more communities undertake resilience planning, realize that implementing plans may take many years, and experience and observe the damage suffered by places unready to cope with extreme climate events.

## Rising public concern

Large and growing numbers of Americans are concerned about climate change and its impacts. In 2019, 62% of Americans surveyed by the Pew Research Center said climate change is having “a great deal” or “some” effect on their local community. Majorities of these respondents said their community had experienced long periods of unusually hot weather, floods or intense storms, droughts or water shortages, more frequent wildfires, or rising sea levels that erode beaches and shorelines.<sup>13</sup>

In April 2020, more than 40% of Americans surveyed said they would be personally harmed by the effects of a warming planet. “The majority of Americans see climate change as a clear and present threat to the health of people in their community,” says Dr. Edward Maibach, director of George Mason University’s Center for Climate Change Communication. “It’s a threat that’s come home.”<sup>14</sup>

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Alarm bells have started to ring in key economic sectors—real estate, banking, and insurance—and this threatens the financial condition of property owners nationwide. In June 2020, the *New York Times* reported that climate-induced risks have pushed down home prices along ocean coasts and rivers, while wildfires in the West are making it harder for homeowners to get insurance. At the same time, “more banks are getting buyers in coastal areas to make bigger down payments . . . a sign that lenders have awakened to climate dangers and want to put less of their own money at risk. . . And in one of the clearest signs that banks are worried about global warming, they are increasingly getting these mortgages off their own books by selling them to government-backed buyers like Fannie Mae, where taxpayers would be on the hook financially if any of the loans fail.”<sup>15</sup>

## Increasing and spreading climate-driven disasters

From California's massive wildfires, pervasive flooding in the Midwest, hurricane damage in the southeast, extreme heat and prolonged drought in the southwest, and rising sea levels on the Atlantic and Pacific coasts, where 21 states are located, and in Puerto Rico—every region of the nation is starting to experience climate changes. The events affect daily life, reduce economic activity, and generate massive and costly emergency relief efforts. Arizona, for example, experienced 10 of the largest wildfires in its history in the past eight years. In 2018, other states—Colorado, Hawaii, Oregon, and Utah—broke local wildfire records.<sup>16</sup>

***Research by the nonprofit First Street Foundation found that 16.2 million homes in the U.S. will be at substantial risk of flooding by 2050.***

Climate scientists predict that there is more and much worse to come—and that it is unfolding more rapidly than predicted. For example, a recent study of US coastlines led by the US Geological Survey raised new alarms: as sea level rises, the number of extreme flooding events could double every five years and major floods expected once every 50 years will occur almost annually in nearly three-fourths of the coastal regions under study.<sup>17</sup> Research by the nonprofit First Street Foundation found that 16.2 million homes in the U.S. will be at substantial risk of flooding by 2050. In Florida, Idaho, Louisiana, Montana, and West Virginia more than 14% of properties currently face substantial flood risk, and adding projections for sea level rise to the First Street model greatly increased the number of properties at risk in Delaware, New Jersey, and South Carolina.<sup>18</sup> In Florida, according

to a 2019 governor's office report, \$26 billion of residential property is at risk of chronic flooding by 2045.<sup>19</sup> A 2020 report from Four Twenty Seven described another looming climate hazard: "Hot and dry conditions combined with the build-up of flammable wildfire fuels will lead to larger fires and longer wildfire seasons across the western United States with implications for public health, insurance, local governments, and economies."<sup>20</sup>

The situation is likely worse than the predictions and large-scale, billion-dollar disasters suggest. Small scale but severe weather events—heat, wet weather, high wind, flooding, and combinations of these, documented by NOAA and the National Weather Service—are common throughout the United States. Between 1996 and 2019, the US experienced 1.36 million such events. Texas alone had 7% of the US total, more than 97,000 events, and Kansas had more than 64,000 events. In a 10-year period ending in 2018, New Jersey experienced 8,476 severe weather events: high wind, cold, wet weather, heat and wildfires, and sea-level events.<sup>21</sup> It is expected that climate change will exacerbate these patterns.

## Growing local demand for state support for climate-resilience strengthening

Hundreds of communities across the nation are assessing their climate hazards and vulnerabilities and planning how to build their climate resilience. Some are acting because they've experienced climate risks, others because they can see what's coming—the inexorable rise of ocean levels, for instance—and want to get ready. Many have developed full-scale climate adaptation or resilience-building plans and have designed, funded, and implemented initial projects such as upgrading storm-water drainage systems for flooding and tree planting for extreme heat in efforts to provide new protection from climate impacts.

Although local climate-resilience building may involve dozens of different actions, or even more, what communities need to do usually falls into general categories developed by Melissa Stults, sustainability and innovations manager for Ann Arbor, MI:<sup>8</sup>

- Advocacy
- Building codes and design standards
- Education and outreach
- Energy conservation
- Financing
- Green infrastructure
- Land use
- Planning
- Physical infrastructure
- Policies
- Practices and behaviors
- Research and monitoring
- Technology
- Water conservation

(For a list of nearly 100 resilience-building actions, sorted by the type of climate hazard each addresses, see in Appendix, “Inventory of Climate Resilience Actions.”)

As more and more communities focus on climate-disaster prevention, what they need to do requires deep technical capacity; access to climate and other data; local political will; and financial and implementation capacities to advance increasingly complex and costly local projects. But in most communities these capacities are in short supply—with the financial deficiency exacerbated in the post-Covid-19 economy. One place that communities are turning to for support is the state governments that control vital assets and resources for building climate resilience.

### Economic and public health benefits of resilience building

Another factor is increasing the interest in resilience actions. Well-crafted investments in climate resilience can generate multiple “co-benefits”—creating jobs and preventing economic disruption, reducing citizens’ vulnerability to extreme weather conditions, increasing property value and recreational space, reducing social inequities, and more. This strengthens the case for investing in climate resilience and increases its appeal for elected officials.

Some of these benefits—such as job creation and business activity and improved public health—can be measured and converted into amounts of money saved in future costs. Resilience investments can generate \$6 in cost savings for every \$1 invested, according to an analysis of risk-mitigation funding by federal agencies.<sup>22</sup> Other benefits—such as preserved biodiversity—are less easily quantified and monetized.

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<sup>8</sup> Melissa Stults, “Planning to be Prepared: Assessing Local Level Planning for Climate Change in the United States,” 2016, [https://deepblue.lib.umich.edu/bitstream/handle/2027.42/135830/stultsm\\_1.pdf?sequence=1](https://deepblue.lib.umich.edu/bitstream/handle/2027.42/135830/stultsm_1.pdf?sequence=1)

# A FRAMEWORK FOR STATE CLIMATE-RESILIENCE BUILDING

When states decide to strengthen their climate resilience, they put in place several essential resilience-building components, including support for local resilience building and helping communities meet the financial

necessities. Below we identify the main components of a state resilience framework based on research on the actions of multiple states. Each component is briefly described below:

## STATE RESILIENCE FRAMEWORK



## Governance and management of resilience building

New Jersey Gov. Phil Murphy established by executive order an Interagency Council on Climate Resilience containing 16 state agencies.<sup>23</sup> Florida's governor created a multi-department coordinating body and the chief resilience officer (CRO) position to facilitate the coordination.<sup>24</sup> Rhode Island's Green Bank hired a director of stormwater and resiliency who is also the state's chief resilience officer.<sup>25</sup> Louisiana created Louisiana Strategic Adaptations for Future Environments (LA SAFE), a multi-year public engagement process for communities facing coastal climate risks.

Within governance and management, some states and stakeholders have begun to follow investment principles to guide how they proceed, including:

- **Equity.** Ensure allocations of investments in resilience building advance equity—prioritizing the needs of more vulnerable places and populations to safeguard the best outcomes for state resources.
- **Maladaptation.** Avoid investing in projects that increase a community's vulnerability to climate hazards or undermine opportunities for future climate adaptation; it is a waste of state funds.

*Ensure allocations of investments in resilience building advance equity—prioritizing the needs of more vulnerable places and populations to safeguard the best outcomes for state resources.*

- **Timing.** Avoid delaying investment decisions unnecessarily; it only increases the cost of resilience building and may cause additional spending on relief after disasters.
- **Leverage.** Design resilience investments to maximize co-benefits whenever possible, including reduction of carbon emissions, improvements in public health, environmental improvements, job creation, and business activity.



## CRITERIA FOR EQUITY IN STATE RESILIENCE

States are in a unique position to enhance social equity—balancing rural versus urban support and increasing flows of investment and services to less resourced neighborhoods within communities. Suggestions for how states can enable communities to improve social equity include:

- Provide technical support and planning and resources to less resourced local governments to develop resilience project ideas into fundable concepts.
  - Offer state resources for inclusive community engagement in local resilience planning.
  - Adopt grant and loan guidelines that require local governments to engage lower resourced neighborhoods in resilience project decision-making.
  - Base the determination of grant and loan awards on the amount of hazard vulnerability and exposure, rather than on the best written proposal.
- For instance, require that communities identify projects targeted at their climate-vulnerable populations, mapping these populations using tools like NOAA’s Social Vulnerability Index.<sup>26</sup>
- Prevent housing displacement. States can require loan and grant recipients to anticipate and mitigate lower resourced community displacement pressures (climate gentrification). An example: the California Strategic Growth Council’s Transformative Climate Communities Program requires local government grant recipients to develop an anti-displacement plan.<sup>27</sup>

Some examples of financial mechanisms that can build social equity:

- General Obligation bonds that combine investment in affordable housing with flood mitigation (See, for example, the Miami’s “Miami Forever” bond, passed in 2017.<sup>28</sup>)
- Environmental and social impact bonds with quantifiable environmental and social measures that the bond issuer aims to meet through their project and that an evaluator verifies. The borrower repays investors based on the project having achieved these measures. (Atlanta implemented an Environmental Impact Bond in 2018 to finance green infrastructure projects intended to mitigate future flooding in a lower resourced community.<sup>29</sup>)
- Community land trusts, whose goal is to protect community resources for environmental and community benefit and inspire community-based ownership and control of land.



## State resilience plan

At a minimum, a statewide plan assesses the state's climate hazards and vulnerabilities, laying out the evidence, and detailing priority issues, strategies, and initiatives to address current and future risks. A plan may also include information about research and best practices for resilience by communities, businesses, and property owners. The planning process is considered to be an important opportunity to engage with stakeholders—local governments, businesses, nonprofits, universities, the federal government and military, and others—and to communicate effectively with the public about climate resilience.

## Resilience standards for infrastructure

The Florida CRO's 2019 report says it well: "Infrastructure standards were set decades ago; we can't design based on old weather patterns."<sup>30</sup> State highways and roads, transit systems, buildings and property, natural systems, emergency preparedness services, and healthcare assets have to be protected and upgraded to address climate risks. In March 2020, for example, Florida required all state-funded buildings in coastal areas to take sea-level rise into account before they can be built.<sup>31</sup> The "Climate Resilience Design Guidelines" adopted by the Port Authority of New York and New Jersey ensure that new infrastructure and buildings are designed to account for projected changes in temperature, precipitation, and sea level rise.<sup>32</sup> In August 2020 Massachusetts issued a draft of resilience design standards and guidelines for state agencies that is "grounded in scientific methodology using the best available climate science data."<sup>33</sup> Stormwater management rules set by states can incentivize greenfield and low-density development, land uses that may work against a community's resilience building. Regulations that require the same stormwater control regardless of the type

of development can unnecessarily increase the cost of housing and environmental impacts, according to a report for Vermont by the Congress for New Urbanism. Instead, states can adopt permit language that recognizes that high-density, mixed-use, and other types of development and re-development, as well as green-infrastructure approaches, can reduce causes of stormwater runoff.

## Resilience policies for state-regulated sectors

States have regulatory authority over utilities—electricity, stormwater, and others—and certain sectors—insurance and real estate, for instance—that play roles in local resilience building. Policies and regulations can direct the attention and behavior of these entities and sectors in ways that support local efforts.

