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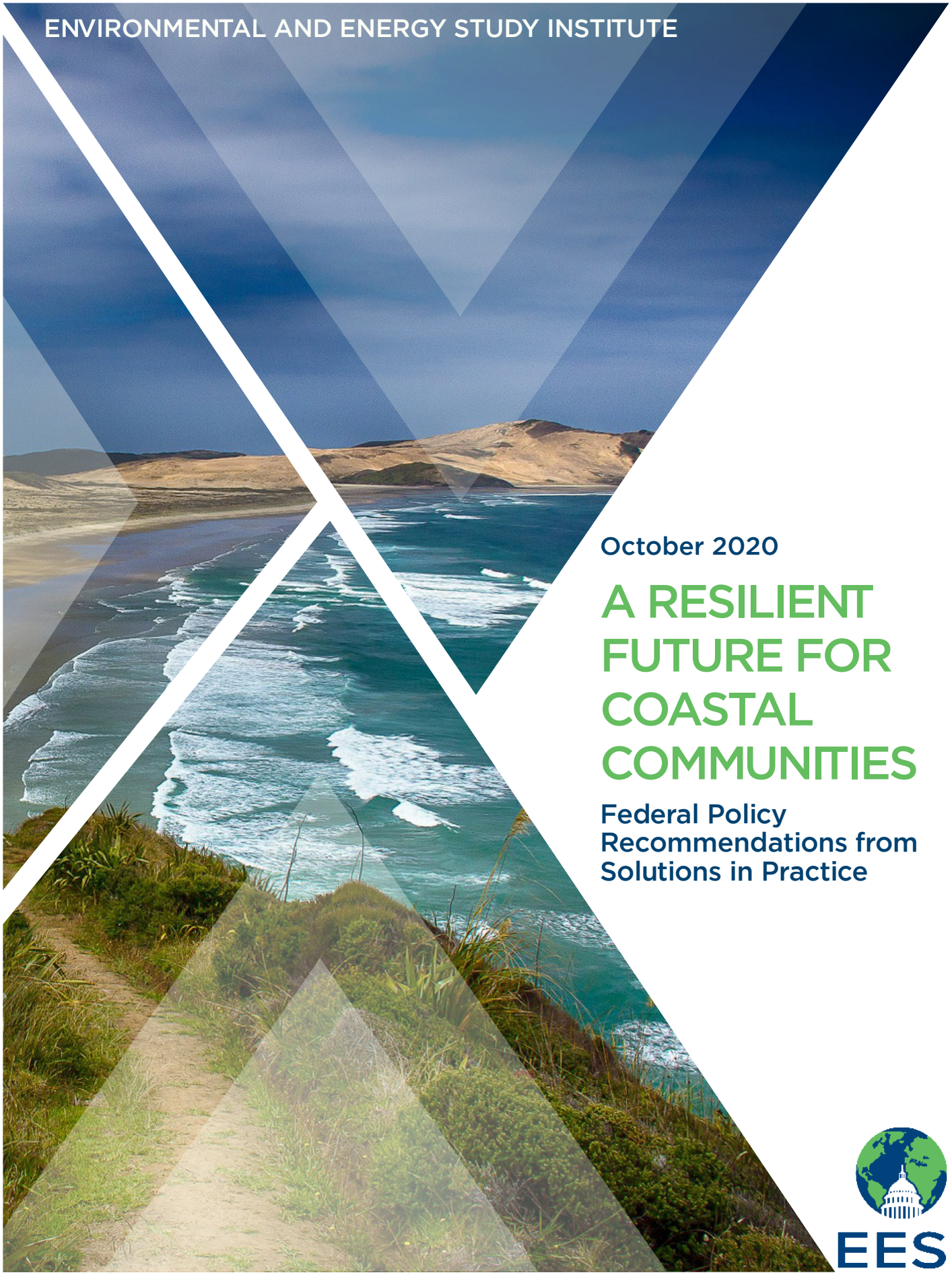


October 2020

A RESILIENT FUTURE FOR COASTAL COMMUNITIES

Federal Policy Recommendations from Solutions in Practice

EESI

ENVIRONMENTAL AND ENERGY STUDY INSTITUTE

EESI is a 501(c)(3) nonprofit organization dedicated to advancing science-based solutions for climate change, energy, and environmental challenges in order to achieve a sustainable, resilient, and equitable world.

CONTENTS

EXECUTIVE SUMMARY

Across the United States, coastal communities face increased uncertainty and risks from intensifying coastal erosion, flooding, sea level rise, and other climate change impacts. These threats need to be taken very seriously. Nearly **100 million** Americans live in coastal counties making up about 30 percent of the U.S. population; another **30 million** people (9 percent) live in the Great Lakes region.

Through creative partnerships, innovative program design, and intentional community engagement, practitioners and researchers around the country are carrying out new work to adapt to the rapidly changing coastal environment. These efforts would be enhanced and more successful with increased support and assistance from the federal government.

EESI recognized the need to educate policymakers by sharing the experiences of coastal communities that are working to adapt to climate change and enhance their resilience to severe weather and natural hazards. Between June 2019 and June 2020, EESI organized and hosted 16 in-person and online Congressional briefings, which featured 42 coastal resilience experts from Alaska, the Caribbean, Great Lakes, Gulf Coast, Hawaii, Northeast, Southeast, and West Coast. This report represents a distillation of the ideas, findings, and policy recommendations identified during **EESI's Regional Coastal Resilience Congressional briefing series**.

Organized by six major sections—Community at the Forefront, Land Use and Development, Cultural Heritage, Climate Adaptation and Resilience Data, Disaster Preparedness, and Financing Adaptation and Resilience—this report provides a comprehensive overview of regional coastal resilience efforts based on panelists presentations made during the briefing series. In addition to the 30 specific recommendations, this report offers six guiding principles intended to inform the implementation of coastal resilience policy:

- Federal policies and programs must be designed and implemented **based on the climate of the future** rather than the climate of the present or past.
- **Climate justice and equity** must be fully embedded into new policies and programs and incorporated into ongoing efforts.
- The federal government should take a leadership role in **connecting science with practice**, and support and expand collaborations with state, local, and tribal efforts.
- The federal government should take a leadership role to ensure that **intra- and inter-agency coordination** helps states, local governments, and tribes to access available coastal resilience resources.
- Federal investments in coastal communities must be leveraged to **create local jobs and help develop a workforce** trained in adaptation and resilience.
- Climate adaptation and resilience work should complement and, when possible, contribute to a **decarbonized, clean energy economy**.

This report—designed as a usable and practical resource for Congress, federal agencies, and the public—includes 30 coastal resilience policy recommendations. These recommendations are brought to life by specific examples of climate solutions in practice today that also hold promise for the future. These various initiatives, projects, examples of community leadership, and funding mechanisms are models for the work that is still needed to accelerate resilience for all coastal communities.

DEFINITIONS

This section provides the definitions for key terms used in the report. We also provide descriptions of each of the categories and policy levers assigned to the policy recommendations throughout the report.

For the purposes of this report, we use the National Climate Assessment's **definitions** of adaptation and resilience.

Adaptation: Adaptations are adjustments in natural or human systems to a new or changing environment that exploit beneficial opportunities and moderate negative effects.

Resilience: A capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment.

Categories:

The categories below describe key features of the policy recommendations. The categories cover the types of engagement available to enhance adaptation and resilience as well as indicate additional benefits of the recommendations for broader climate and environmental policy work.

- **Capacity building**: Programs or funding that invest in building the skills, leadership, processes, and resources at the local/community level with the goal of empowering communities to make their own informed decisions on adaptation and resilience. For example, funding a program that trains community members to be leaders on climate adaptation planning in their region.
- **Federal investment**: Funding needed from the federal government to implement adaptation and resilience programs, initiatives, and partnerships.
- **Knowledge sharing**: The exchange of information, research, and expertise within and between communities, governments, and other entities. Knowledge includes multiple knowledge systems such as traditional ecological knowledge. Examples of knowledge sharing include building up information around managed retreat, or close collaboration between federally-funded scientists and tribal communities.
- **Mitigation co-benefits**: Adaptation and resilience programs and projects that also reduce greenhouse gas emissions. For example, planting trees to reduce urban heat island impacts also provides new trees to sequester carbon. Restoring and conserving mangroves or wetlands protects inland development from storm surge while sequestering carbon.
- **Nature-based solutions**: Restoring or emulating nature in order to increase human, ecosystem, and infrastructure resilience to climate impacts. These solutions often result in environmental, economic, and social co-benefits, including carbon sequestration—a key tool in mitigating greenhouse gas emissions. Nature-based solutions include both green and natural infrastructure. Green infrastructure projects combine gray infrastructure with nature-based solutions to create hybrid systems that improve resilience to climate impacts (i.e., a green roof or bioswale). Natural infrastructure projects use existing or rebuilt natural landscapes (e.g., forests, floodplains, and wetlands) to increase resilience to climate impacts.
- **Research, Development, and Deployment**: Steps taken to create new knowledge on a topic and then take that knowledge and build it into usable tools and technologies.
- **Technical assistance**: Non-financial support provided to a community, government, or other entity to fill a gap in capacity. For example, small communities that do not have the budgets to hire staff focused on climate adaptation and resilience may request technical assistance to conduct a vulnerability assessment. Government programs such as Agricultural Conservation Districts provide technical assistance to farmers on issues like soil management.
- **Training**: Programs designed to enhance an individual or group's knowledge, skills, or accreditation on a particular topic. For example, engineers executing federal contracts should have specific training on using nature-based solutions.

DEFINITIONS

Policy levers:

The policy levers identified below are the main tools members of Congress have available to them to enhance federal action on coastal climate resilience.

- **Amend an existing agency, office, or program authorization**: There are cases where there is no existing agency, office, or program that is currently meeting a need, but there is an existing agency, office, or program that would be a good fit to take on the work.
- **Appropriate funding**: Allocated federal funding for federal agencies and their programs, grants, initiatives, and partnerships.
- **Commission a report**: A key way to collect more information on a topic in order to have the information needed to design effective and equitable policy.
- **Create a new agency, office, or program**: There are cases where there is no existing agency, office, or program that is currently meeting a need and there is no good fit under existing entities. Coastal adaptation and resilience are a relatively new area of work that may require the creation of a new federal agency, office, or program.
- **Establish interagency and intra-agency coordination**: Collaboration, or at minimum communication, within and across federal agencies to ensure that programs are mutually reinforcing, that information is clearly articulated to the public, and that agency work does not inadvertently create barriers for the public to access resources and information.

Vinalhaven, an island community in Maine. Photo from: Island Institute

HOW TO USE THIS REPORT

A PRACTICAL RESOURCE

THIS REPORT IS DESIGNED AS A USABLE AND PRACTICAL RESOURCE FOR CONGRESS, FEDERAL AGENCIES, AND THE PUBLIC INTERESTED IN LEARNING MORE ABOUT FEDERAL POLICY NEEDS AROUND COASTAL RESILIENCE.

All recommendations are drawn from the Environmental and Energy Study Institute's (EESI) 16-part coastal resilience briefing series that featured 42 coastal experts and practitioners. The recommendations are not designed to cover the universe of policy needs on coastal resilience, but rather to elevate key suggestions from the briefing series that highlight important areas for federal action.