- A 2019 law in Puerto Rico for energy supply, in response to years of performance decline exacerbated by Hurricane Maria, contained an array of provisions to improve energy-system climate resilience.
- Florida's CRO recommended that the state "require coastal flooding disclosures for real estate transactions to spread public awareness of SLR and allow Floridians to make decisions about the risks of purchasing coastal property."<sup>34</sup>

***The Florida CRO's 2019 report says it well: "Infrastructure standards were set decades ago; we can't design based on old weather patterns."***

## Local resilience building capacities and actions

Communities are on the front line of climate resilience. Nearly all weather- and climate-related stresses and shocks assault communities, their built and natural environments, and the health, economic, and social welfare of their residents and businesses. But no community was developed to withstand the increasingly severe and frequent hazards that global warming is bringing. Stormwater systems can't handle the increased volume of extreme rainfall. Flood barriers are overwhelmed. Rising sea levels erode shorelines, infect freshwater aquifers, and flood buildings and city streets. Heat waves damage infrastructure and unleash health crises. Wildfires destroy settlements as well as forests. Homeowners and renters are forced to flee swollen rivers and intense coastal storms. And more.

***A community's capacity is the base from which projects, regulations, and other resilience-strengthening efforts arise.***

Ultimately, communities seeking to strengthen their resilience undertake public projects—improving stormwater systems, raising streets above flood levels, for example—and require or incentivize private actions, such as increasing the elevation of building sites or moving building's mechanical and electrical systems onto roofs and out of flood risk, or prohibiting construction in certain high-risk zones.

But designing and implementing climate-related projects and regulations is new work for local governments. It requires new capacities to assess climate risks, plan and implement actions, and financial capacity to support resilience actions. (In the next section we describe seven capacities for local climate resilience building.)

***What's more, communities will depend on these capacities for decades as climate changes unfold; resilience building is not likely to be just a one-time episode in a community's life.***

A community's capacity is the base from which projects, regulations, and other resilience-strengthening efforts arise.<sup>35</sup> "A critical step for building resilience is to improve capacity of communities to prepare, respond, and recover from climate-related health risks," explains California's reports to San Diego and other counties.

What's more, communities will depend on these capacities for decades as climate changes unfold; resilience building is not likely to be just a one-time episode in a community's life.

## State-local resilience financial system

The key elements in this state framework—governance and management, investment principles, statewide plan, resilience standards for state assets, resilience policies for regulated sectors, support for local resilience building capacities—can serve as the foundation of a state approach to helping communities build their resilience. But they inevitably will generate a range of financial needs—from thousands to billions of dollars—that states also must address.

The few states that have started to put in place financial resources for resilience building have assumed that they cannot count for now on the federal government to fund much of the cost of climate resilience. And they have acknowledged that a financial system for resilience strengthening must enable local governments to access and influence financial resources.

# STATE-LOCAL RELATIONSHIP FOR CLIMATE RESILIENCE

In February 2017, officials in San Diego County received a 30-page report from the California Department of Public Health that provided climate change projections for the county and identified local vulnerabilities and assets with an emphasis on social inequities. The report was produced to support county planning to build resilience to climate change. It noted that the county, with more than 3-million residents, faced an increase in annual average temperature of as much as 5.8° Fahrenheit, a decline in rainfall, an increase in the potential area burned by wildfire, sea level rise of more than 5.5 feet, and more heat waves. These changes, the report continued, posed physical dangers for residents and would create health risks, especially for hundreds of thousands of vulnerable residents. It concluded by offering nine public health strategies the county could use to adapt to climate change.<sup>36</sup>

Every one of California's 58 counties received a similar, customized "Climate Change and Health Profile" report, as required by a governor's executive order. The material was just the first in a series of state-generated climate-resilience tools for local governments.

California's detailed reports illustrate several crucial defining elements of the emerging framework for state government responses to strengthening climate resilience: states must determine what their role will be in working with local communities to build resilience and they must understand what local communities need for resilience building.

## **Effective resilience building requires state-local collaboration**

State and local governments are interdependent when it comes to building climate resilience. A state government cannot succeed if it just takes care of its own assets (e.g., highways) and ignores local needs. A local government doesn't have the authority and resources to entirely succeed on its own.

***Intergovernmental relations between state and local governments vary substantially among and within states, of course. But some form of local-state partnering—preferably a co-development approach that starts with local communities' needs and enables local action—is necessary to plan, prioritize, implement, and pay for climate-resilience solutions.***

Intergovernmental relations between state and local governments vary substantially among and within states, of course. But some form of local-state partnering—preferably a co-development approach that starts with local communities' needs and enables local action—is necessary to plan, prioritize, implement, and pay for climate-resilience solutions.

A version of this state-local interdependence was highlighted when Florida Gov. Ron DeSantis, a Republican, appointed Dr. Julia Nesheiwat as the state's first chief resilience officer in August 2019. The governor tasked her with coordinating a state government response to sea level rise that "will help protect our coastal communities."<sup>37</sup> At a news conference, he noted the importance of local resilience: "For a resiliency officer, you need somebody who's going to . . . be able to work with the local communities."<sup>38</sup> The governor's action was a notable shift from the position of the previous governor, also a Republican, who said he was not convinced that human activity causes climate change and whose Department of Environmental Protection banned use of the term "climate change" in official communications.<sup>39</sup>

A few months after Nesheiwat's appointment,<sup>c</sup> she reported to her boss that "Florida needs a statewide strategy. Communities are overwhelmed and need one place to turn for guidance." There was urgency, she added: "Florida's coastal communities and regions do not have time to waste."<sup>40</sup>

Florida's about-face on climate resilience underscores both the political fluidity of state governments' stances toward climate resilience and the need for states to design a resilience-building role for themselves—such as the "guidance" promoted by Nesheiwat—that provides communities with what they need.

It seems likely that most states' legislators, governors, and other elected and appointed officials would agree, whatever their political philosophy and party, that it's better for the state when communities are ready to handle climate-driven events with minimal loss of life and property than not to be ready. But what should state governments do to help communities achieve this preparation?

The answer depends initially on the state's approach to the intergovernmental relationship between the state and the local levels of government. Local governments—their jurisdictions, responsibilities, and authority—are generally established by state government legislation and state-local agreements. These relationships typically involve consultation, cooperation, coordination, and

***Whatever a state government's approach to local government relations, its efforts to support local resilience building depend on an assessment of what communities actually need to build their climate resilience.***

accountability between the levels of government. But they are often characterized by ongoing tensions over which level has what power over which decisions and resources. For example, states may aggressively pre-empt local authority to adopt certain policies and/or mandate certain local processes. They may offer local governments substantial discretion and flexibility in local taxation and other policies, by providing authority, tools, and resources. Or they may simply not legislate many local requirements. In addition, some state policies may unintentionally create barriers to local government action—but identifying and reforming these impediments can be a difficult exercise in inter-governmental relations.

Whatever a state government's approach to local government relations, its efforts to support local resilience building depend on an assessment of what communities actually need to build their climate resilience.



<sup>c</sup> Nesheiwat left the position in February 2020 to serve as President Trump's homeland security advisor.

## What local communities need to build climate resilience

Resilience building at the local level depends on developing new capacities to figure out how to strengthen resilience and to implement actions. Although climate risks may differ from place to place, the set of capacities local governments need tend to be similar. In previous research we identified seven capacities specific to local resilience, which are described in the graphic below.

These capacities enable communities to identify, prioritize, and take actions for strengthening their resilience.<sup>D</sup>

But it is not necessary for each community to build its own capacities; instead, communities can tap into a shared capacity—an arrangement that can save money and ensure that less-resourced communities obtain what they need. For several reasons it may make sense for states to contribute substantially to creating shared, statewide capacities along these lines.

## 7 CAPACITIES OF LOCAL CLIMATE RESILIENCE BUILDING

### Scientific Foundation

Capacity to assess and understand climate risks and vulnerabilities of city's built, natural, and economic assets and its populations, and use these analyses for ongoing adaptation planning.

### Intergovernmental Alignment

Capacity to coordinate planning and action across governments at local, regional, state, tribal, and federal levels.

### Communications

Capacity to communicate with and educate civic leaders and community members in ways that build and sustain a sense of urgency to adapt for climate changes.

### Technical Design

Capacity to design, test, and implement adaptation actions that require engineering, legal, and other highly specialized details, as well as performance metrics for monitoring.

### Equitable Adaptation

Capacity to make social and economic equity a central driver of the city's adaptation approach.

### Financial Resources

Capacity to repurpose, leverage, and obtain public and private funds to invest in infrastructure development and other adaptation actions.

### Inclusive Community Engagement

Capacity to fully engage stakeholders and the public, especially vulnerable and underrepresented populations, in developing, implementing, and monitoring adaptation plans.

<sup>D</sup> For detailed description of these capacities, see "Essential Capacities for Urban Adaptation: A Framework for Cities," March 2017, <http://lifeaftercarbon.net/wp-content/uploads/2017/05/City-Adaptation-Essential-Capacities-March2017.pdf>.

Whether states choose to mandate, incentivize, or just encourage local governments to develop resilience plans, they have to consider at what scale local-level planning should occur: community, county, or region, or a combination of these? Although much local resilience planning happens in individual communities, some states are also focusing on county and regional scales. This reflects the fact that most climate hazards and risks are likely to encompass geographies larger than single towns or cities. If one community within a watershed plans for resilience but others do not, the resilience of all the communities will be compromised.

States also have to consider whether they will introduce standards for mandated or voluntary local resilience planning—recognizing that having communities develop resilience plans with highly variable quality will also compromise the investment in resilience building that occurs.

***Although much local resilience planning happens in individual communities, some states are also focusing on county and regional scales. This reflects the fact that most climate hazards and risks are likely to encompass geographies larger than single towns or cities.***

Whatever approach states take, all of this local capacity building and the ensuing resilience-strengthening activity requires money, far more money than most communities have. And more than state governments have readily available.

### CHALLENGES OF LOCAL FINANCING OF CLIMATE RESILIENCE

A 2019 analysis of California's situation, "Adaptation finance archetypes: local governments' persistent challenges of funding adaptation to climate change and ways to overcome them," revealed seven focal points around which challenges clustered:<sup>41</sup>

- Establishing climate change risks and adaptation as a matter of concern (a prerequisite to bringing attention to and prioritizing an issue for funding)
- Establishing the funding need, which involves assessing and justifying adaptation expenditures
- Proving the financial standing (capacity) of the funding seeker
- Identifying and accessing funding providers
- Accessing different types of funding or financing
- Navigating specific funding mechanisms
- Having or creating the ability to use and administer funds

# BUILDING A STATE-LOCAL RESILIENCE FINANCIAL SYSTEM

An emerging state-scale climate-resilience financial system will be an amalgamation of resources, purposes, and mechanisms. It will blend capital from public sources—state, local, and federal funds—and from private sources. It will support resilience actions by government entities and by private property owners and businesses; in some cases, the public sector takes most or all of the responsibility, but in others—such as resilience of privately-owned land and buildings—it’s up to private parties to act. The system will use a mix of financial entities and tools, incentives, regulations, and barrier removal to spur local resilience building.

***Every state has in place policies and structures to collect revenue and invest in public infrastructure, support local governments, incentivize private investment, and take advantage of federal funding opportunities. But in most states these mechanisms have not yet been revamped to support the new purpose of climate resilience strengthening.***

## **States already have many of the tools and authority they need to build climate-resilience financial systems**

Every state has in place policies and structures to collect revenue and invest in public infrastructure, support local governments, incentivize private investment, and take advantage of federal funding opportunities. But in most states these mechanisms have not yet been revamped to support the new purpose of climate resilience strengthening, nor have they been bolstered with additional revenue that will be needed. In addition, there are some notable gaps due to some unprecedented necessities of resilience building.

## **States can lay the foundation of a system for climate-resilience investment by taking 6 recommended actions**

Although each of the recommendations below for state government action could be enacted separately, when advanced together they form the basis for a whole-system approach to the challenge of paying for local climate resilience.





## The six strategies for building the system are:

### 1 PROVIDE BASIC SERVICES AND TOOLS FOR LOCAL RESILIENCE STRENGTHENING.

State governments should provide local governments with the services—climate data and risk analysis, technical guidance and assistance, and communications assets for resilience—that are key to building local resilience capacities.

### 2 INCREASE THE STATE'S FINANCIAL RESOURCES FOR RESILIENCE INVESTMENT.

State government should use various ways of raising revenue for resilience building—tailored to their political situations, fiscal conditions, and legal constraints. Some states are raising resilience funds by bonding against future tax revenue and/or tapping money generated by carbon-pricing markets. Other methods under consideration include surcharges on property insurance.

### 3 SUPPORT DEVELOPMENT OF LOCAL PIPELINES OF “READY TO GO” PROJECTS FOR CLIMATE RESILIENCE.

State governments should provide resources—expertise and funding—that enable local governments, private sector developers, community organizations, and nonprofit organizations to design numerous resilience projects and get them ready for full-scale implementation and funding.

### 4 ENABLE LOCAL FUNDING FOR IMPLEMENTING PUBLIC INFRASTRUCTURE PROJECTS.

State governments should provide local governments with an array of tools—an enabling environment—for obtaining and attracting financial resources they need to cover significant costs of retrofitting and building climate resilient infrastructures. These include state grant and loan programs, increased local authority to raise revenue, and state-authorized local financial entities.

### 5 LEVERAGE PRIVATE INVESTMENT IN LOCAL RESILIENCE DEVELOPMENT.

State governments should stimulate substantial private investment in resilience building for private purposes such as protecting private land, utilities, buildings, and businesses—and this can contribute significantly to a local community's overall resilience. States can use incentives and regulations to accelerate and expand private investment for resilience building in key economic sectors—real estate, insurance, energy, and finance, for example.

### 6 PUSH TO EXPAND AND INCREASE FLEXIBILITY OF FEDERAL FUNDING FOR PRE-DISASTER LOCAL RESILIENCE.

State governments should press the federal government to more rapidly increase the amount of funding available for resilience building. They can leverage resilience-funding allocations that have been made in several federal funding streams—at the Federal Emergency Management Agency and the Department of Housing and Urban Development—and promote increased and more flexible funding for resilience-relevant traditional federal funds for water, transportation, other infrastructure, and environmental protection.

The following section of the report details each of the strategies, explaining what is involved in the strategy and why states should pursue it, and offering specific ideas and examples of what the strategy entails.



# SIX RECOMMENDATIONS FOR BUILDING STATE RESILIENCE FINANCIAL SYSTEMS

The six recommendations discussed in this section form pillars for a state resilience financing system. Some of these pillars are embodied in the Rhode Island Infrastructure Bank.

The state's Bank, established by the state in 1989 to finance clean-water projects, expanded its purpose in 2015 and now supports financing for climate-resilient infrastructure.<sup>42</sup> It has provided a total of \$2.2 billion in financing, mostly for clean water, operates 13 different financing mechanisms for infrastructure, five mechanisms for financing improvement of natural systems, and five mechanisms for supporting community resilience.

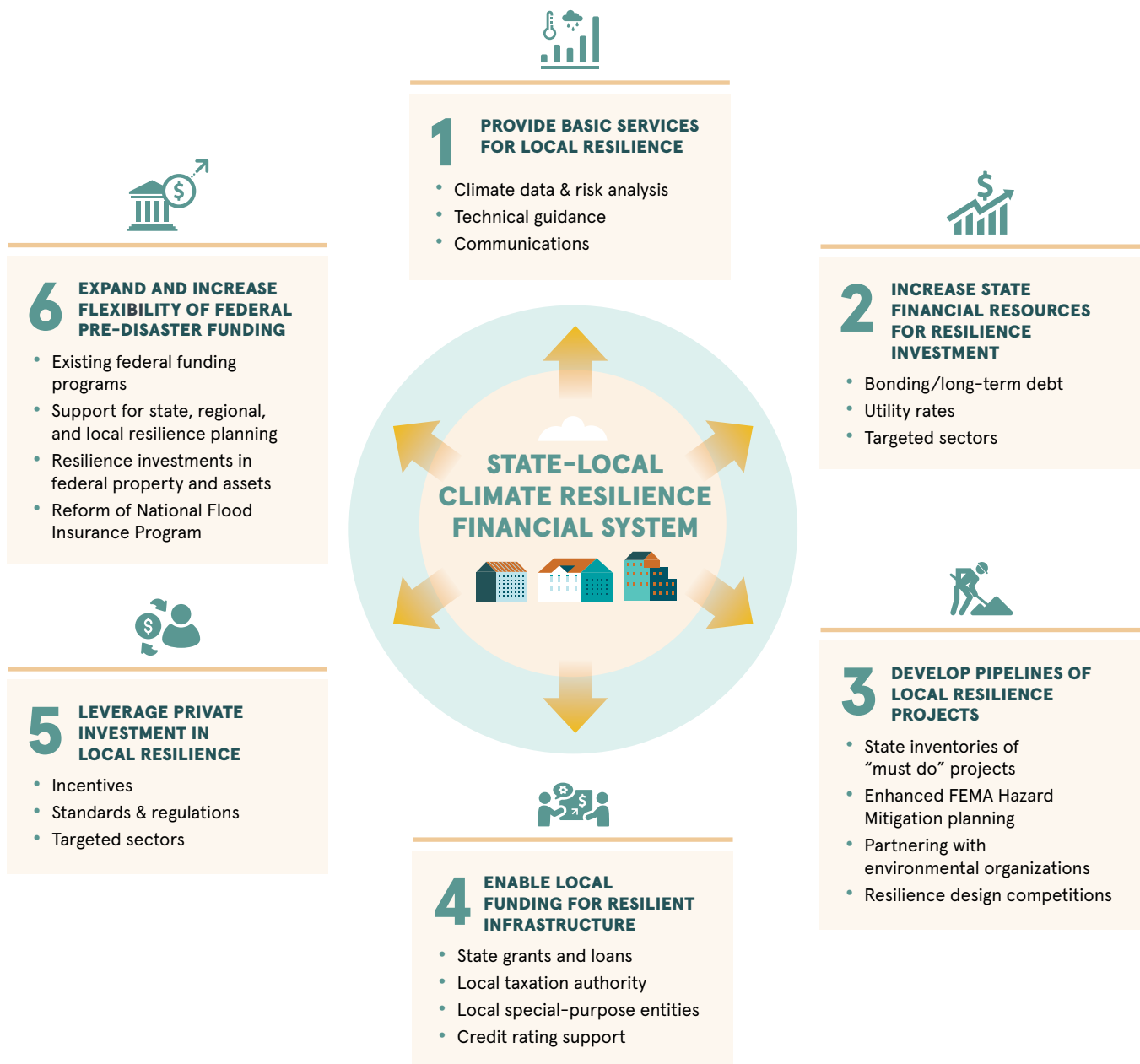
The Bank's structure illustrates some of the design choices involved in building a state resilience financing system: it has multiple "windows" devised to finance different types of projects in different ways and provides a central point for coordination of various resilience-financing efforts.

Although the Bank has only expanded into resilience financing in the past few years, it enacts several of the six key strategies, depicted below, for creating a state-level climate-resilience financial system. It issues bonds, which increases state financial resources dedicated to resilience investment. It enables flexible local funding for implementing public infrastructure projects. And it leverages private investment in resilience. The Bank also partners with other state entities, such as the Department of Environmental Management, which provides resilience-building grants to communities.

Other states' nascent efforts are highlighted in the recommendations that follow.



# STRATEGIES FOR BUILDING STATE-LOCAL CLIMATE RESILIENCE FINANCIAL SYSTEM



## 1

## PROVIDE BASIC SERVICES AND TOOLS FOR LOCAL RESILIENCE STRENGTHENING



**WHAT.** State governments should provide local governments with services—climate data and risk analysis, technical guidance and assistance, and communications assets for resilience—that are key to planning and building local resilience capacities. This is an inter-governmental role that states often assume for other purposes, especially when responding to crises.

**WHY.** Compared to individual communities, states are positioned to aggregate the cost of these services so they will be more financially efficient to provide. They can ensure equitable access to the services by communities that are less affluent and able; this can help to bridge the rural-urban divide in most states. Because climate hazards and impacts are rarely restricted to a single community, states may need to support and facilitate resilience-building efforts that cross local government boundaries. In addition, states can more effectively organize than individual communities' efforts to obtain relevant federal government resources, such as climate data.

### SPECIFIC BASIC SERVICES

#### Climate Data and Risk Analysis

■ State government agencies can provide and maintain/update climate science, data, and analytic tools that are critical for helping local governments to understand their local physical, social, economic, and environmental risks due to global warming, and to plan for resilience building. Without this information, local governments are unlikely to plan successfully, if at all.

— States can rely on federal initiatives like the National Climate Assessment and US Climate Resilience Toolkit, and they can use and promote NOAA's Regional Integrated Science Assessments.<sup>43</sup>

■ Some states (e.g. New Jersey, Virginia) already deliver climate data, relying on partnerships with public universities, although typically these data are at the community scale, not specific to particular properties or other assets or systems. Some states also provide information about particular social risks due to climate changes, such as California's county-level data and Louisiana's Strategic Adaptation for Future Environments (LA-SAFE) emphasis on parish-level housing, transportation, jobs, and economic development.

— As the Center for Neighborhood Technology notes, private property owners need to be able to estimate the flooding damage that future years will bring to understand whether an upfront investment in resilience of their property is worthwhile. In many cases, improvements would pay for themselves by reducing damage from flooding in the long term, but these future damages are not known by property owners. "To support this, we need a method to assess flood risk that allows parcel-based predictive estimates of flood damage over a multi-year period, given current and projected precipitation patterns."<sup>44</sup>

■ States can press the federal government to improve crucial data resources such as the Federal Emergency Management Agency (FEMA) flood maps, which are mostly outdated and do not reflect recent land development or future climate scenarios. These maps are key to state and local government access to federal disaster recovery funds and are almost universally used by local governments to design standards for infrastructure and building regulations.

### Technical Guidance and Assistance

■ States can provide local governments with resilience standards and cost-benefit analysis requirements for local infrastructure, and technical assistance, such as analytic tools and expertise, that help them to develop effective resilience-building plans. The Massachusetts Vulnerability Preparedness Action Grant Program provides such expertise with the intent to help local government's craft actionable resilience plans.<sup>45</sup>

■ States can clarify cost-benefit analysis requirements for proposed resilience-building activities to include full lifecycle accounting, anticipation of climate risks in discounting investment, inclusion of the value of ecosystem services, quantification of the public health and other benefits, and description of the cost of inaction, especially for rural and marginalized populations. For instance, a green infrastructure project might result in better air quality, which improves public health; less basement flooding, which improves property values and can save owners and renters money; more tourism, which attracts business and produces tax revenue; and less stormwater to treat, which results in cost reduction for public utilities.

— Cost-benefit analysis should account for the need for long-term resilience and current acceptable levels of service. Useful tools for states to assess these factors include the National Academies of Science guidebook, [\*"Incorporating the Costs and Benefits\*](#)

*States can provide technical guidance for local planning processes, such as how to protect a particular roadbed from flooding or how much green infrastructure is needed to retain a certain amount of water after a rainfall.*

[\*of Adaptation Measures in Preparation for Extreme Weather Events and Climate Change,\*](#) and the National Institute of Science and Technology (NIST) [\*"Economic Decisions Guide."\*](#) California's Office of Planning and Research offers suggestions for life-cycle cost accounting, directed to state agencies and applicable to local government, in its [\*"Planning and Investing for a Resilient California Guidebook."\*](#)

■ States can provide technical guidance for local planning processes, such as how to protect a particular roadbed from flooding or how much green infrastructure is needed to retain a certain amount of water after a rainfall. They can advise local governments about which local codes, ordinances, and permitting processes should contain new climate-adaptation standards for buildings or how to make sure that city prohibitions against development in certain high-risk areas could survive legal challenges. They can provide expertise to help local governments integrate resilience-building policies into the array of hazard mitigation, emergency response, and other local plans that typically exist, such as comprehensive plans, watershed management plans, tree and shade plans, capital improvement plans, and the like. In some cases, infrastructure-specific information directed to state asset holders is also used by city officials. For instance the National Cooperative Highway Research Program has multiple resilience resources for state highway transportation officials that relate to local roads.

## #1: PROVIDE BASIC SERVICES AND TOOLS FOR LOCAL RESILIENCE STRENGTHENING

■ States can condition local government access to state funding on the use of specific climate-risk scenarios to assess local needs. For instance, they can require the use of university-based climate models, rather than FEMA models, for stormwater calculations. Or they can require the use of scenarios that assume stable or increasing greenhouse gas emissions, rather than scenarios that project decreasing greenhouse gas emissions and thus relatively fewer significant climate impacts over time.