The report includes guiding principles, which should be considered in conjunction with each of the 30 recommendations. The recommendations are grouped by six central themes: community at the forefront, disaster policy, land use and development, cultural heritage, climate adaptation and resilience data, and financing adaptation and resilience.

Each recommendation also includes categories, federal policy levers, and key committees of jurisdiction. The summary tables at the conclusion of the report organize the recommendations by categories and federal policy levers.

Eight categories provide a way to look at the type of work and outcomes associated with the recommendations: capacity building; federal investment; knowledge sharing; mitigation co-benefits; nature-based solutions; research, development, and deployment; technical assistance; and training.

The federal policy levers suggest possible ways to implement the recommendations given the tools Congress has available. The five levers identified in this report are to amend an existing agency, office, or program authorization; appropriate funding; commission a report; create a new agency, office, or program; establish interagency and intra-agency coordination.

The key committees of jurisdiction identify the Senate and House committees whose jurisdictions most closely overlap with the content of the recommendations. This should be seen as a guide rather than an authoritative pronouncement on committee jurisdiction. The eight Senate Committees identified in the report are Agriculture, Nutrition, and Forestry; Appropriations; Banking, Housing, and Urban Affairs; Commerce, Science, and Transportation; Energy and Natural Resources; Environment and Public Works; Homeland Security and Governmental Affairs; and Indian Affairs. The 10 House committees included in the report are Agriculture; Appropriations; Energy and Commerce; Financial Services; Homeland Security; Natural Resources; Oversight and Reform; Science, Space, and Technology; Transportation and Infrastructure.

Each recommendation provides a description of the concept along with a specific example from the briefing series of a state, local, or regional initiative currently carrying out such work. These examples should serve as a starting point for understanding work already in progress on the recommendation and can be seen as potential models that can be scaled up or better supported at the federal level.

At the beginning of each thematic section, we provide key laws relevant to the information in the section. This is not a comprehensive list, but rather a starting reference point. Some recommendations in the report also provide information on legislation introduced during the 116th Congress (2019-2020). Inclusion of the legislation is not an endorsement of the legislation nor does it suggest that the legislation would entirely address the recommendation presented. It is included as an example of one way to make progress on the topic as suggested by a panelist during the briefing series.

The appendices are designed to complement the recommendations. Appendix A includes all the federal program and funding sources mentioned throughout the briefing series to provide a partial list of the existing federal work on adaptation and resilience. Appendix B outlines the methodology underlying the report. Appendix C provides a comprehensive list of resources presented during the briefing series including climate impact reports, climate adaptation plans, tools, resources, databases, and information about partnerships on adaptation and resilience. These resources are a key way to dig deeper into the examples and ideas that inform the policy recommendations.

The recommendations are designed to be mutually reinforcing, but each could also be implemented separately with consideration of the six guiding principles.

The California coastline. Photo from: C. Lester presentation, Ocean and Coastal Policy Center, Marine Science Institute, UCSB

GUIDING PRINCIPLES

Over the course of **EESI's 16-part coastal resilience briefing series**, 42 panelists—including Congressional staff, federal and state agency officials, academics and researchers, community leaders and organizers, and experts on a wide-range of topics—brought forth findings and policy recommendations to urgently address the present and future impacts of climate change on coastal areas. Most briefings focused on the challenges and solutions faced by a specific region in the country. But, stepping back, there are a number of through-lines common across the briefing series that deserve to be elevated to six major principles for policymakers to consider for all potential climate resilience solutions, regardless of the coastal region:

Federal policies and programs must be designed and implemented based on the climate of the future rather than the climate of the present or past.

Climate justice and equity must be fully embedded into new policies and programs and incorporated into ongoing efforts.

The federal government should take a leadership role in connecting science with practice, and support and expand collaborations with state, local, and tribal efforts.

The federal government should take a leadership role to ensure that intra- and inter-agency coordination helps states, local governments, and tribes to access available coastal resilience resources.

Federal investments in coastal communities must be leveraged to create local jobs and help develop a workforce trained in adaptation and resilience.

Climate adaptation and resilience work should complement and, when possible, contribute to a decarbonized, clean energy economy.

FEDERAL POLICY RECOMMENDATIONS

COASTAL RESILIENCE

01 COMMUNITY AT THE FOREFRONT

Communities are the linchpin of climate change adaptation and resilience work — the on-the-ground idea generators and laboratories for climate solutions.

EESI's Congressional briefings underpinning this report included panelists representing the Great Lakes Indian Fish and Wildlife Commission; the Tlingit and Haida tribes in Alaska; rural island communities off the coast of Maine; communities of color, working class, and low-income communities in the bayous of Louisiana and on the shores of Lake Erie; farmers in Wisconsin; homeowners and renters in Hawaii and Puerto Rico; and the diverse populations that make up major U.S. cities from Seattle and San Francisco to Miami and New York City. These communities span rural and urban spaces, tribal lands, and culturally and historically significant sites (from National Parks to historic town centers). Clearly, these communities are not homogenous, and, within even the smallest communities, different stakeholders bring to bear a variety of approaches and ideas (i.e., local businesses, industry, religious organizations, community groups, local leaders, etc.).

This report encourages community-centered policy development and program design. Communities, especially those that do not usually have a voice in decision-making processes—including Black, Indigenous, and people of color communities; frontline communities (where climate impacts have hit first and worst); and low-income communities—must shape climate adaptation and resilience policy and work from idea development through implementation. This is all the more important because the most climate-vulnerable communities are also disproportionately low-income and disproportionately people of color. This section addresses ways the federal government can facilitate conditions for robust community engagement on climate adaptation and resilience work.

1.1

IN ORDER TO ESTABLISH AND STRENGTHEN LONG-TERM RELATIONSHIPS, FEDERAL AGENCIES SHOULD CONSULT WITH COMMUNITIES TO ENSURE THAT PROJECTS AND PROGRAMS ARE DESIGNED WITH THE COMMUNITY AND SPECIFICALLY ADDRESS COMMUNITY NEEDS.

Categories:
Technical assistance

Federal policy levers:
Establish interagency and intra-agency coordination; Amend an existing agency, office, or program authorization

Key Committees of Jurisdiction:
Senate Agriculture, Nutrition, and Forestry; Senate Energy and Natural Resources; Senate Indian Affairs; Senate Environment and Public Works; House Agriculture; House Natural Resources; House Transportation and Infrastructure

SUMMARY

Meaningful community engagement requires designing planning processes, outreach, and project outputs with the community in order to meet the community's specific needs. This means ensuring that community members are educated about the particular issues at stake, relevant laws, and government processes. Agencies, in collaboration with local partners, have multiple tools at their disposal to engage with community members, including workshops and planning sessions. Project outputs should be designed to be useful to the people intended to use them. Parties from outside the community should allocate time to learn about and from the community, and, in the case of tribal communities, outside parties should educate themselves on and work within cultural traditions and practices. Indigenous knowledge should be valued and included in adaptation planning to the extent tribes want to share their sovereign knowledge.

EXAMPLES

The **Great Lakes Indian Fish and Wildlife Commission** has partnered with a diverse team including the Northern Institute of Applied Climate Science and the Department of Agriculture's Forest Service to create Dibaginjigaadeg Anishinaabe Ezhitwaad: A Tribal Climate Adaptation Menu. The tribally led effort integrated Ojibwe and Menominee knowledge systems with Western science to determine culturally appropriate climate adaptation measures. The Ojibwe title, Dibaginjigaadeg Anishinaabe Ezhitwaad, roughly translates to Doing Something the Anishinaabe Way, the Ojibwe Way, and references bringing original stories, culture, history, and ways of doing things into climate adaptation. The Adaptation Menu envisions a new way partner agencies could interact with tribes. For example, community engagement is important in tribal communities, so non-tribal partners need to understand that speaking to the Natural Resources Department or just speaking to the tribal leaders does not mean you have fulfilled the expectation of speaking with the tribe. **Louisiana's Strategic Adaptations for Future Environments (LA SAFE)** initiative is another model program for community-centered planning and project implementation.

1.2

FEDERAL AGENCIES SHOULD PROVIDE FUNDING WITHIN ADAPTATION AND RESILIENCE GRANT OPPORTUNITIES FOR LOCAL LEADER TRAINING.

Categories:
Federal investment; Training; Capacity building

Federal policy levers:
Appropriate funding; Amend an existing agency, office, or program authorization

Key Committees of Jurisdiction:
Senate and House Appropriations

SUMMARY

Integrating communities into climate adaptation and resilience programs is essential and requires resources. Federal grants providing support for adaptation and resilience work (Examples in Appendix A) should encourage building these costs into proposals. Specifically, funding to train local leaders (i.e., faith leaders, business owners, activists, youths) to take on long-term leadership roles to plan and carry out climate adaptation and resilience work is critical for the programs to be both community-driven and sustainable. With appropriations support from Congress, this can be implemented administratively through an agency like the Department of Housing and Urban Development (HUD) and through a vehicle like Community Development Block Grants funding. In this example, HUD could work with local intermediaries to get resources directly to the community level. Community-based organizations with the existing technical capacity to manage funding and programs could accept grants directly from the state agencies that manage CDBG funding and have community engagement agreements with them.

EXAMPLES

Louisiana's Strategic Adaptations for Future Environments (LA SAFE) initiative, a model for community-centered adaptation planning, was made possible by the Lead the Coast program. Lead the Coast trained local leaders on coastal and climate change, race and power, facilitation skills, organizing training, and advocacy training. Graduates of the Lead the Coast program were then paid to organize and facilitate the LA SAFE community meetings that led to community buy-in and interest in adaptation planning through community leadership. The LA SAFE communities now have full adaptation plans and the first projects, selected by the communities, are underway.

LA SAFE Community Planning Session. Photo From: LA SAFE

Community visioning session for Metro Parks, Takoma, Washington. Photo from: Washington Sea Grant

1.3

FEDERAL FUNDING FOR ADAPTATION AND RESILIENCE SHOULD BE DESIGNED SO THAT COMMUNITIES HAVE MORE DECISION-MAKING AUTHORITY IN PROJECT IMPLEMENTATION.

SUMMARY

Community consultations on projects are fairly common; however, these consultations often happen after most decisions are made. Rather than having outside entities or federal agencies determine projects to be implemented in communities, federal funding can be designed so that communities have control over how funding is spent in their communities within the parameters of the funding goals (i.e., enhancing climate adaptation and resilience).

Categories:
Federal investment; Capacity building

Federal policy levers:
Appropriate funding; Amend an existing agency, office, or program authorization

Key Committees of Jurisdiction:
House and Senate Appropriations

EXAMPLES

Louisiana's Strategic Adaptation for Future Environments initiative not only put the communities' land use planning in the hands of the community members, but it also created the space for the communities to select the projects they wanted to prioritize and implement based on the funding available through the state and federal government. During community meetings, people voted on their priority projects and the 10 winning projects are now under implementation. The projects include a resilient housing initiative in Lafourche Parish, which blends low-income housing tax credits with Community Development Block Grant funds and provides very specific requirements relative to site selection and building standards to take into account all climate data. The project considers all conceivable flooding events over a 50-year time frame, in other words the lifespan of the asset, to ensure it is designed appropriately. A second example is in St. John the Baptist Parish, which is a high-ground corridor around which new economic activity can and should be coalesced, but is also a place that suffers from periodic flooding. The selected street revitalization project builds out water retention and detention along that particular corridor, while also incentivizing economic development along it. The **Bureau of Indian Affairs' (BIA) Rights Protection Initiative Program**, also known as BIA 638, provides funding to tribes and intertribal organizations for a wide variety of items, from police departments to climate change programs to intergovernmental relations. The Great Lakes Restoration Initiative is able to effectively disperse these BIA 638 funds to allow tribes in the Great Lakes region to prioritize their own needs on the ground.