■ States can develop scenarios of the possible climate migrations that could impact communities in the state due to flight from repeated climate disasters or in anticipation of unlivable conditions because of climate hazards such as rising seas. Which communities can expect to lose population and business, which may serve as “receiving” communities for climate migrants?

### Communications Assets for Resilience

State governments can increase public awareness and will for local resilience building by publicizing the risks of climate change and acknowledging that the risks include the heightened exposure and vulnerability of marginalized communities. Maine, for example, has been developing an analysis of “the cost of doing nothing” to build resilience, which can highlight the financial value of costs saved by investing in resilience. Rhode Island’s resilience building also provides examples:

■ States can “lead by example”—highlighting what they are doing to address climate risk. Rhode Island appointed Resilience Coordinators pursuing resilience initiatives across critical infrastructure and utilities, natural systems, emergency preparedness, community health and financing.

■ States can communicate about state funds, programs, and regulations that support local resilience-building activities. “[Resilient Rhody](#),” the state’s 2018 climate-resilience plan, describes existing new and emerging climate finance mechanisms.

■ States can provide local officials with communications assets to use, including communications messages, cases/examples, tools, activities, etc. Rhode Island’s Municipal Resilience Program provides a [Community Resilience Building Framework](#) and workshops for this purpose.

***States can develop scenarios of the possible climate migrations that could impact communities in the state due to flight from repeated climate disasters or in anticipation of unlivable conditions because of climate hazards such as rising seas.***

## 2

INCREASE THE STATE'S FINANCIAL RESOURCES  
FOR RESILIENCE INVESTMENT

**WHAT.** State government can use various ways of raising revenue for resilience building—tailored to their political situations, fiscal conditions, and legal barriers, such as caps on tax increases, which may constrain the use of particular taxes or fees. Some states are raising resilience funds by bonding against future tax revenue—long-term borrowing of private capital—and/or tapping money generated by carbon-pricing markets. Other revenue-raising methods under consideration in states include surcharges on property insurance.

**WHY.** In 2019, all 50 states combined collected nearly \$1.1 trillion in taxes.<sup>46</sup> However, most, if not all, state governments will need to obtain additional revenue to pay for their portion of resilience building costs—to protect state assets and enable local communities. Some funding can come through repurposing existing state programs and funds, i.e., by making resilience building an eligible activity. But as states become more ambitious in enacting comprehensive resilience frameworks and using strategies like those recommended in this report, they will need to either divert substantial sums from

other uses or raise new revenue. The likelihood of needing to raise additional revenue is increased by two other factors: (1) the revenue-reducing impacts of the pandemic shutdown in the short and intermediate terms, and (2) the long-term nature of resilience building, which suggests the need to pay for costs over decades, not just one time.

### REVENUE RAISING METHODS

As states realize that building resilience means they will need more revenue, and that federal funding for this purpose is quite modest, they turn to traditional methods and explore other methods. However, most of the current funding schemes for resilience cover only a very small percentage of the resilience investments that need to be made.

#### Bonds & Utility Rates

The traditional method is a bond issue—borrowing long-term from private capital markets. Before New York sought voter approval for a \$3-billion bond, Massachusetts approved a measure to borrow \$2.4 billion for investments in climate adaptation, including \$75 million dedicated to communities for preparedness planning grants.<sup>47</sup> In California, Gov. Newsom's 2020–21 budget proposed a \$4.75 billion bond for climate resilience, with \$250 million dedicated to community resilience—\$25 million for planning and \$225 million for construction of new and retrofitting of existing facilities for resilience and recovery operations.<sup>48</sup> (The governor postponed a vote on the bond ballot question in the wake of the pandemic economic downturn.)

*As states become more ambitious in enacting comprehensive resilience frameworks and using strategies like those recommended in this report, they will need to either divert substantial sums from other uses or raise new revenue.*

## #2: INCREASE THE STATE'S FINANCIAL RESOURCES FOR RESILIENCE INVESTMENT

Another traditional approach to generating revenue is to tap utility revenues by adjusting rates, although the use of these funds is restricted to actions consistent with the utility's purpose. With electric utilities, this can be done through rate-setting decisions by state regulators. Stormwater utilities around the US have been raising rates to pay for flood-prevention improvements.

In New York, surcharges on customers' energy bill pay for the state's Clean Energy Communities program, which certifies "climate smart communities" and provides grants of up to \$250,000 for a wide range of actions. More than 300 communities have been certified.<sup>49</sup> The program is a possible model for a statewide community resilience program.

An advantage of using bonds and utility rates is that they spread the costs across very large numbers of payers, which allows the increases to be minimized. But this spread also means that the benefits of resilience building that may be realized are not tied to the costs that one will pay.

### Insurance Surcharges

In 2019, Rebuild By Design (RBD) produced a report, "Resilient Infrastructure for New York State," that identified two options for raising revenue to strengthen climate resilience infrastructure statewide without taking money from existing transportation, environmental, or infrastructure funding. One option, a bond that would have to be approved by voters, could provide billions of dollars. But, RBD noted, it would be a one-time, rather than recurring, source of revenue. The other option was to create a surcharge on property-casualty insurance, which at 2% could generate \$17.6 billion over 10 years. RBD argued that a surcharge would be "progressive" because higher-income people insure more expensive items. Gov Andrew Cuomo choose to go with a bond issue.<sup>50</sup>

Targeting the insurance sector for resilience funding would also tap a large pool of payers, but it draws opposition from insurers. In 2019 in the state of Washington, the elected commissioner of public lands, Hilary Franz, proposed a \$5 surcharge on home and auto insurance policies to raise \$63 million annually for wildfire prevention. A US Forest Service study a year earlier had found that 2.2 million homes in the state were at risk of wildfire damage. "Every year, we go in and we beg for dollars for wildfire suppression and forest health," Franz said. "We cannot set this state up to be successful until we truly start investing in the problem."<sup>51</sup> The state legislature did not adopt the legislation.

A 2017 plan for three states—New York, New Jersey, and Connecticut—proposed creation of a Regional Coastal Commission to develop strategies and standards for regional resilience projects.<sup>52</sup> The plan envisioned the creation of Adaptation Trust Funds that would support priority projects and would be organized as public benefit corporations capitalized from surcharges on property and casualty premiums.<sup>53</sup>

***An advantage of using bonds and utility rates is that they spread the costs across very large numbers of payers, which allows the increases to be minimized. But this spread also means that the benefits of resilience building that may be realized are not tied to the costs that one will pay.***

## #2: INCREASE THE STATE'S FINANCIAL RESOURCES FOR RESILIENCE INVESTMENT

### Carbon Pricing

The energy sector is another potential target. California invests in resilience with funds obtained from the carbon-pricing market it uses to reduce carbon emissions. In 2019, the state's cap-and-trade auctions generated more than \$2 billion that was appropriated by the legislature. Investments included:

- \$2 million for coastal resilience planning
- \$10 million for community fire planning and preparedness
- \$85 million for fire prevention
- \$100 million for resilient drinking water systems
- \$2 million for resilience planning in San Francisco Bay area<sup>54</sup>

Virginia's new Community Flood Preparedness Fund, created in 2020, was expected to receive about \$45 million in its first year from the state's share of carbon-auction proceeds of the Regional Greenhouse Gas Initiative.<sup>55</sup>

### Dedicated Tax Revenue

The Georgia Outdoor Stewardship Act became effective in July 2019<sup>56</sup> after the Georgia General Assembly's House bill amending the state constitution passed with 83% of Georgia voters giving the amendment their support. The act dedicates a portion of existing sales and use tax on outdoor sporting goods to support clean water and land acquisition projects that increase resilience across the state of Georgia. The Trust for Public Land partnered with state and local leaders to design and pass the conservation ballot measure.<sup>57</sup>





## 3

SUPPORT DEVELOPMENT OF LOCAL PIPELINES OF  
“READY-TO-GO” PROJECTS FOR CLIMATE RESILIENCE

**WHAT.** State governments can provide resources—funding and expertise—that enable local governments, private sector developers, community organizations, and nonprofit organizations to design numerous resilience projects and get them ready for funding. These pipelines may contain a variety of projects: building new storm-water parks and sea barriers, for instance, or retrofitting a water treatment facility, elevating a bridge or roadway, or modernizing a dam.

Pipeline development includes:

- Assessing the need for the project and the options for meeting the need
- Defining the project, its scope, design, and likely budget requirements
- Considering the feasibility and commercial viability of the project, possible funding options, and review of applicable laws and regulations
- Identifying the consents necessary for project implementation, especially regulatory permits and land rights, and providing evidence that each can be obtained
- Preparing a fully worked through funding/financing plan that can be presented to prospective investors<sup>58</sup>

**WHY.** Building a state financial system for resilience involves more than creating a supply of capital. There also has to be sufficient qualified demand for the money, a robust pipeline of fundable local projects. This is why “priming the pump” for development of critical local infrastructure projects is a traditional role of government that should be applied to resilience strengthening. Developing a ready-to-go pipeline of projects helps position communities to take advantage of funding and financing opportunities that may arise, such as federal government economic-stimulus funds. State support for project pipelines in communities with less capacity and resources to plan projects can ensure they will not be left behind when money is available. As states support pipeline development, they can also work to standardize similar projects in different communities, which may reduce the costs of project development.

***Developing a ready-to-go pipeline of projects helps position communities to take advantage of funding and financing opportunities that may arise, such as federal government economic-stimulus funds.***

#### PIPELINE DEVELOPMENT APPROACHES

■ States can inventory “must do” resilience projects of state departments and local governments. For instance, after Hurricane Irene, Vermont’s Department of Transportation developed an online database of every culvert in the state, inputting local conditions to help plan for resilience. This helped to prioritize maintenance and improvement projects that would decrease climate vulnerability of rural and urban communities. In New York, a coalition of nonprofit organizations assembled by Rebuild By Design reviewed public documents and advocates’ wish lists to develop a statewide inventory of resilience projects to illustrate the need for a state bond issue dedicated to local resilience projects.

■ States can enhance the FEMA Hazard Mitigation planning process to include resilience outcomes. Massachusetts developed a Hazard Mitigation and Climate Adaptation plan that built on the FEMA planning process<sup>69</sup> to include climate change hazards and prioritize projects and processes that would reduce the impact of drought, flooding, extreme heat, and wildfire. The EPA’s Office of Community Revitalization identifies state agency resilience action plans as key portals to local resilience funding. For instance, in Minnesota and Wisconsin, these plans have helped identify a few key actions that support local priorities and are not being addressed through traditional hazard mitigation planning.

■ States can partner with nonprofit conservation/environmental organizations. Several nonprofits—Trust for Public Land (TPL) and The Nature Conservancy, for example—are developing “nature-based” projects across the US that protect ecosystems and, in many cases, can strengthen local resilience, especially for rural communities. After wildfires burned 1.8 million acres in California in 2018, TPL experts canvassed the state to develop a high-priority list of resilience and recovery projects.

■ States can support resilience design competitions in regions. The New York City and San Francisco Bay regions conducted elaborate competitions, with funding from philanthropies, to identify essential resilience projects at parcel, site, neighborhood, community, and landscape or watershed scales. The New York competition, managed by Rebuild By Design, led to about \$1 billion in federal funding for projects. The San Francisco competition selected nine projects, seven of which have obtained funding to advance into the design stage.

## 4

## ENABLE LOCAL FUNDING FOR IMPLEMENTING PUBLIC INFRASTRUCTURE PROJECTS



**WHAT.** State governments should provide local governments with an array of tools—an enabling environment—for obtaining and attracting financial resources they need to cover significant costs of retrofitting and building climate resilient infrastructures. These financial tools fall into several categories:

- Resilience-building grants and loans from existing and new state government entities and programs
- Increased local taxation authority to raise revenue for resilience building
- New local authority to create special-purpose entities to fund resilience projects
- Credit rating support for local borrowing from the municipal bond market

***Funding currently available from states is insufficient and typically not flexible enough to meet local governments' needs.***

**WHY.** Local government budgets are simply not big enough to cover many of the costs that building climate resilience requires. Communities large and small report they don't have the money to fully implement resilience plans, and even municipalities that have allocated substantial local funds for short-term resilience improvements are unlikely to be able to afford the longer-term costs. (See [“Playbook 1.0: How Cities Are Paying for Climate Resilience.”](#)) Funding currently available from states is insufficient and typically not flexible enough to meet local governments' needs. It is in a state government's interest to address this financial problem since local resilience building can prevent substantial future costs in infrastructure repair and disaster-emergency relief, as well as loss of state and local tax revenues (property, income, sales, and business taxes/fees) due to chronic and acute climate hazards. Resilience investments can generate \$6 in cost savings for every \$1 invested, according to an analysis of risk-mitigation funding by federal agencies.<sup>60</sup>



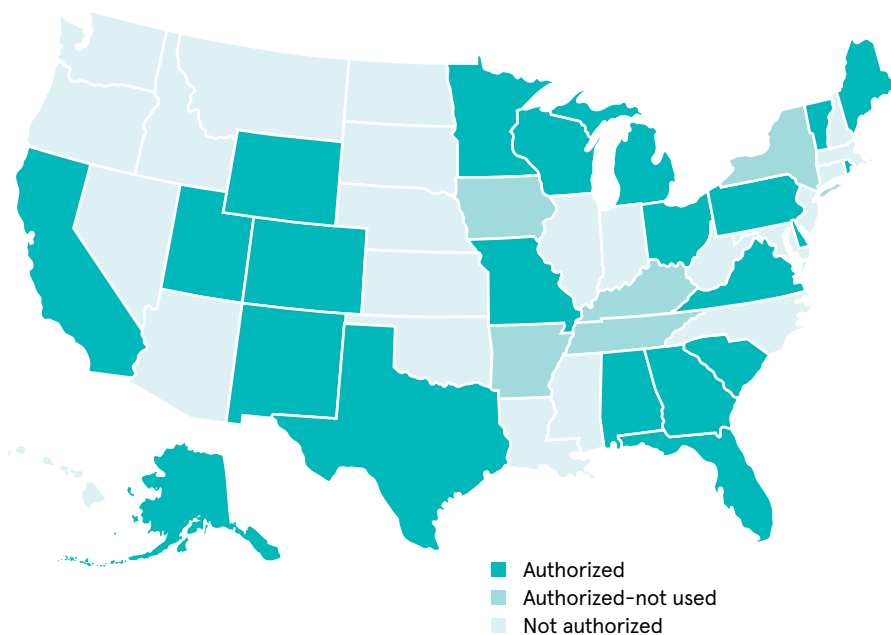
## ENABLING ENVIRONMENT TOOLS

### State Grants and Loans

Some states use existing state financial entities, or are creating new entities, to provide local governments with resilience-building grants and loans. These entities include:

■ **State Infrastructure Banks.** These state entities are designed to provide and generate funds for local resilience projects. Rhode Island's Infrastructure Bank, discussed earlier, is an example. In 2016, the US Conference of Mayors identified 22 states with active infrastructure banks, though it did not specify which ones funded resilience projects. (Although [Green Banks](#) are sometimes combined with infrastructure banks, the financial support they provide focuses mostly on leveraging private investment in resilience and low-carbon projects. See Recommendation #5.)

— In 2020, Virginia created the Virginia Community Flood Preparedness Fund, a low-interest, revolving loan and grant fund to help local governments adapt to coastal and inland flooding. Local governments can tap the fund to support construction projects, implement land-use standards for resilience, and prepare flood-prevention studies. The state expects to put \$45 million annually into the fund, with revenue coming primarily from carbon auctions generated through the state's participation in the Regional Greenhouse Gas Initiative. Additional sources of revenue can also support the fund including money appropriated by the Virginia General Assembly, federal funding, and the repayment of local government loans.<sup>61</sup>



#### STATE INFRASTRUCTURE BANKS

- Authorized in 27 states, 22 of which have active infrastructure banks
- One state (California) deems roads, transit and water projects as eligible, while 15 states deem road and transit projects eligible. Four states deem only road projects as eligible, one state (Wyoming) funds water and roads and one state (Delaware) funds only water projects.

(US Conference of Mayors)

#### #4: ENABLE LOCAL FUNDING FOR IMPLEMENTING PUBLIC INFRASTRUCTURE PROJECTS.

■ **State Revolving Loan Funds (SRF) for Water Infrastructure.** All 50 states have clean water and drinking water state revolving funds, partly funded by an annual federal investment, and some states have revised policies to focus explicitly on resilience building. For example:

- Maine’s Clean Water State Revolving Loan Fund provides low-interest loans to municipalities. Through principal forgiveness on loans, the fund encourages the development of climate adaptation plans that inform construction of wastewater infrastructure projects, i.e., publicly owned sewage collection systems, interceptor sewers, pumping stations, and wastewater treatment plants.<sup>62</sup>
- Ohio worked with the US Environmental Protection Agency to allow its revolving fund to finance the protection and restoration of streams and wetlands, a non-point source solution that boosts natural-system resilience.<sup>63</sup> Ohio’s program also includes a linked deposit program which opens up the SRF to private organizations and individuals who can borrow from a private lending entity at a below-market interest rate for nonpoint source projects.
- North Carolina’s program offers 0% interest loans for green projects and has developed a Wastewater Reserve program that sets aside a portion of the state’s federal allocation for grants and low-interest loans for planning, design, and construction of critical water infrastructure for economically disadvantaged communities. Eligible municipalities may receive up to \$3 million for three years of work (presumably covering a multi-year project, involving planning, design, and construction). The state also awards funds to study the potential benefits of merging existing local water infrastructure systems to be more efficient.<sup>64</sup>

- In the Great Lakes area, both New York and Pennsylvania have institutions established to market and sometimes creatively use these funds; there are built in incentives for “green project reserves” and “economically disadvantaged communities.” They are not explicitly tied to climate resilience planning and strategy but should be.

■ **Property Buy-Out Funds.** These are used to purchase and remove privately owned buildings in floodplains and other at-risk areas. Most buy-out programs administered by states are funded by FEMA and/or the US Department of Housing and Urban Development, with states providing matching funds. The US Department of Agriculture also funds buyouts; between 1996 and 2015, the department purchased 180,000 acres for emergency flood control in 36 states.<sup>65</sup> But increasingly state and local governments are also using their own funds for this purpose. After Hurricane Sandy, for example, New York and New Jersey pledged a total of \$700 million in state and federal funds for buyouts in flood-prone areas.<sup>66</sup> Also:

- In 2018 voters in Harris County, TX (where Houston is located), approved a \$2.5 billion bond issue for flood control, with nearly \$250 million allocated for acquisition of property in flood plains.<sup>67</sup>
- Charlotte and Mecklenburg County in North Carolina have used a utility surcharge to raise more than \$60 million that has been used to acquire about 700 houses and create nearly 200 acres of open land.<sup>68</sup>

#### #4: ENABLE LOCAL FUNDING FOR IMPLEMENTING PUBLIC INFRASTRUCTURE PROJECTS.

■ **Environmental Protection and Open-Space Grants.** These improve and preserve natural systems that act as buffers against flooding, wildfire, and other climate hazards. This can include coastal and wildfire protection funding programs. Wisconsin's Municipal Flood Control program offers grants through the state's Department of Natural Resources that prioritize voluntary property buyouts and land transfers. Similarly, New Jersey's Department of Environmental Protection runs the Blue Acres program, which acquires flood-risk properties and transfers land to open space uses. With support from the Trust for Public Land, Georgia voters approved the Georgia Outdoor Stewardship Act in a 2018 ballot initiative to further clean water and land acquisition projects.

- Community land trusts may offer another vehicle for resilience-strengthening protection of natural systems. The nonprofit trusts take ownership of land that they and/or local and state governments have acquired and allow the land to revert to open space and/or restore its environmental and resilience value. Some trusts also develop or maintain affordable housing, community gardens, civic buildings, and commercial spaces.

■ **State Programs.** Various state departments may have programs with grants that can be used for local resilience projects. For example, Massachusetts' flagship Vulnerability Preparedness Action Grant Program has committed to awarding \$1 billion between 2017 and 2022. In winter 2020, it awarded \$11.6 million in grants; to date more than 80% of the state's communities have been involved in the program.<sup>69</sup> In 2020 Rhode Island's Department of Environmental Management awarded \$4.36 million in grants to 13 municipalities and community organizations for climate-resilience projects, using funds from state-issued clean water and green economy bonds.<sup>70</sup> In addition, some states' other grant programs can be revised to permit the local use of funds for resilience projects. For instance, city leaders in Charleston, SC, expressed interest in having resilience building

become an eligible use of money the city receives from the State Accommodations Tax, which can be used for tourism-related capital projects and operating costs.

■ **State Treasury Linked Deposit Funds.** Most states have enabling legislation that supports linked deposit investing, in which state and local government funds that might otherwise be deposited in non-interest-bearing accounts are used instead to purchase certificates of deposit from the lenders. Participating governments earn a financial return on their deposits, the money from which is used by the banks to invest in public purposes designated by the governments. Common purposes include support for local agriculture and family farms, affordable housing, small business development, energy efficiency, and recycling initiatives. This mechanism could be extended to cover resilience-oriented lending by financial institutions for public and private borrowers.<sup>71</sup>

#### **Local Taxation Authority**

Many states provide local governments with the authority to impose certain types of taxes locally. For example, 16 states give local governments the option of levying a fuel tax, 29 have a local option sales tax, and 26 have a local option motor vehicle fee.<sup>72</sup> So an option states have is to expand local authority to raise revenue in this way.

Iowa provides local governments with the emergency taxing authority to raise property taxes a small amount for a year. In 2020, Iowa City imposed a small, emergency property tax increase to raise nearly \$1 million-a-year to fund climate-emergency actions. The increase will cost property owners \$24 yearly on every \$100,000 of property value. The city has used this emergency authority in the past to deal with flooding.

It's not unusual for some communities to use multiple state-authorized local-option mechanisms. The revenue sources of Charleston, SC, for example, include a local

#### #4: ENABLE LOCAL FUNDING FOR IMPLEMENTING PUBLIC INFRASTRUCTURE PROJECTS.

2% Hospitality Tax on sales of prepared meals, food, and beverages, a local Accommodations Tax of 2%, and a local option sales tax of 1%, in addition to obtaining funds from the state's Accommodations Tax of 2%.

### Local Authority for Special-Purpose Financial Entities

States have also allowed local governments to create a variety of entities to collect and spend revenue for special purposes. These can be authorized to support resilience investments and, increasingly, states are looking at authorizing new local entities dedicated specifically to resilience.

Among the special purpose entities are:

- **Tax Increment Financing (TIF) Districts**—In nearly every state municipalities are allowed to divert future property tax revenue increases from a defined area or district toward an economic development project or public improvement project in the community. Unlike municipality-wide property taxes, TIFs target fees to the distinct needs of a district.
  - TIFs could be used to take advantage of green infrastructure improvements that add to the future value of property, attract visitors and increase local business sales, and create jobs. The Center for Neighborhood Technology suggests that an application is “tree increment financing,” or capturing the additional property value caused by planting trees or installing other green infrastructure. San Francisco has created a structure for residential and mixed-use neighborhoods known as a “Green Benefits District,” which can build and maintain green stormwater infrastructure and other open space improvements.<sup>73</sup>

- **Stormwater Utilities**—More than 40 states permit local governments to create stormwater districts and establish fees to pay for managing storm-related flooding and runoff. For example, New Jersey's law, adopted in 2019, allows locally established stormwater utilities to collect fees based on the amount of stormwater the property generates that needs to be managed. Funds generated from these fees are dedicated to stormwater management and cannot be diverted for other purposes.<sup>74</sup>

- **California expanded the authority of its Enhanced Infrastructure Financing Districts** to include public infrastructure projects for climate resilience. These districts may borrow funds from private capital markets, repaying loans with a portion of local property tax revenue or project revenues.

- **Several states have allowed local governments to establish resilience-specific entities.** Maryland in 2020 adopted legislation that allows one or more local governments to establish a resilience authority, a new entity that can bond against local government revenue, to raise money to finance resilience infrastructure projects.<sup>75</sup> Resilience authorities have the power to:
  - Undertake, finance, manage, acquire, own, convey or support resilience infrastructure projects—which are defined as infrastructure that “mitigates the effects of climate change.” This specifically includes flood barriers, green spaces, building elevation, and stormwater infrastructure.