> "[WE] DEVELOP SCIENCE THAT IS NOT ONLY USEFUL, BUT IS ACTUALLY USED, AND THIS MEANS THAT WE NEED TO WORK DIRECTLY WITH STAKEHOLDERS AND PARTNERS IN THE COMMUNITY TO DEVELOP SHARED UNDERSTANDING OF WHY CLIMATE MATTERS TO LOCAL ECOSYSTEMS AND COMMUNITY, TO CO-IDENTIFY KNOWLEDGE GAPS THAT IMPEDE CLIMATE RISK MANAGEMENT, AND TO CO-PRODUCE THE NEEDED ADDITIONAL SCIENTIFIC RESEARCH, DATA, PRODUCTS, AND RESOURCES THAT ARE NECESSARY FOR EFFECTIVELY MANAGING THIS RISK."
>
> CLIMATE ADAPTATION DATA WEEK

02

LAND USE AND DEVELOPMENT

The United States needs to build infrastructure in anticipation of the climate of the future, rather than based on the climate record of the past. Climate resilience work provides the opportunity to look at land use planning in a holistic way and to re-envision how we use coastal land to decrease community climate vulnerability. Doing so can produce a host of co-benefits, including lower post-disaster costs and healthier communities.

A relevant federal law for this section is the Coastal Zone Management Act of 1972 **(P.L. 92-583, 16 U.S.C. §§1451-1466)**.

The Hawaii coastline. Photo from: Lynn Englum, Vanishing Places, Instagram

2.1

CONGRESS SHOULD ENSURE THAT ALL LAND USE PLANNING IS DESIGNED—AND ALL INFRASTRUCTURE IS BUILT—TO ANTICIPATE AND WITHSTAND FUTURE CLIMATE CONDITIONS.

Categories:
Mitigation co-benefits; Federal investment; Nature-based solutions; Research, development, and deployment

Federal policy levers:
Amend an existing agency, office, or program authorization; Establish interagency and intra-agency coordination

Key Committees of Jurisdiction:
Senate Energy and Natural Resources; Senate Environment and Public Works; House Energy and Commerce; House Science, Space, and Technology; House Transportation and Infrastructure

SUMMARY

A significant proportion of coastal property is at risk over the next century, including private property and critical infrastructure (i.e., airports, primary roads, energy facilities, military bases). Most coastal infrastructure is not adequate to withstand current climate conditions. To avoid catastrophic property damage from hurricanes and other coastal hazards, new planning processes and new infrastructure must be constructed based on future climate conditions. These plans should include delineating areas that must not host any future construction and areas that are currently built out but should be subject to relocation planning. For example, sea level rise projections should be integrated into planning for all coastal infrastructure. Policy levers at the local, state, and federal level should be available to prevent new infrastructure planned for high-risk locations, especially if the plans do not consider future climate conditions.

EXAMPLES

Washington Sea Grant, in collaboration with Climate Impacts Group and other partners, conducted a **sea level rise assessment** for the entire coast of Washington state. Now, a community planner or any decision-maker in Washington State can use the Climate Impacts Group's interactive map to easily access a set of sea level rise projections for their particular location on the Washington coast. The City of Tacoma is using these projections to inform its climate adaptation efforts and associated planning project, and Metro Parks Tacoma has already integrated the sea level rise information into a park redesign so that its facilities will now be built upland, outside the extent of the sea level rise projections. **Virginia Beach, Virginia,** is one of—if not the first—locality that said "no" to a development based on future flood conditions. The developer wanted to build in an area that already has flooding concerns in southern Virginia Beach. The city rejected the project and also won the lawsuit that followed, setting a precedent for the other localities in that region. The **Waterfront Alliance's** Waterfront Edge Design Guidelines serve as a key tool for design and engineering professionals, community members, and governments committed to integrating climate resilience into land use and development decisions. These guidelines could be adopted by governments at the local, state, and federal level to ensure that new construction or retrofits include considerations of future climate conditions.

2.2

THE FEDERAL GOVERNMENT SHOULD ENCOURAGE, FUND, AND PROVIDE TECHNICAL ASSISTANCE FOR ALL COASTAL AREAS TO CONDUCT CLIMATE VULNERABILITY ASSESSMENTS.

Categories:
Federal investment; Technical assistance

Federal policy levers:
Appropriate funding; Amend an existing agency, office, or program authorization

Key Committees of Jurisdiction:
Senate and House Appropriations; Senate Energy and Natural Resources; Senate Environment and Public Works; House Energy and Commerce; House Science, Space, and Technology; House Transportation and Infrastructure

SUMMARY

Vulnerability assessments are the first step to understanding climate risks for a community or for federal agency assets. Vulnerability includes exposure to an impact, sensitivity (or how something will react to that impact), as well as the existing adaptive capacity to respond to that impact. Where vulnerability assessments have not been conducted, funding and technical assistance should be made available to support this work, especially in communities of color and low-income communities. Communities should be given the resources and support to drive these assessment processes (see recommendations in the Community section). Federal agencies can lead by example by updating and publishing vulnerability assessments for all federally owned or managed coastal areas and infrastructure.

EXAMPLES

The **Massachusetts Municipal Vulnerability Preparedness** (MVP) program provides funding to municipalities in two phases to achieve the goals of both vulnerability planning and adaptation implementation. During phase one, municipalities receive funding for workshops and vulnerability planning based on The Nature Conservancy's Community Resilience Building model. Once a community has set its plans and priorities in place, it unlocks access to a second phase of funding for project implementation. The state agency dispensing the funding prioritizes nature-based solutions, and the program provides extra money for community outreach and includes incentives for enhanced community engagement. Section 1407 of the *America's Transportation and Infrastructure Act of 2019* (**S.2302**) includes the Promoting Resilience Operations for Transformative, Efficient, and Cost-saving Transportation grants program, which would enable a funding program similar to the MVP model. The National Park Service has partnered with the **Program for the Study of Developed Shorelines**, a joint effort between Western Carolina University and Duke University, to develop a protocol to help the National Park Service understand the vulnerability of its infrastructure. The vulnerability assessments are built directly into park management databases and are organized by individual assets (i.e., individual buildings, individual bridges, individual stretches of roadway). This approach provides actionable information to park managers who can then assess the importance of each highly vulnerable asset to the park's mission and make resource allocation decisions appropriately. This vulnerability assessment strategy has also been applied to the village of Duck on the northern Outer Banks of North Carolina.

2.3

FEDERAL AGENCIES SHOULD USE CLIMATE VULNERABILITY ASSESSMENTS TO EFFICIENTLY ALLOCATE RESOURCES.

SUMMARY

Well-designed climate vulnerability assessments, that are integrated into federal agencies' existing management tools, provide federal agencies with clear, science-based guidance for the allocation of limited maintenance funding. For example, if there is an infrastructure asset that is of very low mission priority but that is extremely vulnerable, the resource managers may reconsider spending maintenance funds on that asset. On the other hand, if an asset is critically important to the mission of the federal agency and it is vulnerable, then adaptation and resilience projects should be devised to make that asset viable under future climate conditions. In these cases, vulnerability assessments provide the data to support the funding need and the development of proposals for these adaptation and resilience projects.

Categories:
Federal investment; Mitigation co-benefits

Federal policy levers:
Amend an existing agency, office, or program authorization

Key Committees of Jurisdiction:
Senate Banking, Housing, and Urban Affairs; Senate Commerce, Science, and Transportation; Senate Energy and Natural Resources; Senate Environment and Public Works; Senate Indian Affairs; House Natural Resources; House Transportation and Infrastructure; House Financial Services

EXAMPLES

The **Program for the Study of Developed Shorelines**, a joint effort between Western Carolina University and Duke University, produces vulnerability assessments for the National Park Service. At Cape Lookout National Seashore, the park managers are taking a close look at the future of the historical villages, like Portsmouth Village, and working to incorporate the local perspective on the historical, cultural, and local value of those buildings with the vulnerability assessment information to plan next steps. At Biscayne in Florida, the vulnerability assessment was directly used in an institutional planning process to raise utilities out of the flood zone on several planned buildings, thereby reducing the sensitivity of the structures and their vulnerability. In this case, a relatively small expenditure led to a fairly large reduction in overall vulnerability.

The National Park Service relocating the Cape Hatteras Lighthouse, National Seashore North Carolina. Photo from: NPS

"THE INFORMATION NEEDS TO BE ACTIONABLE. DECISION-MAKERS DON'T HAVE THE TIME TO PORE THROUGH A WHOLE BUNCH OF HAZARD EXPOSURE MAPS AND LOOK FOR THEIR INFRASTRUCTURE, SO WE TURNED THAT ON ITS HEAD AND WE STARTED WITH THE INFRASTRUCTURE. WE STARTED WITH THE ASSET MANAGEMENT DATABASE AND BUILT THE EXPOSURE AND VULNERABILITY DATA UP FROM THAT IN ORDER TO ALLOW EASY ACCESS FOR DECISION-MAKERS TO LOOK ONE BUILDING'S [VULNERABILITY] AT A TIME"

CLIMATE ADAPTATION DATA WEEK

2.4

FEDERAL AGENCIES SHOULD ENSURE NATURE-BASED SOLUTIONS ARE GIVEN EQUAL, OR PREFERENTIAL, CONSIDERATION TO GRAY INFRASTRUCTURE AS LONG-TERM COASTAL RESILIENCE INFRASTRUCTURE SOLUTIONS.

Categories:
Nature-based solutions; Mitigation co-benefits

Federal policy levers:
Amend an existing agency, office, or program authorization

Key Committees of Jurisdiction:
Senate Environment and Public Works; House Transportation and Infrastructure

SUMMARY

The federal government's definition of infrastructure should be extended to include **nature-based solutions**. The federal government has tentatively explored green infrastructure, but has not fully incorporated nature-based solutions into its programs or as alternatives in project environmental assessments. Beaches, dunes, coral reefs, and wetlands are critical natural infrastructure that provide protection and resilience to the rest of the nation's infrastructure by attenuating wave action and containing flooding. Infrastructure decisions should always incorporate future local climate projections, and projects that provide more resilience benefits should be prioritized and funded. Local permitting should be adjusted to reflect these priorities, including making living shoreline permits at least as accessible as concrete bulkhead and seawall permits. The *Living Shorelines Act of 2019* (**S.1730**/**H.R.3115**) is one proposed approach to address elements of this recommendation.

EXAMPLES

In Marquette, Michigan, a storm destroyed a key section of Lakeshore Boulevard. Local leadership and community groups from the Superior Watershed Partnership worked with the city to move Lakeshore Boulevard a hundred yards inland and restore the waterfront to improve the long-term resilience of the local transportation system. On the **Gulf Coast** of Texas, the U.S. Fish and Wildlife Service is working with partners to implement the Salt Bayou Watershed Restoration Plan. Salt Bayou is an important place for the regional economy, with activities ranging from recreation to the oil and gas industry. With the understanding that a restored wetland will protect critical infrastructure from storm surge and flooding, the partners worked together to restore Keith Lake fish pass to its historic width and depth in order to reduce the quantity of saltwater entering the bayou from a connected shipping channel. They are also working to install siphons to restore freshwater flows in the wetlands to create a habitat for native vegetation. Another piece of the project is restoring beaches and dunes at McFaddin National Wildlife Refuge. In the **Southeast**, North Carolina changed its permitting system for living shorelines based on a process led by the state's Division of Coastal Management that included input from state and federal agencies, practitioners like the Coastal Federation, and local scientists.

Installing a living shoreline. Photo from: U.S. Fish and Wildlife Service

2.5

THE FEDERAL GOVERNMENT SHOULD DEVELOP A COMPREHENSIVE APPROACH TO MANAGING PUBLIC LANDS THAT HAVE ALREADY STARTED, AND WILL CONTINUE, TO ERODE DUE TO SEA LEVEL RISE AND STORM SURGE.

SUMMARY

Beaches in many parts of the country are held in public trust. As sea level rises and rapid erosion persists, beach land, and land just inland of beaches, will decrease in area. While much public trust land is managed at the state level, the federal government also faces the challenge of eroding coastlines on federal lands. The federal government must develop a plan to address how federal public lands will be managed under different sea level rise scenarios. Federal agencies in charge of approving infrastructure development along coastlines must also consider how those developments would impact state and federal public lands. In the case of beach loss because of seawall construction, the cost of lost land could be shifted to the seawall owner/user.

Categories:
Capacity building; Nature-based solutions

Federal policy levers:
Establish interagency and intra-agency coordination; Commission a report

Key Committees of Jurisdiction:
Senate Energy and Natural Resources; Senate Environment and Public Works; House Natural Resources; House Transportation and Infrastructure

EXAMPLES

In **Malibu, California**, the homes along the shore are already elevated to accommodate storm and tidal surges. As the ocean encroaches inland, the mean high tide moves inland, too. In California and most other states, this means a loss of public trust lands—namely the beaches. Legislators need to develop policies to address the issue of shrinking or disappearing public land between the ocean and private developments. **Hawaii** also faces a similar challenge. Private property owners may want to build seawalls to protect their buildings. However, because of coastal processes, seawalls eventually result in the disappearance of the beaches in front of them. Since the beaches are public lands, allowing seawalls to protect private property may ultimately take land away from the public. In 2020, the Hawaii State Legislature and Governor David Ige enacted Act 16, which explicitly identifies sea level rise as a coastal hazard, grants counties more discretion in the permitting of residences along the shoreline, and effectively prohibits new shoreline armoring structures on sandy beaches.

> "IT'S NOT EASY BUT RESILIENCE IS FINDING THAT SWEET SPOT, THE BALANCE BETWEEN COST-EFFECTIVE RISK REDUCTION, ENVIRONMENTAL PROTECTION AND STEWARDSHIP, AND SOCIAL EQUITY, AND ALL THREE OF THOSE THINGS NEED TO BE TAKEN INTO ACCOUNT CONSIDERING ANY OPTION GOING FORWARD, ANY SOLUTION...THAT'S WHAT YOU NEED TO DO IN ORDER TO SOLVE IT."
>
> WEST COAST BRIEFING

2.6

FEDERAL AGENCIES SHOULD EXTEND THE WORK OF DEPARTMENT OF AGRICULTURE CONSERVATION DISTRICTS TO INCLUDE CLIMATE RESILIENCE SERVICES FOR PRIVATE LANDOWNERS, OR USE USDA CONSERVATION DISTRICTS AS A MODEL FOR A 'CLIMATE RESILIENCE DISTRICTS' PROGRAM.

Categories:
Technical assistance

Federal policy levers:
Amend an existing agency, office, or program authorization; Create a new agency, office, or program

Key Committees of Jurisdiction:
Senate Agriculture, Nutrition, and Forestry; House Agriculture

SUMMARY

There are conservation districts, also called soil conservation districts, in almost every county in the country. The conservation districts work directly with private landowners to voluntarily preserve and enhance natural resources. They also deliver Natural Resources Conservation Service and U.S. Department of Agriculture agricultural assistance programs to farmers. A number of conservation-related programs, such as riparian buffers and wetland reserves, are already administered and implemented by conservation districts. They can provide project designs, guidance for finding contractors and consultants, financial assistance, and financial oversight to individuals in a collaborative, non-regulatory context. It is a model for one-on-one technical and financial assistance to private landowners (using public-private cost share to support conservation stewardship actions on private land) that could be expanded to design and implement appropriate parcel-scale adaptation actions.

EXAMPLES

Conservation districts are a key partner in implementing the **Shore Friendly program**, which is run through the Estuary and Salmon Restoration Program at the Washington Department of Fish and Wildlife. This program provides technical assistance and financial incentives to aid homeowners in assessing erosion and flooding risk on their property and then identifying appropriate shoreline management measures, like installing living shorelines. Their face-to-face technical assistance model is similar to agricultural conservation programs that have been implemented by conservation districts for decades. Puget Sound area conservation districts have also begun to support businesses, churches, schools, and homes in installing green stormwater infrastructure.

A property on the Puget Sound before and after removal of the bulkhead. Photos from: Shore Friendly program, Puget Sound Institute

2.7

FEDERAL AGENCIES SHOULD ACCOUNT FOR ENVIRONMENTAL AND SOCIAL IMPACTS IN BENEFIT-COST ANALYSIS TOOLS.

SUMMARY

Currently, different agencies use different benefit-cost analysis (BCA) tools, and most of these tools limit project types, disadvantage nature-based solutions, and reinforce structural inequalities. Traditional benefit-cost analysis tools of the Army Corps of Engineers, Federal Emergency Management Agency, and U.S. Department of Housing and Urban Development are built to favor rapid return on investment. When decisions are made using existing BCA tools, investments with higher costs in the short-term, but with lower operations and maintenance costs in the mid- to long-term—including infrastructure that will have longer design life (i.e., nature-based solutions)—are not favored. Existing BCA tools also assess projects on a single variable, so for a flood risk management project, for example, all the benefits calculated are flood risk management benefits. Multiple benefits of projects, for example a flood risk management project with significant ancillary wildlife, habitat, or ecological value, are not calculated. To more accurately assess projects, the environmental and social cost of carbon should be considered when evaluating proposed infrastructure options. BCA tools, as they are currently designed, reinforce structural inequality. Restoring homes and infrastructure of higher value results in a higher benefit-cost ratio. This is problematic when working in low- to moderate-income communities, which see lower benefit-cost ratios as a result of the low value of their homes and property. There have been some efforts to address the shortfalls of BCA tools. The Modernized Principles, Requirements, and Guidelines (PR&G) for federal water investments went into effect in 2015. These PR&G changes expand the consideration of environmental and social goals as well as nature-based solutions when developing projects and selecting federally-preferred alternatives.

Categories:
Federal investment

Federal policy levers:
Amend an existing agency, office, or program authorization; Establish interagency and intra-agency coordination

Key Committees of Jurisdiction:
Senate Banking, Housing, and Urban Affairs; Senate Environment and Public Works; Senate Homeland Security and Governmental Affairs; House Financial Services; House Transportation and Infrastructure; House Homeland Security

EXAMPLES

In Virginia, a project in the Ohio Creek watershed illustrated the difference between agency BCA tools: when the project was run through the Housing and Urban Development tool, the benefits-cost ratio was 35:1, in the Army Corps' BCA, the ratio was 5:1. This creates confusion at the local level for how to best design projects. Illustrating the social justice and environmental justice problems with current BCA tools, the City of Hampton, Virginia, was looking to install a tide gate in a low- to moderate-income neighborhood, and they were not able to get a high enough benefit-cost ratio because the homes were not worth enough money.

Flooded New York City street. Photo from: The Waterfront Alliance

2.8

FEDERAL AGENCIES SHOULD ENSURE, THROUGH PROVISIONS IN FEDERAL CONTRACTS, THAT ENGINEERS AND CONTRACTORS ARE TRAINED AND QUALIFIED TO INCORPORATE NATURE-BASED SOLUTIONS IN INFRASTRUCTURE PROJECTS.

Categories:
Training; Nature-based solutions; Mitigation co-benefits

Federal policy levers:
Amend an existing agency, office, or program authorization

Key Committees of Jurisdiction:
Senate Environment and Public Works; House Transportation and Infrastructure

SUMMARY

Engineers design most hard structures, and engineers should be involved in designing risk reduction natural systems as well. Standardized guidelines and training on those guidelines are needed for engineers to understand both the protection benefits as well as the regenerative benefits of nature-based solutions, and to know how and when to deploy them. Engineering specifications for nature-based solutions would also provide planners and decision makers with information about a given natural system's risk reduction potential and how long it takes a system to bounce back from an impact.

EXAMPLES

The U.S. Fish and Wildlife Service's (FWS) **Coastal Program** provides technical assistance that could serve as a model for broader training for engineers. One set of courses from FWS focuses on stream restoration and conservation. The Advanced Stream Simulations Design Course teaches design principles around road-stream crossings. The principles focus on both ecology (i.e., fish passage and stream processes) and public safety.

"WE DO THIS WORK FOR THE SIMPLE REASON THAT EVERY SINGLE DAY PEOPLE ARE MAKING DECISIONS AND INVESTMENTS THAT WILL EITHER EXACERBATE OR AMELIORATE THE IMPACTS OF CLIMATE CHANGE FOR DECADES TO COME, SO WE'RE WORKING WITH TODAY'S PROFESSIONALS TO ENABLE INCLUSION OF THE BEST AVAILABLE CLIMATE AND CLIMATE IMPACT SCIENCE AND CLIMATE RESILIENCE THINKING IN THOSE DECISIONS. PEOPLE EVERY DAY ARE SHAPING OUR FUTURE, AND WE ARE ACTING TO HELP THEM SHAPE THAT FUTURE IN A WAY THAT BUILDS CLIMATE RESILIENCE INTO IT."

CLIMATE ADAPTATION DATA WEEK

2.9

CONGRESS SHOULD FACILITATE AND PROVIDE FUNDING TO BUY-OUT HIGH-RISK OR REPEATEDLY DAMAGED HOMES AND OTHER PROPERTY.

Categories:
Federal investment

Federal policy levers:
Appropriate funding; Amend an existing agency, office, or program authorization

Key Committees of Jurisdiction:
Senate and House Appropriations; Senate Homeland Security and Governmental Affairs; House Homeland Security

SUMMARY

Recurring flooding on properties have cost the federal government millions of dollars in insurance payouts through the National Flood Insurance Program (NFIP). Many property owners are aware of their heightened flood risk or are tired of recurring flood damage to their properties and would be interested in opportunities for their homes to be bought out. For many people, their home is their most valuable asset, and asking them to abandon it with no payment can cause severe economic hardship. Unfortunately, while buyouts are an extremely effective means of reducing flood risk for people and property, buyout programs are underfunded, difficult to access, and slow to be implemented after disaster. Policymakers should consider allocating more funds to buyout programs, like Federal Emergency Management Agency's Flood Mitigation Assistance, Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program, and Severe Repetitive Loss Program, or similar state and local programs. Policymakers should also consider more flexible options to facilitate buyouts, such as advance planning opt-ins, which would give interested homeowners priority for buyouts and a subsidy on their flood insurance over a longer-term time horizon. Additionally, buyout programs could be reformed to offer opportunities for more holistic community relocation planning, including relocation assistance, counseling, and integrating habitat restoration of formerly occupied areas.