***Maryland in 2020 adopted legislation that allows one or more local governments to establish a resilience authority, a new entity that can bond against local government revenue, to raise money to finance resilience infrastructure projects.***



#### #4: ENABLE LOCAL FUNDING FOR IMPLEMENTING PUBLIC INFRASTRUCTURE PROJECTS.

- Finance or refinance acquisition, planning, design, construction, repair, renovation, reconstruction, expansion, site improvement, and capital equipping for resilience infrastructure projects.
- Receive money from their incorporating government, the state, other governmental units, or private organizations for its services to back limited-obligation bond issuances, subject to approval of the incorporating local government. (Authorities may not levy taxes.)

The enabling legislation is broad and flexible; it is expected that what the authority will look like in each locality will be different. Designers of the legislation believe the authorities will provide local governments with flexibility to implement innovative financing mechanisms, such as debt guarantees and investment in resilience-based ventures. They can also be designed to work for multiple local jurisdictions, which will provide a faster way to finance resilience projects than would occur if the jurisdictions try to coordinate their respective capital investment processes. Authorities, as distinct entities, will be able to work in partnerships with other sources of private and public capital, which might be prevented by a government's typical procurement processes.

#### Credit Ratings

■ States can help to reduce the cost of long-term borrowing by local governments. Maintaining or upgrading their own credit ratings can reflect positively on local credit ratings. States can also help reduce local credit costs in several other ways: reducing other forms of local government debt, such as pension obligations, that may drag down municipal credit ratings, or increasing communities' ability to raise local taxes, since lenders carefully evaluate the ability of communities to repay loans. These cost improvements are valuable for every type of municipal bond borrowing, from general obligation bonds to traditional revenue bonds to environmental and social impact revenue bonds.

***States have also allowed local governments to create a variety of entities to collect and spend revenue for special purposes. These can be authorized to support resilience investments and, increasingly, states are looking at authorizing local entities dedicated specifically to resilience.***



## 5

## LEVERAGE PRIVATE INVESTMENT IN LOCAL RESILIENCE DEVELOPMENT



**WHAT.** State governments can stimulate substantial private investment in resilience building for private purposes such as protecting private land, buildings, and businesses—and this can contribute significantly to a local community’s overall resilience. Certain economic sectors in states—real estate, finance, insurance, and energy, for example—have strong interests in local climate-resilience building but have not yet unleashed substantial capital investment for resilience. State governments can use the traditional “carrots and sticks” of government policy—financial incentives and regulatory requirements—to guide private capital into resilience building. They can customize policies for specific targeted economic sectors.

**WHY.** The overall resilience of a community or state depends on more than climate-proofing public infrastructure and facilities. Private property and businesses also need protection from and adaptation to climate hazards. States have an interest in ensuring that the private sector invests in reducing its own climate risks since the alternative could be that investors and lenders in properties and businesses choose to manage their exposure to the risks by reducing or eliminating their investments. Analysts are increasingly raising the alarm about potential climate-driven “capital flight” from communities and sectors as investors and lenders begin to avoid or pull out from climate-risky properties and businesses.

## PRIVATE INVESTMENT LEVERAGING MECHANISMS

A 2020 report, “A Roadmap to Resilience Incentivization,” by the National Institute of Building Sciences and based on deliberations of the Multi-Hazard Mitigation Council, proposed a set of incentives by which finance, insurance, real estate, and government infrastructure stakeholders would share more fairly the costs of resilience. Incentives, it noted, can be built into mortgages, insurance policies, tax incentives, grants, and other mechanisms. “The incentives include loan discounts and preferences; insurance premium reductions; tax incentives; grants; and others. Insurers already offer some resilience incentives. Green lending could expand into the resilience market. A variety of public-sector programs promote energy efficiency and could be expanded to better promote disaster resilience.”<sup>76</sup>

*States have an interest in ensuring that the private sector invests in reducing its own climate risks since the alternative could be that investors and lenders in properties and businesses choose to manage their exposure to the risks by reducing or eliminating their investments.*

### Incentives

States have a number of tools that can provide financial incentives for private investment in resilience building:

■ **Tax Credits.** State tax breaks, such as those that boosted early large-scale production of renewable energy, along with preferential tax treatment for income from resilience projects, can help to stimulate private investment in resilience. Credits can be offered for a range of actions that build resilience. For instance, property owners and developers could be motivated to invest in green infrastructure on their land and buildings to mitigate flooding. Other angles on tax incentives that could support resilience include:

- In Massachusetts the Community Investment Tax Credit provides a 50 percent tax credit for private and corporate donors that give to community-led development initiatives.
- In Ohio, Cincinnati offers 100% tax abatements for 10–15 years for new construction and existing building retrofits that are LEED certified.<sup>77</sup>

■ **Green Banks.** These public investment entities are initially capitalized by public funds as well as philanthropic and institutional investors such as pension funds. They use public funds to attract private capital to green projects, financially supporting transactions that, with scale and experience, can ultimately be financed by the private sector without government support. Connecticut established the first state green bank in 2011, and New York created a green bank in 2014. Rhode Island's Infrastructure Bank incorporates some elements of a green bank. California, Hawaii, and New Jersey also have green banks. Other states have various sorts of clean-energy funds that perform green bank-like functions.

To date, green banks have focused on clean energy and renewables transactions; resilience investments have not traditionally been a part of their legislated priorities. But "Green Banks around the US are beginning to finance resilience measures," reported the Coalition for Green

Capital in 2018, citing Rhode Island's Municipal Resilience and stormwater resiliency programs and a program of the Florida Solar Energy Loan Fund to finance renovations to boost storm-resilience of homes.<sup>78</sup>

■ **Business Improvement Districts (BID).** States create these districts to allow businesses within a defined area to pay an additional tax on property and obtain other public or private funding to pay for projects, including capital improvements, and services that the local government is not undertaking. The formation of BIDs varies state by state. Most states rule that a BID must be governed by a board of directors composed of a certain percentage of property owners, business owners, and residents in the district, as well as public officials.

■ **Direct public investment in private stormwater management.** States can support definitions of "public benefit standards" to allow government investment in resilience projects on private property. They can help communities expand their capacity to acquire property in floodplains, provide grants to property owners for technical assistance, and provide low-interest financing for private property improvements.

■ **Stormwater credit trading.** Municipalities or utilities can create a private market for the purchase and sale of stormwater credits, allowing the market to establish the appropriate value for these credits and encouraging private property owners to build stormwater infrastructure by establishing a market for it. In the market, property owners that manage their stormwater above minimum regulatory standards can generate credits based on how much stormwater they manage and sell these credits to other property owners who need them to meet their stormwater requirements.<sup>79</sup>

■ **Philanthropic support.** Grants and investments by philanthropic entities can be used to support other private investment in resilience, taking some of the financial risks or filling gaps between public funds and private capital. Some mechanisms, such as the [Living](#)

Cities' Catalyst Fund, pool capital from foundations to provide below-market rate investments and loan guarantees in underserved communities.

- **Development incentives.** Providing developers with project-based incentives, such as waivers of height limits on new buildings, can be exchanged for investment in increased resilience of the development site.

- **Earned income**—e.g., incentives for installation of electricity microgrids. In addition to some grant support, California allows microgrids to earn money by putting electricity generated into the state's grid. In mid-August 2020, as the state experienced rolling blackouts, microgrids around the state delivered backup electricity and produced income for owners. A network of home microgrids on one day provided 220 MWh to the grid and was paid \$300,000 for its energy.<sup>80</sup>

- **Performance contracting.** The use of public-private partnerships can attract private capital into resilience projects. In the Great Lakes region, for instance, leaders are experimenting with alternative finance delivery options such as Community-based Public-Private Partnerships (CBP3).<sup>81</sup> An early leader is the Milwaukee Metropolitan Sewerage District, which entered into a CBP3 with the company Corvias. Working together, they will design and construct 8.45 million gallons in stormwater management projects through green infrastructure that reduces overflows and flooding and improves water quality. The program is budgeted at \$20 million over three years, and Corvias is paid \$2.37 for every gallon of storage created with green infrastructure.<sup>82</sup> Corvias will provide upfront financing, design, and construction.

### Standards and Regulations

Across agencies and sectors, states should require companies to regularly conduct climate-risk assessments to ensure that in the future they prioritize investment in reducing their own climate exposure and vulnerability. For state-regulated financial firms,

states can require periodic climate-stress tests to ensure financial-sector stability. For all firms operating in a state, states can include climate risk management as a duty of company directors and investors.

In several sectors, targeted regulatory actions can also stimulate increased investment in resilience.

#### Real Estate/Built Environment.

- Upgrading building codes to increase resilience. In the 2019 “National Building Code Assessment Report,” Neil Spector, president of ISO Underwriting, noted that “industry data shows that effective building codes have a strong positive effect on disaster preparation and resilience.” Communities with “well-enforced, up-to-date codes generally demonstrate better loss experience, both monetarily and in terms of human suffering.” They “fare better during a natural disaster or catastrophe, cutting down on insured losses while providing better protection to properties, residents, and businesses.” But, the report added, “code adoption and enforcement practices vary widely from community to community, even within the same state.”<sup>83</sup>

In 2020, FEMA also highlighted the importance of building codes for strengthening resilience. It released a study of building codes in Florida and California that found that adoption and enforcement of “modern hazard-resistant building codes” would save billions of dollars in future losses due to flooding, wind, and seismic damage. FEMA noted that 18 states had not adopted statewide minimum requirements for elevation above flood levels, eight states had weakened some minimum wind provisions, and 10 states had not mandated statewide adoption of seismic provisions.<sup>84</sup>

Later in 2020, when FEMA unveiled its new resilience-building program, Building Resilient Infrastructure and Communities (BRIC), the eligible uses of funds included incentives for state and local adoption and enforcement of “building codes, standards, and policies that will protect the health, safety, and general welfare of the public, take into account future conditions, and have long-lasting impacts on community risk reduction, including for critical services and facilities and for future disaster costs.”<sup>85</sup> FEMA also included building codes in its technical evaluation criteria for proposals to BRIC.

States can revise building codes so that design and construction practices ensure that new buildings can weather, for the life cycle of the facility, the intense storms, high winds, fires, floods, and extreme heat that are increasing due to climate change. For example:

- Rhode Island amended its building code to require that development in coastal areas be at least one foot above flood levels. The state offered expedited permitting for projects that would meet the insurance industry’s Fortified Home Program, which helps new and existing homes to better withstand catastrophic weather.<sup>86</sup>
  - California’s legislature required the state’s building standards commission to consider ways to reduce the heat island effect in new construction.
  - States with seismic retrofit standards for buildings cover a large portion of the state’s building stock, both existing and new construction.
- Requiring disclosure of a property’s climate exposure. In 2019 Texas became the 29th state to require sellers of houses to disclose to potential buyers the property’s flood risks or past flood damages.<sup>87</sup> The new law added questions to the

***States can revise building codes so that design and construction practices ensure that new buildings can weather, for the life cycle of the facility, the intense storms, high winds, fires, floods, and extreme heat that are increasing due to climate change.***

“Seller’s Disclosure Notice,” including whether the property has flood insurance coverage or experienced previous flooding due to reservoir failure or a natural flood; whether the property is located in a 100- or 500-year floodplain; and whether the seller had ever filed a claim for flood damage with any insurer, including the National Flood Insurance Program, or received assistance from FEMA or the US Small Business Administration for flood damage to the property.<sup>88</sup>

In a state-by-state analysis, the Natural Resources Defense Council scored the new law as only “adequate,” noting that sellers had not been required to disclose whether the property was mandated to be covered by flood insurance due, for instance, to prior receipt of federal disaster aid. NRDC rated neighboring Louisiana and Oklahoma’s disclosure laws as “best.”<sup>89</sup>

An additional concern: if disclosure only requires certification that property is inside or outside of a FEMA-identified flood plain, this will leave out many properties in urban areas that flood but are outside of FEMA’s limited, out-of-date maps.

Additionally, the historical data exists to allow state disclosure requirements to be expanded to include severe weather exposure—heat, wet weather, high wind, for example—not just flooding.

- States can require private developers to meet a particular resilience standard or to contribute towards necessary resilient infrastructure in order to receive development permission.

■ Insurance. Several states mandate insurance discounts or credits for property owners who take certain actions to mitigate weather-related damage, such as wind-resistant features, seismic-resistant retrofitting, and wildfire safety measures for neighborhoods taken by communities.<sup>90</sup> Other actions could include:

- Promoting green insurance products. California’s insurance commissioner created the nation’s first consumer-oriented list of “green” insurance products in 2020 to help the public understand and access these products and encourage further insurance policy innovation in commercial, home-owners, and auto lines. “Recognizing the potential for specific insurance products to address climate risks and contribute to a sustainable future will encourage consumers and insurance companies to explore products that harness new technologies and promote resilience,” Insurance Commissioner Ricardo Lara said. The [Climate Smart Insurance Products Database](#) contains more than 400 products divided into nine categories including Fortified Homes, Nature-Based Solutions, and Green Buildings and Equipment. California is working with the State of Washington’s insurance commission to update and enhance the inventory.

***State insurance regulators should take multiple steps to ensure that the sector increasingly takes into account the material risks that climate change poses.***

- Accounting for climate risks. State insurance regulators should take multiple steps to ensure that the sector increasingly takes into account the material risks that climate change poses, according to a 2020 report by the environmental and sustainability nonprofit Ceres.<sup>91</sup> These steps include:

- Acknowledge the material risks climate change poses to the insurance sector and pledge coordinated action with other states and the federal government to address them
- Require insurance companies to conduct climate-risk stress tests and scenario analyses to evaluate potential financial exposure to climate change risks.
- Require insurance companies to assess and manage their climate risk exposure through their investments and examine how climate trends affect company holdings and long-term solvency.
- Encourage insurers to develop products for the new technologies, practices, and business models that will emerge in response to climate risk that are responsive to both risks and opportunities.
- Mandate insurer climate risk disclosure using the recommendations of the [Task Force on Climate-related Financial Disclosures](#).

In addition, it’s crucial for insurance commissioners to require that the industry help to build an all-states database of flood claims coded by geography—so that states and property owners have a dependable source of information about where flooding has happened.

## 6

## PUSH TO EXPAND AND INCREASE FLEXIBILITY OF FEDERAL FUNDING FOR PRE-DISASTER RESILIENCE



**WHAT.** State governments can press the federal government—Congress and the executive branch departments—to more rapidly increase the amount of funding available for resilience building. They can seek to leverage resilience beachheads that have been made in several traditional federal funding streams—FEMA and the US Department of Housing and Urban Development, for example. They can promote increased and more flexible funding for resilience-relevant traditional federal sources for water and transportation infrastructure. And they can consider other approaches, such as added funding for local community development financial institutions, which receive support from the Department of the Treasury, and changes in the National Flood Insurance Program.

**WHY.** For decades federal resources—tens of billions of dollars annually—have focused mostly on the aftermath of disasters rather than prevention and on promoting housing and business development in areas that are at risk of flooding and other weather events. As a result, building resilience—and the long-term cost savings it can produce—is shortchanged and, in many cases, federal funding supports maladaptation that reduces local resilience. Meanwhile, federal efforts such as Army Corps of Engineers flood-prevention projects and funding for property buyouts in floodplains are underfunded and slow to act.

### FEDERAL FUNDING FOR RESILIENCE

The federal government “does not have a strategic approach to guide its investments in high-priority climate resilience projects,” reported the US Government Accountability Office in late 2019. The GAO study found that since 2005 federal funding for disaster assistance totaled at least \$450 billion—and would likely increase due to climate change. “Current federal climate resilience investments are ad hoc and not aligned with the nation’s most significant climate risks.” The GAO recommended that Congress consider establishing “a federal organizational arrangement to periodically identify and prioritize climate resilience projects for federal investment.” Its report pointed to Louisiana’s Coastal Protection and Restoration Authority, a master planning effort initiated after Hurricane Katrina, as an example of the strategic coordination that was recommended.<sup>92</sup>

***The GAO study found that since 2005 federal funding for disaster assistance totaled at least \$450 billion—and would likely increase due to climate change. “Current federal climate resilience investments are ad hoc and not aligned with the nation’s most significant climate risks.”***



## #6: PUSH TO EXPAND AND INCREASE FLEXIBILITY OF FEDERAL FUNDING FOR PRE-DISASTER RESILIENCE

Lack of coordination is just one concern with the federal non-approach to climate resilience. In general, key federal programs have been designed for post-disaster recovery much more than for pre-disaster resilience building and have supported real estate development even in places with significant risk of flooding and other natural disasters. Even though in recent years some resilience-building funding has been provided to both FEMA and HUD, it's not nearly enough money. FEMA can now use 6% of its funding—estimated as \$300–500 million annually—on pre-disaster mitigation, and recently announced a new program, Building Resilient Infrastructure and Communities (BRIC), for that purpose. HUD was allocated \$16 billion to reduce climate risks in nine states, Puerto Rico, and the US Virgin Islands. In addition, highway infrastructure legislation under congressional consideration in mid-2020 contained a first-time program for supporting coastal infrastructure threatened by sea level rise and storm surges.

Consider, though, how much money is needed: Louisiana's planning, the GAO reported, identified \$50 billion in high-priority projects to be implemented when funding is available. In Texas, it would cost more than \$20 billion to construct a system of barriers and gates to protect the coast with its large endowment of oil refineries and chemical plants. But the project would not hold back storm surges from category 4 and 5 hurricanes, which could mean having to spend more money on additional defense measures.<sup>93</sup> Even a

neighborhood-scale project in New Orleans, modernizing water-management infrastructure in the Gentilly neighborhood, came with a price tag of more than \$141 million.<sup>94</sup>

Here is what states need from the federal government, recognizing that one size does not fit all states,

- Affirmation of the need for strengthening climate resilience as a national priority and a federal responsibility. Among other things, this should take the form of supporting states in developing their resilience frameworks, especially inter-department coordination, assessment of climate risks, and resilience standards for public infrastructure. In addition, there should be a federal effort to identify and remove barriers to state and local use of existing funds for resilience strengthening.

- Support for state, regional, and local community resilience planning efforts for the short and medium terms (5–10 years). Federal efforts could leverage local planning requirements in states that have them; encourage and incentivize local planning in other states; and more generally support state-local partnerships for resilience building. FEMA's new BRIC program, for instance, will provide non-financial technical assistance to communities to build their capacity to develop and implement resilience projects. The development of local plans could be a requirement for obtaining other federal funding for local resilience.

### A FEDERAL APPROACH TO SUPPORTING STATE-LOCAL FUNDING AND FLEXIBILITY

A federal model for easing into a planning-driven, more strategic approach for state-local resilience building is the Intermodal Surface Transportation Efficiency Act of 1991, now known as the FAST Act. The law devolved authority to both States and metropolitan areas, provided funding flexibility to allow highway dollars to be used for transit and

other transportation modes and also for projects to reduce transportation demand, including those that help reduce air pollution. FAST also put teeth into public engagement ("it should be early and continuing"). Current authority lapses September 30, 2020, but it will certainly run on extensions until the next session of Congress.

## #6: PUSH TO EXPAND AND INCREASE FLEXIBILITY OF FEDERAL FUNDING FOR PRE-DISASTER RESILIENCE

■ Increased funding for existing federal funds—transportation and water infrastructure, flood prevention, FEMA, and HUD—with resilience building designated as an eligible use and more flexibility in how states match and use the funds. Flexibility is needed to encourage experimentation in paying for projects, e.g., allowing incentives for innovation and use of private investment, converting loans to grants based on project performance, packaging regional-scale projects and funding. Flexibility also is needed to support non-traditional resilience solutions such as the use of green infrastructure. BRIC will pay for projects that incorporate nature-based solutions and for adoption and enforcement of modern building codes.<sup>95</sup>

■ Resilience investments in federal property and assets, many of which are located in or near local communities. A good example of this is Department of Defense sites, military bases, around the nation. Along these lines, the federal government could require that any project receiving federal funding must use predictions of future climate risks to inform design of the project.

■ Set asides and enhanced support in federal resilience funding for economically disadvantaged communities to ensure that some places are not left out of resilience strengthening. BRIC provides up to 75% of funded projects, but for small, impoverished communities it provides up to 90% per project.

■ Criteria for resilience funding that seek economic, health, and other community benefits from local-level resilience-building investments.

■ Reform of the National Flood Insurance Program (NFIP). This federal program, established in the 1960s, provides property owners with financial benefits—payments on damage claims and insurance premiums subsidized by US taxpayers. Because NFIP collects less from policyholders than it pays out in claims, it has borrowed funds from the US Treasury to cover its losses.

The GAO reported that although Congress cancelled NFIP's debt of \$16 billion in 2017, by early 2020 the program owed Treasury \$20.5 billion. Among the topics raised to strengthen NFIP since the last major changes were made in 2014:

- Provide reliable funding for flood-hazard mapping. While FEMA classifies 8.7 million properties as having substantial risk, within Special Flood Hazard Areas, its maps are out of date and have not taken climate risks into account. The First Street Foundation conducted a mapping exercise that include climate risks and identified 14.6 million properties as having substantial risk—70% more than FEMA. Disaster losses may be exacerbated when local decisions are based on currently flawed flood maps and, thus, signals about where and how to build are not informed by modern risk information and robust building codes.
- NFIP's below-market rate flood insurance policies do not reflect the full risk of loss in floodplains, which dilutes price signals that would help communities and property owners make informed decisions about the true cost of occupying flood-prone areas. If the cost of flood insurance increases, however, low-income homeowners should receive additional financial support to cover insurance costs.
- Requiring federally funded post-disaster rebuilding of infrastructure and buildings to meet science-based building codes and standards that are proven to perform better in extreme weather.



# CONCLUSION

As the climate emergency unfolds, states will be under increasing pressure to take responsibility for protecting life, property, and business from climate hazards. The challenge of resilience is mostly local—it happens or doesn't happen in communities throughout a state. But local governments don't have the capacities, including financial wherewithal, to cope entirely with the climate risks they face during the next decades.

States have the ability to make a difference in building local climate resilience. They can reap the rewards of improving quality of life, reducing climate-disaster impacts, and increasing economic stability for their constituents—by fully enacting their unique potential to create a climate-resilience financial system that local governments can use for decades to come.

***As the climate emergency unfolds, states will be under increasing pressure to take responsibility for protecting life, property, and business from climate hazards. States have the ability to make a difference in building local climate resilience.***



# FRAMEWORK CHECKLIST: STATE CLIMATE RESILIENCE ACTIONS

This checklist provides state government leaders and stakeholders with a quick way to self-assess their progress on developing and implementing an approach to strengthening climate resilience.

The checklist uses the framework for state resilience (rows 1-14) and the recommendations for developing a state-local climate resilience financial system (rows 15-24) that are contained in “How State Governments Can Help Communities Invest in Climate Resilience.”

For each row, check whichever column best describes the state’s current situation.

A completed checklist will suggest areas that need strengthening to further state resilience and can be compared annually to gauge progress.

DOES THE STATE...	No and no plan to do this	State is planning to do this	State is starting to implement this statewide	State is well down the road of implementing this statewide	Don't know
<b>1</b> Have an interdepartmental body to coordinate climate resilience action	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>2</b> Have principles or other guidance for state investment in resilience building	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>3</b> Have a state climate resilience plan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>4</b> Have resilience standards for state infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>5</b> Have resilience standards for new buildings in the state	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>6</b> Have resilience policies for utilities (e.g. water, electric)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>7</b> Have an insurance commission with climate-risk policies for the insurance sector	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>8</b> Dedicate specific revenues/funds for use in climate resilience strengthening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>9</b> Generate additional revenue exclusively for resilience building	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>10</b> Have criteria for investing state funds equitably in climate resilience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>11</b> Have research, funding, outreach, or other resilience-building partnerships with universities, nonprofits or networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## FRAMEWORK CHECKLIST: STATE CLIMATE RESILIENCE ACTIONS



DOES THE STATE...	No and no plan to do this	State is planning to do this	State is starting to implement this statewide	State is well down the road of implementing this statewide	Don't know
<b>12</b> Have an agenda for federal policies/programs to support state and local resilience building	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>13</b> Include resilience building in the state's all hazard mitigation plan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>14</b> Provide ways for local governments to address regional and metropolitan resilience challenges and opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>15</b> Provide local governments with climate data and risk analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>16</b> Provide local governments with technical guidance and assistance for developing climate resilience plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>17</b> Provide local governments with communications assets/support for building public commitment to resilience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>18</b> Provide local governments with support in developing local "ready to go" projects for resilience building	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>19</b> Provide local governments with authority to generate and spend <u>local</u> funds for resilience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>20</b> Provide local governments with ways to leverage private investments for local resilience development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>21</b> Have funds that can be used to buy out at-risk properties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>22</b> Provide real estate developers or owners with incentives to strengthen property resilience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>23</b> Have building codes that require strengthened resilience of properties and buildings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>24</b> Have an infrastructure bank whose funds can be used for resilience strengthening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

# APPENDICES

## Inventory of Climate Resilience Actions

Communities are developing and implementing a multitude of resilience-building actions and inventing new ones all of the time. Melissa Stults developed an inventory, sorted by climate hazards, that offers one of the more thorough snapshots of resilience actions. This was contained in her 2016 doctoral dissertation, [“Planning to be Prepared: Assessing Local Level Planning for Climate Change in the United States.”](#)

Starting from left, column one denotes the six major climate drivers, column two the local impacts most likely to occur due to those drivers, column 3 examples of commonly promoted actions within the peer-reviewed and gray literature to adapt to those impacts, and column four denotes the type of action. This table is not meant to identify every possible potential action.