EXAMPLES

Arlington, **Massachusetts**, is located on an inland tidal river and community members frequently had to be evacuated by boats from their neighborhood during flood events. In 2003, the Federal Emergency Management Agency and Community Development Block Grant funding was used to buy out and relocate 22 homeowners and tenants. The vulnerable housing was then converted into grassy fields. Scituate, Massachusetts, has also had successful property buyouts in highly vulnerable areas. The **Blue Acres Program in New Jersey** is another example of a successful buyout program for locations that face flood hazards. Blue Acres used $300 million in federal disaster recovery funds to acquire approximately 1,000 properties in tidal areas affected by Superstorm Sandy and another 300 properties in other towns with repeated flooding. The program gives willing sellers the option to sell damaged homes at their pre-storm value in flood-prone areas. After homes are acquired they are demolished and turned into green spaces that will protect against future flooding.

2.10

FEDERAL AGENCIES SHOULD INCLUDE TRIBAL AND INDIGENOUS COMMUNITIES EARLY IN THE ADAPTATION OR RELOCATION PLANNING PROCESS SO THAT CONCERNS CAN BE RAISED REGARDING TRIBAL SOVEREIGNTY.

SUMMARY

Tribal sovereignty is a critical issue in retreat discussions with native communities. Agencies should take care to keep the community at the center of the planning process and to be sensitive to their perspectives and desires. Indigenous communities often lack the resources to create climate adaptation plans or to have a grant writer on staff to assist them in accessing funds they would be qualified for. Developing methodologies for engaging effectively with these communities and incorporating their knowledge into adaptation plans is important to reduce the considerable emotional and financial cost of climate adaptation.

Categories:
Capacity building

Federal policy levers:
Establish interagency and intra-agency coordination; Appropriate funding

Key Committees of Jurisdiction:
Senate Indian Affairs; House Natural Resources

EXAMPLES

Dibaginjigaadeg Anishinaabe Ezhitwaad: A Tribal Climate Adaptation Menu, an adaptation toolkit created in consultation with Ojibwe and Menominee tribal members, contains strategies, approaches, and tactics designed to foster tribal sovereignty, tribal capacity building, community engagement, and incorporation of tribal and indigenous culture, history, and language into climate adaptation. While originally created using Ojibwe and Menominee perspectives, the authoring team envisioned the incorporation of culture, history, language, and perspectives of other tribal communities where the menu may be used. While primarily created as a tool for climate adaptation for natural resources, the Menu contains guiding principles for working with tribal communities along with strategies, approaches, and tactics that are applicable for other adaptation and relocation scenarios.

Ojibwe and Menominee tribal communities in the Great Lakes Region. Photos From: Great Lakes Indian Fish and Wildlife Commission

2.11

THE FEDERAL GOVERNMENT SHOULD ENCOURAGE RESEARCH INTO THE COST OF CLIMATE VULNERABLE COMMUNITIES STAYING IN PLACE COMPARED TO ADAPTING THROUGH RELOCATION.

SUMMARY

Adapting structures to coastal hazards through relocation can be costly, but staying in place can also be an extremely expensive proposition for coastal communities facing repeated disasters. Replenishing beaches, building seawalls, or otherwise hardening the shoreline through artificial means every few years cost local, state, and federal resources that are often difficult to quantify. These costs come in addition to the environmental destruction from such repeated efforts, which are even more difficult for community decision makers to understand. Policymakers can make an effort to analyze the real costs of protecting at-risk structures, or enabling entire communities to stay in place, compared to the cost of relocation.

Community mapping exercise to understand community needs and land use change in coastal Louisiana. Photo from: Louisiana Strategic Adaptations for Future Environments (LA SAFE)

Categories:
Knowledge sharing; Research, development, and deployment

Federal policy levers:
Commission a report

Key Committees of Jurisdiction:
Senate Homeland Security and Governmental Affairs; House Homeland Security

EXAMPLES

There are currently no comprehensive analyses of the environmental and financial costs of enabling communities at risk to remain in place.

"THE MIGRATION OF PEOPLE THAT WE SEE MOVING AWAY FROM THE COAST [OF LOUISIANA], THAT'S A LOT LESS NOTICEABLE THAN THE STORM SURGE THAT INUNDATES THAT COMMUNITY. THE THOUSANDS OF LAND-USE DECISIONS THAT RESULT IN A MORE VULNERABLE POPULATION AND AT-RISK INFRASTRUCTURE, THAT'S A LOT LESS NOTICEABLE THAN A FIRE OR FLOOD THAT DESTROYS THAT PLACE... THOSE LAND-USE DECISIONS, EACH ONE INDIVIDUALLY, YOU COULD ARGUE, ARE RATIONAL DECISIONS, BUT EVERY ONE OF THOSE DECISIONS ADDS UP TO AN IRRATIONAL RESULT."

LOUISIANA BRIEFING

2.12

CONGRESS SHOULD DEVELOP NATIONAL POLICY TO PREPARE FOR THE MOVEMENT OF PEOPLE AS A RESULT OF COASTAL HAZARDS AND CLIMATE IMPACTS.

Categories:
Capacity building; Knowledge sharing

Federal policy levers:
Establish interagency and intra-agency coordination; Commission a report

Key Committees of Jurisdiction:
Senate Homeland Security and Governmental Affairs; Senate Banking, Housing, and Urban Affairs; House Homeland Security; House Financial Services

SUMMARY

Shorelines change over time and rising sea levels will make relocation inevitable for many communities. The federal government must develop a framework to prepare vulnerable communities and the cities and regions that will likely absorb these populations. One disaster event can destroy enough infrastructure to make rebuilding an impossible option, causing unplanned, permanent displacement. Some communities are already anticipating relocation as erosion or encroaching water levels make long-term plans to stay untenable; others have already started the relocation process. Communities deal with planned and unplanned retreats in other ways too—as cities receiving populations on the move. These receiving cities may become the permanent home of disaster refugees. Scientific analyses have already determined the likeliest candidates to be receiving cities, and these areas should have a plan for accommodating and building capacity for sudden new arrivals so resources and services are not overwhelmed.

EXAMPLE

At **Gleason Beach in Sonoma County**, a significant amount of development has had to be removed or demolished due to the rapidly eroding coastline. The California Department of Transportation is also planning the inland relocation of the adjacent highway to avoid the impacts of erosion until 2100. **The town of Holyoke, Massachusetts**, has accommodated a population influx of 2,000 people who migrated from Puerto Rico after Hurricane Maria. Holyoke received funding from the Municipal Vulnerability Program to interview those residents as part of a study on climate migration and the shared vulnerability that Holyoke now has with Puerto Rico.

Erosion along Gleason Beach in Sonoma County, California. Photo from: C. Lester presentation, Ocean and Coastal Policy Center, Marine Science Institute, UCSB

03

CULTURAL HERITAGE

Cultural heritage sites include historically or culturally important places, landscapes, historic buildings, structures, monuments, and archaeological sites, along with museums and archives that hold artifacts important to the understanding of history and culture. Heritage also encompasses intangible elements of culture like oral traditions, arts, manners, rituals, practices, and knowledge. Cultural heritage has significance across a range of scales, from local communities to states, regions, and the national level. At all scales, cultural heritage provides connections between people and places.

Many cultural heritage sites and traditions are threatened by climate impacts and require specific attention. Cultural heritage also provides multiple avenues of research for understanding past climate change and human responses to both past and anticipated climate impacts.

Key laws for cultural heritage are the *Archeological Resources Protection Act of 1979* (**P.L. 96-95**) and the *National Historic Preservation Act of 1966* (**P.L. 89-665**).

Coastal Alaska. Photo from: Alaska Conservation Foundation

3.1

CONGRESS SHOULD ESTABLISH A NAMED CLIMATE HERITAGE FEDERAL COORDINATION OFFICE TO MANAGE RESEARCH, COORDINATION, AND POLICY REGARDING CULTURAL HERITAGE AND CLIMATE CHANGE.

Categories:
Federal investment; Capacity building; Research, development, and deployment

Federal policy levers:
Create a new agency, office, or program

Key Committees of Jurisdiction:
Senate Energy and Natural Resources; House Natural Resources

SUMMARY

Long before human civilization impacted the Earth's climate, climate shaped human civilization. Humans inhabit both a natural environment and a social environment, which is created by human interactions, perceptions, and beliefs, and shapes the kind of actions that are acceptable or desirable after hundreds or thousands of years of custom. A climate heritage coordination office would be responsible for connecting agencies that address climate and cultural heritage, supporting relevant research, representing heritage in interagency and other government forums, and possibly coordinating on compilation of data. This office would provide greater visibility for archaeology and heritage both inside and outside of the federal government and leverage existing knowledge and resources.

EXAMPLES

While **cultural heritage** does fall largely under the jurisdiction of the National Park Service, the agency does not currently coordinate within and across agencies on cultural heritage and climate change. This is in part due to lack of funding delineated for this work. NPS funding and staffing for natural versus cultural resources were roughly equivalent in 1995. However, between 1995 and 2008 (the most recent data available), funding and staffing for natural resources increased by 71 and 31 percent respectively, while funding and staffing for cultural resources decreased by 19 and 27 percent respectively. Expert observations suggest that this trend has continued. Without a coordinating body to facilitate work on cultural heritage and climate change, there is a gap in the federal response to climate adaptation and resilience.

3.2

THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION AND THE U.S. GLOBAL CHANGE RESEARCH PROGRAM SHOULD INCLUDE RESEARCH ON CULTURAL HERITAGE IN THE NATIONAL CLIMATE ASSESSMENT.

SUMMARY

The National Climate Assessment (NCA) brings together research from across disciplines to describe the most up-to-date information on climate change at regular intervals. Contributions from the study of cultural heritage have not been well integrated into the past four NCAs. Given the valuable contributions archeology, anthropology, and other social sciences bring to bear on understanding human responses to past and current climate, relevant research on cultural heritage and climate should be included in future NCAs. While recent NCAs have included attention to the intersections of culture, heritage, and climate with respect to Indigenous communities, which is essential, future NCAs should expand consideration of culture and heritage in relation to climate for all communities.

Fishing boat in Salt Bayou, Texas. Photo from: U.S. Fish and Wildlife Service

Categories:
Knowledge sharing; Research, development, and deployment

Federal policy levers:
Establish interagency and intra-agency coordination

Key Committees of Jurisdiction:
Senate Commerce, Science, and Transportation; House Science, Space and Technology

EXAMPLES

Researchers are working to understand the **full scale of climate change impacts on archaeology and heritage**. For example, researchers studying Jamestown Island, Virginia, have long understood that the island was eroding into the James River. There has been a seawall there for more than 100 years to help protect the site, so the seawall itself is historic. However, in recent years, staff have recognized that when it rains, the island does not drain well, so marsh vegetation that had not grown there before is emerging. By working with the United States Geological Survey, researchers have learned that the water table on the island is rising (due to sea level rise), meaning that brackish is saturating the archaeological sites on the island from the bottom up. Further, while the National Park Service preserved Jamestown Island due to its role as an early English settlement in North America, recent historical discoveries have shown Jamestown Island may also hold new evidence on the experiences of the first slaves brought to the American colonies from Africa. This is one example of research showing that some of the most urgent threats to heritage may take careful stewardship to identify. In addition, more attention is needed to salt water intrusion along the coast and its impact on archeological sites.