Climate	Impact	Suggested Actions	Type
Temperature change	Extreme heat	Open additional cooling centers during extreme heat	Practice and behavior
		Improve early warning systems for extreme heat	Technology
		Use urban greening to reduce temperatures	Green infrastructure
		Install cool roofs	Physical infrastructure
		Update heat response plan in light of climate change	Planning
	Vector-borne disease	Increase monitoring of disease	Research and monitoring
		Enhance vector-control management practices	Practice and behavior
	Ecosystem impacts	Assist migration of flora and fauna	Practice and behavior
		Purchase upland ecosystems to allow species to migrate	Land use
	Ocean acidification	Remove CO <sub>2</sub> from oceans	Technology
		Continue to monitor changes to ocean pH and ecosystem impacts	Research and monitoring
	Air quality	Improve early warning systems	Technology Advocacy
		Advocate for stricter air quality standards	
		Install air quality monitoring stations	Research and monitoring
		Change timing of behaviors, such as sports team practices, during days with poor air quality	Practice and behavior
		Increase urban forest and greening	
	Energy demand	Conserve energy	Energy conservation
		Implement green building codes	Building codes and design standards
	Infrastructure damage	Use alternative materials that are resistant to heat damage	Physical infrastructure
		Establish stricter building codes	Building codes and design standards
		Conduct maintenance more frequently	Practice and behavior

## APPENDICES: INVENTORY OF CLIMATE RESILIENCE ACTIONS

Climate	Impact	Suggested Actions	Type
Sea level rise	Inundation	Facilitate managed retreat from areas at risk of inundation	Land use
		Preserve undeveloped shoreline	Land use
		Mandate real-estate disclosures	Practice and behavior
		Educate homeowners and members of the private sector	Education and outreach
		Protect structures	Physical infrastructure
		Maintain or restore coastal wetlands	Green infrastructure
		Create a 'no-build' zone or district	Policy
		Plan for relocation	Planning
		Elevate and strengthen buildings against more frequent flooding	Building codes and design standards
			Physical infrastructure
	Ecosystem impacts	Assist migration of flora and fauna	Practice and behavior
		Establish transfer of development rights program	Land use
	Salt water intrusion	Relocate wells and septic tanks	Land use
		Install a desalinization plant	Technology
		Expand water and sewer infrastructure	Physical infrastructure
Decreased precipitation	Reduced water supply	Expand and diversify water supply	Practice and behavior
		Increase water storage	Physical infrastructure
		Enhance rainwater infiltration	Green infrastructure
		Conduct water management planning	Planning
		Reduce water demand	Water conservation
		Increase water reclamation and purple pipes	Physical infrastructure
		Update landscape ordinance	Policy
		Improve information used for water management	Technology
	Ecosystem impacts	Initiate water conservation programs	Water conservation
	Reduced water quality	Enhance water treatment processes	Practice and behavior
		Protect and restore riparian buffers	Green infrastructure
			Land use



## APPENDICES: INVENTORY OF CLIMATE RESILIENCE ACTIONS

Climate	Impact	Suggested Actions	Type
Increased precipitation	Flooding	Increase stormwater management capacity	Physical infrastructure
		Encourage low-impact development	Land use
		Capture stormwater where it falls	Green infrastructure
		Reduce number of properties at risk of flooding and stormwater damage	Land use
		Plan for relocation	Planning
		Create a 'no-build' zone or district	Policy
		Make properties and infrastructure more resilient to flooding	Physical infrastructure
			Building codes and design standards
		Promote the purchase of flood insurance	Education and outreach
			Financing
	Infrastructure damage	Strengthen buildings to prevent damage	Physical infrastructure
		Install or restore green infrastructure to help lessen flood damage to built infrastructure	Green infrastructure
		Relocate vulnerable infrastructure	Land use
		Strengthen building codes	Building codes and design standards
	Ecosystem impacts	Maintain natural vegetation for stormwater retention	Green infrastructure
Extreme events	Storm surge	Make adjustments to water treatment processes	Practice and behavior
		Capture stormwater where it falls	Green infrastructure
		Protect and restore riparian buffers	Land use
		Preserve natural shorelines	Land use
		Protect and enhance natural breakwaters	Green infrastructure
		Install floodgates and other structural protection	Physical infrastructure
	Power outages	Educate homeowners and members of the private sector	Education and outreach
		Create a 'no-build' zone or district	Policy
	Hurricanes / coastal storms	Strengthen buildings to prevent damage	Building codes
		Create renewable energy systems for back-up power	Technology
		Strengthen energy infrastructure	Physical infrastructure
		Conduct evacuation planning	Planning
		Strengthen building codes	Building codes and design standards
		Educate homeowners and members of the private sector	Education and outreach
		Maintain or restore natural systems to serve as a storm buffer	Green infrastructure
	Erosion	Convert land adjacent to coastline into parks	Land use
		Ensure that evacuation routes are usable during disaster	Physical infrastructure
		Restore wetlands and dunes	Green infrastructure
		Install revetments or other pieces of hard infrastructure	Physical infrastructure

## APPENDICES: INVENTORY OF CLIMATE RESILIENCE ACTIONS

Climate	Impact	Suggested Actions	Type
Extreme events (cont.)	Thunderstorms / winter storms	Implement ice and snow removal programs	Practice and behavior
		Retrofit homes and businesses to withstand extreme weather	Physical infrastructure
		Strengthen building codes	Building codes and design standards
		Educate homeowners and members of the private sector	Education and outreach
	Ecosystem impacts	Purchase less vulnerable land and create migration corridors	Land use
		Establish transfer of development or purchase of development rights programs	Land use
	Infrastructure damage	Strengthen building codes	Building codes and design standards
		Maintain or restore natural systems to serve as a storm buffer	Green infrastructure
		Harden physical infrastructure	Physical infrastructure
	Extreme wind	Strengthen building codes to address extreme winds	Building codes and design standards
		Conduct regular tree maintenance	Practice and behavior
Wildfire	Infrastructure and property damage	Design buildings and infrastructure to minimize vulnerability to fire	Building codes and design standards
			Physical infrastructure
		Educate homeowners about tree maintenance and vegetation cover	Education and outreach
		Promote fuel breaks and defensible space	Practice and behavior
		Regulate development in the wildland-urban interface	Land use
		Manage fuel load through thinning and brush removal	Practice and behavior
	Air quality	Improve early warning systems	Technology
		Change timing of outdoor activities to correspond to times with better air quality	Practice and behavior



## Resources for Local Climate Resilience Planning

- Florida Department of Environmental Protection, “Florida Adaptation Planning Guidebook,” June 2018, <https://www.adaptationclearinghouse.org/resources/florida-adaptation-planning-guidebook.html>
- FEMA, “Pre-Disaster Planning Guide for Local Governments,” February 2017, <https://www.fema.gov/media-library-data/1487096102974-e33c774e-3170bebd5846ab8dc9b61504/PreDisasterRecoveryPlanningGuideforLocalGovernmentsFinal50820170203.pdf>
- NIST, “Community Resilience Planning Guide,” <https://www.nist.gov/topics/community-resilience/planning-guide>
- UN Office for Disaster Risk Reduction, “The Ten Essentials for Making Cities Resilient,” <https://www.unisdr.org/campaign/resilientcities/toolkit/article/the-ten-essentials-for-making-cities-resilient>
- Center for Neighborhood Technology, “RainReady,” <https://www.cnt.org/rainready>

## Resources for Local Climate Resilience Funding and Financing

Much has been written recently about mechanisms local governments can use to finance resilience. See for instance:

- Alice Hill, Leonard Martinez Diaz: [Building a Resilient Tomorrow: How to Prepare for the Coming Climate Disruption](#) (2019)
- Innovation Network for Communities, Cadmus Group, and Ramboll: [Toward a Climate Resilience Financial System for US Cities](#) (2019)
- Jesse M. Keenan, [Climate Adaptation Finance and Investment in California](#) (2019)

- Joyce Coffee [Money for Resilient Infrastructure: How to Finance America’s Climate Changed Future](#) (2018)
- Resources Legacy Fund and AECOM, [Paying for Climate Adaptation in California: A Primer for Practitioners](#) (2018)

## Resources for National Flood Insurance Program

- 100 Resilient Cities, “Strengthening the National Flood Insurance Program,” November 2017, <https://www.adaptationclearinghouse.org/resources/100rc-strengthening-the-national-flood-insurance-program.html>
- American Society of Floodplain Managers, National Flood Programs and Policy Reports, <https://www.floods.org/policy-advocacy/asfpm-policy-positions/>
- Carolyn Kousky, Brett Lingle, Howard Kunreuther, and Leonard Shabman, Wharton Risk Management and Decision Processes Center, “Issue Paper: Moving the Needle on Closing the Flood Insurance Gap,” February 2019, <https://riskcenter.wharton.upenn.edu/wp-content/uploads/2019/02/Moving-the-Needle-on-Closing-the-Flood-Insurance-Gap.pdf>
- House Select Committee on the Climate Crisis, “Solving the Climate Crisis, The Congressional Action Plan for a Clean Energy Economy and a Healthy, Resilient, and Just America,” <https://climatecrisis.house.gov/report>
- United States Government Accountability Office Report to Congressional Requesters, “National Flood Insurance Program Fiscal Exposure Persists Despite Property Acquisitions,” June 2020, <https://www.gao.gov/products/GAO-20-508>



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- <sup>2</sup> City of Annapolis, “Annapolis Resilience Finance Authority Becomes Law,” press release, May 8, 2020, <https://patch.com/maryland/annapolis/annapolis-resilience-finance-authority-becomes-law>
- <sup>3</sup> Lara Korte and Connie Hanzhang Jin, “After Harvey surprised thousands with unexpected flooding, new law aims to better inform homebuyers,” *The Texas Tribune*, August 22, 2019, <https://www.texastribune.org/2019/08/22/texas-law-requires-buyers-to-disclose-flood-risks/>
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- <sup>12</sup> Some of the forward-backward motion in states is due to changes in or conflicts between political leaders. A 2015 study of states that had moved on creating resilience plans noted that five states—Alaska, Florida, Maine, Pennsylvania, and Virginia—“experienced changes in their respective governor’s offices after the adoption of their plans. In Alaska, Governor Parnell retired the climate cabinet created by his predecessor, Governor Palin (Goldenberg 2013). In Florida in 2011, the legislature passed and Governor Scott signed a bill to abolish the Florida Energy and Climate Commission (Florida 2011). In 2013, Maine’s Governor LePage vetoed legislation that would have authorized the Department of Agriculture, Conservation, and Forestry to work with other state agencies to study the effects of climate change (Hoey 2013). In Pennsylvania, staffers at the Department of Conservation and Natural Resources were reportedly instructed by representatives of Governor Corbett to remove references to climate change from agency materials (Allegheny Front 2014). Finally, in Virginia, the Governor’s Commission on Climate Change was discontinued by Governor McDonnell, who served from 2010 to 2014 (Springston 2014).” See Aaron D. Ray and Jessica Grannis, “From Planning to Action: Implementation of State Climate Change Adaptation Plans,” *Michigan Journal of Sustainability*, volume 3, Spring 2015, <http://dx.doi.org/10.3998/mjs.12333712.0003.001>
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