3.3

CULTURAL HERITAGE CONSIDERATIONS SHOULD BE INTEGRATED INTO FEDERAL REQUESTS FOR PROPOSALS FOR CLIMATE ADAPTATION AND RESILIENCE WORK.

Categories:
Federal investment, Mitigation co-benefits

Federal policy levers:
Amend an existing agency, office, or program authorization; Establish interagency and intra-agency coordination

Key Committees of Jurisdiction:
Senate Energy and Natural Resources; Senate Environment and Public Works; Senate Homeland Security and Governmental Affairs;
House Energy and Commerce; House Science, Space, and Technology; House Transportation and Infrastructure

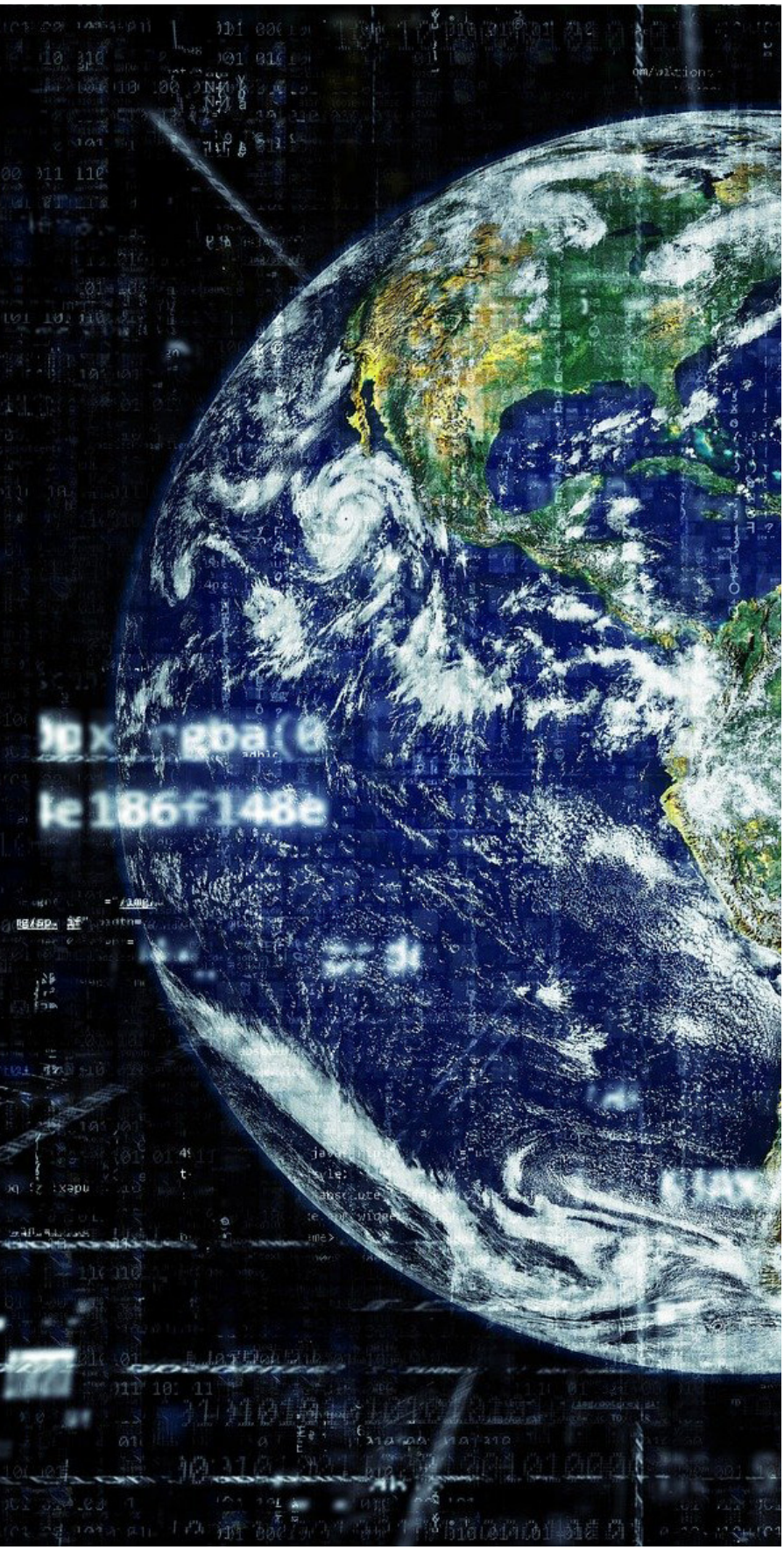
SUMMARY

Several member agencies of the U.S. Global Change Research Program manage or fund diverse adaptation projects. Heritage can be integrated into projects in multiple ways, including by integrating archaeological contributions into land management or ensuring culturally important sites and community histories are incorporated into vulnerability assessments and adaptation projects. Sequestered carbon in historic buildings and traditional land management practices also may support mitigation and carbon sequestration initiatives.

EXAMPLE

The **Gulf of Mexico Alliance's** Coastal Resilience Team is focusing its actions on the region's ability to respond to natural and manmade hazards, including the preservation of heritage. The team is developing strategies and tools that will increase awareness and improve access to information and resources; promote understanding of those resources; and employ adaptation, mitigation, and restoration strategies that help preserve heritage along with natural resources. By including cultural heritage in the Alliance's focus areas, that heritage is more likely to receive consideration when the Gulf of Mexico Alliance funds and implements adaptation projects.

> "HISTORICALLY, A LOT OF THE RESTORATION WORK [HAS BEEN] PIECEMEAL. I CALL IT RANDOM ACTS OF CONSERVATION, OR RANDOM ACTS OF RESTORATION. THEY'RE OPPORTUNISTIC, YOU HAVE THESE SPORADIC PROJECTS, LITTLE PROJECTS HERE AND THERE. WHAT [WE] HAVE BEEN WORKING ON IS AN IMPLEMENTATION STRATEGY BASED ON LANDSCAPE CONSERVATION DESIGN PRINCIPLES...IT'S AN IDEA OF LOOKING AT A SYSTEM--LOOKING AT THE LANDSCAPE AND DESIGNING. NOT JUST PICKING RANDOM PROJECTS, BUT DESIGNING PROJECTS THAT WORK TOGETHER."
>
> GREAT LAKES BRIEFING



04

CLIMATE ADAPTATION AND RESILIENCE DATA

Successful adaptation and resilience work relies heavily on access to locally-specific, actionable data about climate impacts, risks and vulnerabilities, and to information on effective strategies to address those risks. Data, combined with the capacity to interpret and apply it in risk assessment, planning, design and other management contexts, is a foundation for climate-informed decision making. These recommendations address both the need for more comprehensive datasets for the entire country as well as how that information can be more effectively communicated and used by the public.

4.1

FEDERAL AGENCIES SHOULD ENCOURAGE, THROUGH FUNDING AND PROGRAM DESIGN, SCIENTISTS AND TRIBES TO CO-PRODUCE CLIMATE ADAPTATION AND RESILIENCE KNOWLEDGE.

Categories:
Federal investment; Knowledge sharing; Research, development, and deployment

Federal policy levers:
Appropriate funding, Create a new agency, office, or program

Key Committees of Jurisdiction:
Senate and House Appropriations; Senate Indian Affairs; Senate Commerce; House Natural Resources; House Science

SUMMARY

Amidst all the entities working on coastal resilience and adaptation, indigenous people offer a unique perspective as they have been an integral part of local ecosystems for millennia. There is no substitute for the knowledge that tribes hold about the land and the resources around their communities. However, this knowledge is often not considered when federal agencies and other government entities launch adaptation planning efforts aimed to benefit these communities. Further, there are limited incentives (e.g., funding) that explicitly encourage the scientific or agency communities to connect indigenous knowledge to the science that typically has been driving management decisions. These structures need to change to first acknowledge tribal sovereignty over knowledge, and then to encourage the co-identification of knowledge gaps that impede climate risk management, and finally to co-produce the needed additional scientific research, data, products, and resources that are necessary to address climate risks.

EXAMPLES

The Bureau of Indian Affairs' Tribal Climate Science Liaison in **Alaska** works to better coordinate integration of western science and indigenous knowledge to create better adaptation opportunities for communities statewide. The Southeast Alaska Tribal Ocean Research and Indigenous Sentinels Network are two examples of indigenous-led efforts that bring tribal and non-tribal partners together to research and monitor rapid environmental change and its effects on species, habitats, and traditional foods. The Northwest Climate Adaptation Science Center and the **Climate Impacts Group** worked with the Northwest and Great Basin tribes to develop climate risk tools. Based on input from the 84 tribes that chose to participate, they created an online tool that provides climate summaries and climate information specifically tailored to the needs of those tribes. The information is provided in multiple formats—as a map, a graphic, text, and as downloadable, custom reports—that summarize all of the changes by geographic area. The tool has been successful because of the development process's heavy focus on soliciting iterative user testing, feedback, and revisions. Recognizing that in tribal and indigenous communities natural resources are cultural resources, the **Great Lakes Indian Fish and Wildlife Commission (GLIFWC)** is in the process of completing version two of their Climate Change Vulnerability Assessment. Researchers used the NatureServe Climate Change Vulnerability Index Tool, which incorporates climate projections, to look at best- and worst-case climate sensitivity and exposure scenarios for 68 culturally important plants and animals. Scores were validated by expert reviewers, including tribal biologists and university experts. Concurrently, Traditional Ecological Knowledge (TEK) outreach specialists conducted at least three interviews in each of the 11 GLIFWC member Ojibwe communities, and the interviewees provided stories, teachings, and historical knowledge along with narratives about the changes that they are seeing on the landscape. This TEK was given equal weight to the expert reviews and was used to validate and adjust scores. The document incorporates results from both knowledge systems and will be used by GLIFWC, its member tribes, and partner agencies to plan for climate adaptation in the Ojibwe Ceded Territories in Michigan, Wisconsin, and Minnesota. This effort was funded through the Bureau of Indian Affairs.

4.2

FEDERAL AGENCIES SHOULD COMMUNICATE CLIMATE DATA IN A FORMAT THAT IS ACCESSIBLE TO NON-EXPERTS, AND PROVIDE AVENUES FOR STATE, LOCAL, AND TRIBAL ENTITIES TO ACCESS TECHNICAL SUPPORT TO INTERPRET AND APPLY THIS DATA TO DECISION-MAKING.

Categories:
Capacity building; Technical assistance; Federal investment

Federal policy levers:
Establish interagency and intra-agency coordination

Key Committees of Jurisdiction:
Senate Banking, Housing, and Urban Affairs; Senate Commerce, Science, and Transportation; Senate Energy and Natural Resources; Senate Environment and Public Works; Senate Indian Affairs; House Natural Resources; House Transportation and Infrastructure; House Financial Services

SUMMARY

The federal government already does an excellent job of communicating certain datasets to the public via tools such as the **Digital Coast** and the U.S. Climate Resilience Toolkit. These efforts should be continued and built upon. In addition to access to tools, many communities also require technical support to apply the information in those tools to their specific decision-making contexts. Many small, and often rural, communities are under-resourced, with limited staff, time, and finances. Adaptation projects not only cost money, but also require that someone knows how to plan and implement them. These communities usually do not have a sufficient population base to tap into traditional taxation structures and payment structures to pay for the projects or hire the necessary staff. Technical support that accompanies access to data and resources can enable communities to plan and implement adaptation measures that would otherwise be out of reach.

EXAMPLES

The Island Institute in Maine works with rural, under-resourced island communities to adapt to climate impacts. Working with the Maine towns of Vinalhaven, Stonington, and Scarborough, the Island Institute compiled publicly available information to look at how properties in these communities will be inundated and how that will impact municipal tax rolls under various sea level rise scenarios. This work also looked at how municipal costs will change based on climate action or inaction scenarios. The information is compiled as a story map to integrate communities telling their story with models for sea level rise. Armed with this accessible and localized information, the communities can then make climate-informed policy decisions. **New York Sea Grant** provides technical support to communities along Lake Erie and Lake Ontario. When conducting vulnerability assessments, New York Sea Grant, its partners, and the community look at different types of weather events and how sectors of the community (i.e., critical infrastructure and facilities; transportation routes; businesses, especially fuel- and food-related ones; plans and agreements that a community has in place; and culturally important spots, including churches and community gathering areas) are impacted by these events. For example, the Village of Sodus Point in Wayne County, New York—one of the lowest-lying communities along Lake Ontario—is very connected to the water, and also very impacted by it: both by high and low water levels. Using the vulnerability assessment, the community led an effort to assess water level scenarios for coastal flooding. Using a localized inundation mapping tool, they looked at where their key facilities were on the map and whether or not they were impacted. They paired this information with the Community Resilience Building Process developed by National Oceanic and Atmospheric Administration and the Nature Conservancy. As a result of working closely with the community to build their understanding of vulnerability and impacts, a wide range of stakeholders from the community determined resilience actions that the village is now implementing.

4.3

THE FEDERAL GOVERNMENT NEEDS TO INVEST IN MORE DATA COLLECTION OF DIVERSE DATA SETS TO UNDERSTAND LOCALIZED CLIMATE IMPACTS AND RESPONSES.

Categories:

Federal investment; Capacity building; Research, development, and deployment

Federal policy levers:

Appropriate funding

Key Committees of Jurisdiction:

House and Senate Appropriations; Senate Banking, Housing, and Urban Affairs; Senate Commerce, Science, and Transportation; Senate Energy and Natural Resources; Senate Environment and Public Works; Senate Indian Affairs; House Natural Resources; House Transportation and Infrastructure; House Financial Services

SUMMARY

Data needed to inform climate decision making is not evenly available across the United States. While some areas have access to more data than they can process, other areas of the country have significant data gaps. The federal government should dedicate additional resources to ensure that all parts of the country have data on existing conditions and projected future conditions. Data on existing conditions includes coastline and inland elevation mapping, local bathymetry (depth of ocean and lake floors) data, shoreline models, and national wetlands information (in the National Wetlands Inventory). Data on projected future conditions includes localized sea level rise projections and erosion modeling. Some existing programs, such as Atlas 14—a series of documents that provide essential precipitation information for flood maps and stakeholders—are very much out of date. Dedicated funding is needed for NOAA's National Weather Service Office of Weather Prediction to maintain and update Atlas 14. All data sources should be integrated with traditional ecological knowledge and social science information about risk perceptions and human responses to climate impacts to inform robust adaptation planning and action.

EXAMPLES

Alaska faces the most stark data deficit in the country. Much of coastal Alaska does not have adequate elevation data to project community level flood risks. Shorelines are also changing so quickly both in position and topography, that the baseline is now fluid, and repeat observation is often required. A number of community collaborations within Alaska, combining state, federal, and tribal entities, are collaborating to meet these needs, but the rate of change and the absence of even basic data represent considerable challenges. For example, in Alaska, only about 40 percent of the state is covered by the National Wetlands Inventory, and the places that are not covered are those that are most rapidly changing. This is basic information needed to inform infrastructure decisions. It would cost about seven million dollars to finish out the rest of the state, but it could have the potential to save tens of millions in planning and surveying costs, and it would allow communities to more quickly determine their adaptation actions. In the Northwestern United States, before the **Climate Impacts Group** and its partners started working with the Northwest and Great Basin tribes, few tribes had access to the kind of locally specific climate projections that support adaptation planning. Through this collaboration, the tribes now have access to information on impacts on plants and animals, wildfire, heat waves, and water availability, which enables them to evaluate climate risks and make decisions across multiple geographic areas, not just reserved land, but also the watersheds in which they are living, counties, their traditional territories, and their ceded lands. Consistency of data across areas is also a challenge. Though statewide watershed mapping is now underway in **Louisiana**, on a county-by-county basis there is a lack of consistency in development and adoption of Flood Insurance Rate Maps. This creates a challenge if two counties want to work together to align respective development patterns. Even once its watershed maps are updated across the state, Louisiana has yet to institutionalize how the maps will be used to inform land use decision making.

4.4

CONGRESS SHOULD INCREASE FUNDING AND OTHER SUPPORT FOR EXISTING FEDERAL ENTITIES FOCUSED ON COORDINATING AND COMMUNICATING CLIMATE INFORMATION FOR PUBLIC USE.

Categories:
Federal investment; Capacity building; Research, development, and deployment

Federal policy levers:
Appropriate funding

Key Committees of Jurisdiction:
House and Senate Appropriations

SUMMARY

Existing federal entities, including United States Geological Survey's Climate Adaptation Science Centers (CASCs), National Oceanic and Atmospheric Administration's Regional Integrated Sciences and Assessments (RISA) programs (e.g., **GLISA**, the Great Lakes Integrated Sciences and Assessments team), and NOAA's Sea Grant network, are important conduits facilitating the development and delivery of federal climate information for public use (See Appendix A). High demand within state, tribal, and community governments for adaptation and resilience support overwhelm the capacity of these programs at current funding levels. The federal government should also reinvest in the Landscape Conservation Cooperative Network (LCCs). The LCCs are self-directed, public-private partnerships governed by steering committees of resilience practitioners from agencies, tribes, non-governmental organizations, and academia. They were launched in 2009 by the U.S. Department of Interior to "engage DOI and federal agencies, states, tribal and local governments and the public to craft practical, landscape-level strategies for managing climate change impacts." With financial and staff support from the U.S. Fish and Wildlife Service (USFWS), individual steering committees for 22 LCCs across North America established operational charters as well as their own regional priorities. During several years, the LCC Network conducted hundreds of science and planning projects to inform conservation and climate adaptation at regional scales. These partnerships were the subject of a National Academy of Sciences review in 2015 that found the Network was making unique contributions in coordinating science and planning across multiple jurisdictions. Though funding changes in 2017 eroded the extent of the Network, many individual LCC partnerships remain active along the coasts under different names and funding models. Reinvestment in these existing partnerships would accelerate coordination across the array of federally-funded resilience programs and efforts. It would also leverage the connections these partnerships have maintained with resilience leaders working in state, tribal, non-governmental organization, and academic institutions.

EXAMPLES

Alaska has continued three of its original five LCCs. They work together as the Northern Latitudes Partnerships while at the same time each maintaining their own regional identities as the Aleutian Bering Sea Initiative, the Western Alaska Partnerships, and the Northwest Boreal Partnership.The Northwest Boreal Partnership has a joint steering committee made up of Alaskans and individuals from three different provinces in Canada, so it is an international partnership working on climate adaptation and resilience. Collectively, these three partnerships have about 150 different partners, either serving in steering committee roles or on individual projects, and all building on the nine years of trust established over time. These partnerships now operate under a public-private funding model and though they continue to make important progress helping communities and agencies adapt to rapid change, they have approximately a quarter of the staff capacity that had been supporting these efforts in 2017.

4.5

FEDERAL AGENCIES SHOULD STUDY THE LONG-TERM EFFICACY, COST-EFFECTIVENESS, AND CO-BENEFITS OF NATURE-BASED SOLUTIONS AS THESE NATURE-BASED SOLUTIONS EXPERIENCE STORMS AND OTHER IMPACTS.

Categories:
Nature-based solutions; Federal investment; Mitigation co-benefits; Research, development, and deployment

Federal policy levers:
Commission a report

Key Committees of Jurisdiction:
Senate Commerce, Science, and Transportation; House Science, Space, and Technology

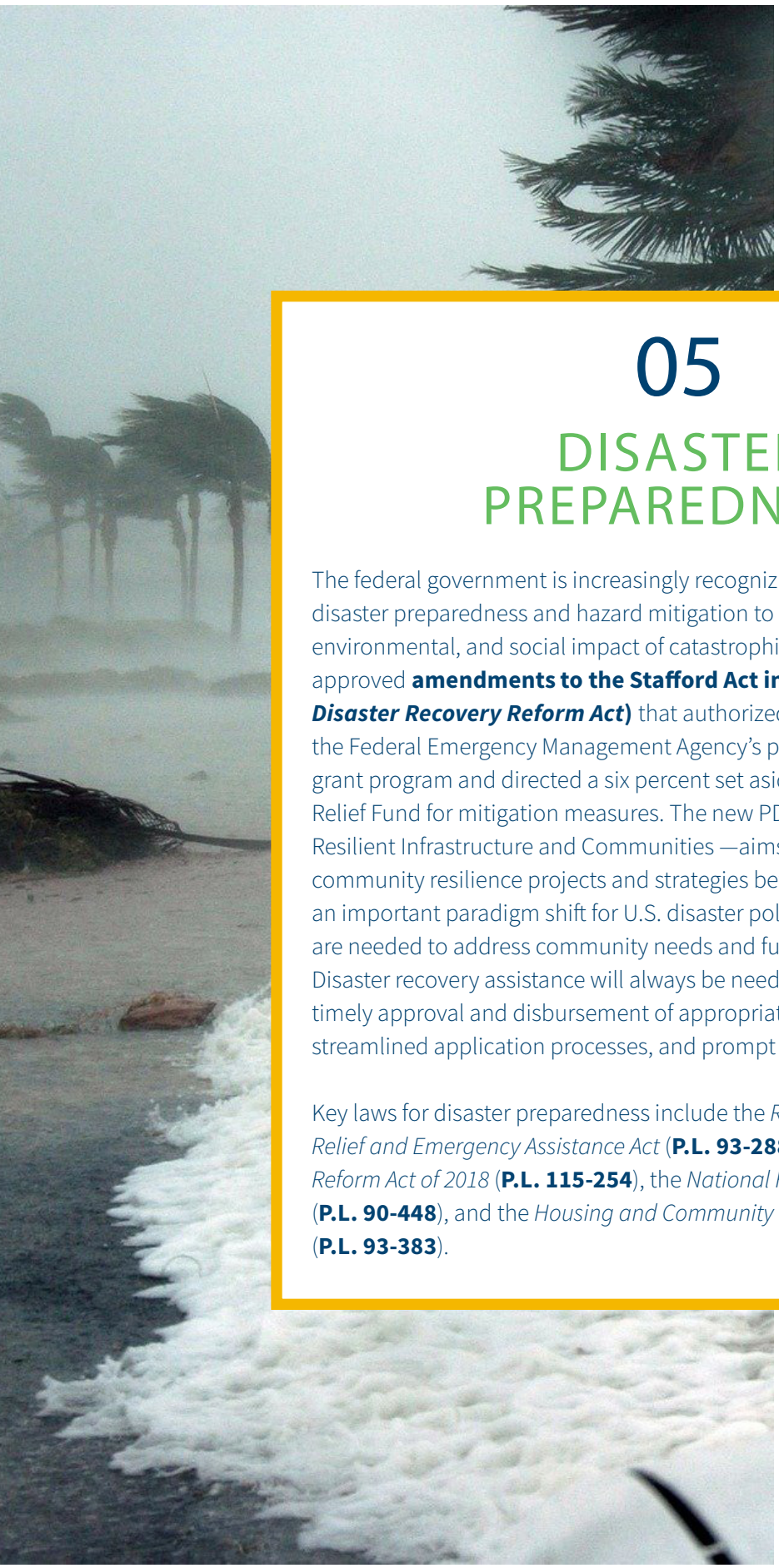
SUMMARY

Federal agencies, including the U.S. Fish and Wildlife Service, have conducted some preliminary monitoring of nature-based solutions projects, but more research is necessary to fully understand the efficacy and co-benefits of these projects so they can be more widely deployed in coastal areas. Research efforts could take the form of pilot studies and long-term monitoring projects and could be carried out by federal agencies, universities, or other research entities. This research could inform inputs to benefit-cost analysis tools, local and state permitting processes, and infrastructure design guidelines.

EXAMPLE

In Florida, The Nature Conservancy's research on coral reefs shows that healthy reefs diminish wave energy by 95 percent. However, there is more work to be done in terms of measuring and monitoring the effectiveness of different ecological systems and their risk reduction value. **The Florida Department of Environmental Protection** does monitor coral reefs, and identified a coral disease outbreak that has impacted the coral population since 2014. In response, the agencies have worked to both understand the drivers of the outbreak and rescue corals from the disease, growing them in tanks so the population can be replenished. This monitoring demonstrates the importance of understanding these ecological systems over time to understand, and where possible reduce, the stressors that could reduce the ability of the system to provide coastal protection.

Studying and growing corals in Florida. Photo From: Florida Department of Environmental Protection



05

DISASTER PREPAREDNESS

The federal government is increasingly recognizing the value of disaster preparedness and hazard mitigation to reduce the economic, environmental, and social impact of catastrophic events. Congress approved **amendments to the Stafford Act in 2018 (enacted as the *Disaster Recovery Reform Act*)** that authorized increased funding for the Federal Emergency Management Agency's pre-disaster mitigation grant program and directed a six percent set aside from the Disaster Relief Fund for mitigation measures. The new PDM program—Building Resilient Infrastructure and Communities —aims to support state and community resilience projects and strategies before disaster strikes. This is an important paradigm shift for U.S. disaster policy, but additional reforms are needed to address community needs and future climate conditions. Disaster recovery assistance will always be needed and its urgency requires timely approval and disbursement of appropriations, simplified and streamlined application processes, and prompt reviews of grant awards.

Key laws for disaster preparedness include the *Robert T. Stafford Disaster Relief and Emergency Assistance Act* (**P.L. 93-288**), the *Disaster Recovery Reform Act of 2018* (**P.L. 115-254**), the *National Flood Insurance Act of 1968* (**P.L. 90-448**), and the *Housing and Community Development Act of 1974* (**P.L. 93-383**).

5.1

CONGRESS SHOULD DIRECT MORE FEDERAL DISASTER ASSISTANCE FUNDING TO PRE-DISASTER MITIGATION AND REQUIRE AGENCIES TO PROPERLY ACCOUNT FOR THE BENEFITS OF NATURE-BASED SOLUTIONS.

Categories:
Federal investment; Mitigation co-benefits; Nature-based solutions; Technical assistance; Training

Federal policy levers:
Appropriate funding; Amend an existing agency, office, or program authorization

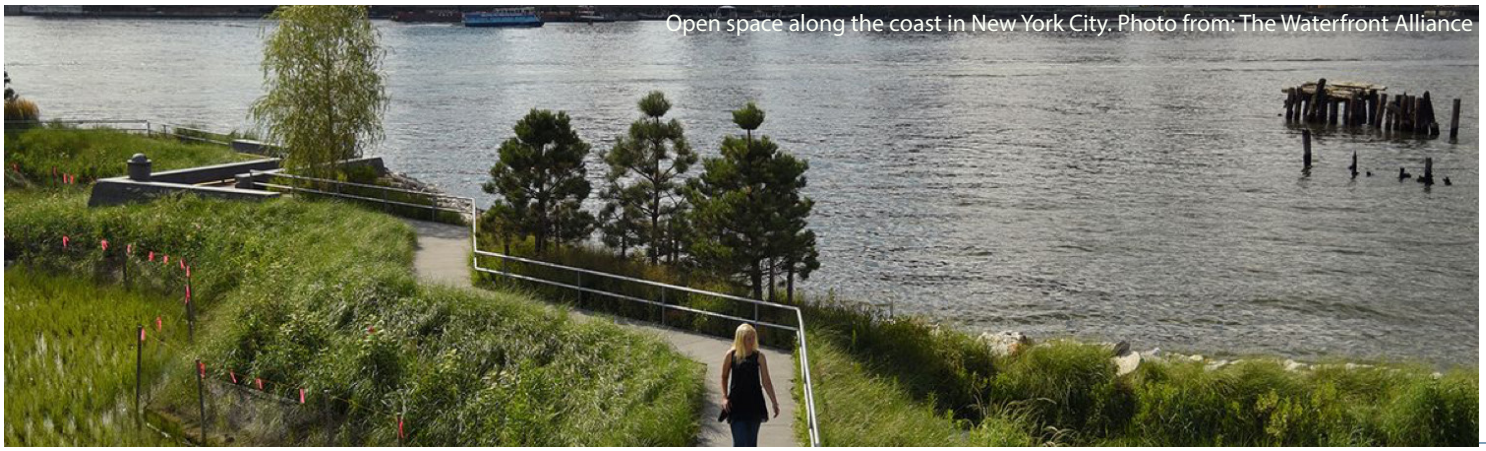
Key Committees of Jurisdiction:
Senate Environment and Public Works; Senate Homeland Security and Governmental Affairs; House Homeland Security; House Transportation and Infrastructure

SUMMARY

To help U.S. communities become more resilient to the impacts of climate change and reduce the cost of supplemental disaster appropriations, Congress should prioritize pre-disaster hazard mitigation in program authorizations, appropriations, and robust oversight of BRIC implementation. Additional reforms to the Stafford Act and administrative actions are needed to increase funding for PDM and ensure that the Army Corps of Engineers, Federal Emergency Management Agency, U.S. Department of Housing and Urban Development, and other agencies use benefit-cost analysis tools that account for the long-term efficacy and resilience of natural infrastructure, such as coral reefs and wetlands, and green infrastructure.

EXAMPLES

Massachusetts developed the first FEMA-approved Natural Hazard Mitigation Plan that incorporates climate change projections. The plan was also the vehicle for statewide vulnerability analyses and opens the door to FEMA funding. This project could be replicated for other states. In **Puerto Rico**, after Hurricane Maria in 2017, the Puerto Rico Department of Natural and Environmental Resources submitted a hazard mitigation plan to FEMA to restore coral reefs that are able to attenuate a significant amount of wave energy and reduce coastal erosion (although the project has yet to be determined eligible). **The U.S. Virgin Islands** is looking at its own unique natural resources to provide resilience benefits as it updates its Hazard Mitigation and Resilience Plan.



Open space along the coast in New York City. Photo from: The Waterfront Alliance

5.2

CONGRESS SHOULD UPDATE THE NATIONAL FLOOD INSURANCE PROGRAM TO DISCOURAGE CONSTRUCTION IN RISK-PRONE AREAS, INCLUDING BY REQUIRING THAT FLOOD INSURANCE RATE MAPS CONSIDER CLIMATE PROJECTIONS AND REFLECT ACTUAL RISK, AND CONTINUE TO ENSURE THE AFFORDABILITY OF PREMIUMS.

Categories:
Federal investment

Federal policy levers:
Amend an existing agency, office, or program authorization; Appropriate funding

Key Committees of Jurisdiction:
Senate Banking, Housing, and Urban Affairs; House Financial Services

SUMMARY

Federal Emergency Management Agency's flood maps are used to identify flood-risk areas, manage flood risk, and meet **National Flood Insurance Program (NFIP)** requirements. But flood maps must account for climate change projections, so legislation to reform NFIP is needed to ensure that climate change is a criteria for flood map updates. FEMA is already moving to ensure that NFIP rates are based on actual risk with its Risk Rating 2.0 initiative, but implementation has been delayed to October 1, 2021, to address concerns about premium spikes for policyholders. Additional housing burden and affordability protections are needed to reduce flood risk in low-income communities.

EXAMPLES

The **Coastal Flood Exposure Mapper from National Oceanic and Atmospheric Administration's Digital Coast** tool helps communities visualize coastal hazards and solutions. The mapper allows users to search for a specific geography, then look at various coastal hazards, including flooding, sea level rise, FEMA flood zones, and storm surge. It can also provide a composite layer that combines hazards to show highest exposure, and a user can then overlay any coastal hazard with societal infrastructure like schools or fire stations. Ecosystem maps show natural infrastructure, which helps a user think about where existing natural areas already provide protection, and where additional natural infrastructure might need to be deployed.

> "WE REALLY NEED TO GET SERIOUS ABOUT RECOGNIZING THAT THIS IS SOMETHING THAT WE'RE PAYING FOR NOW, ALREADY AND AGAIN AND AGAIN. EVERY COUNTY IN NEW YORK STATE HAS HAD DISASTER DECLARATIONS, 90% OF WHICH WERE FOR FLOODING."
>
> NORTHEAST BRIEFING

5.3

CONGRESS SHOULD CARRY OUT ROBUST OVERSIGHT TO ENSURE FEDERAL AGENCIES' TIMELY DISBURSEMENT OF APPROPRIATIONS FOR DISASTER RECOVERY AND APPROVAL OF HAZARD MITIGATION PLANS.

Categories:
Federal investment

Federal policy levers:
Appropriate funding

Key Committees of Jurisdiction:
Senate Committee on Banking, Housing and Urban Affairs; Senate Homeland Security and Government Affairs; House and Senate Appropriations; House Homeland Security, House Committee on Financial Services; House Natural Resources

SUMMARY

Even after the rapid approval of emergency funding for relief and resilient rebuilding after major disasters, it sometimes takes months or even years for the funds to reach those in need. For communities to benefit from climate-informed resilience projects, appropriations must be disbursed in a timely manner. Problems that hinder this include agency delays in evaluating and approving grant applications (often due to unclear guidance on eligibility criteria and inconsistent or outdated Benefit Cost Analysis tools) and matching funding requirements. In addition to Congressional oversight, permanent solutions are needed to address these problems, including legislative and administrative reforms, such as new authorizations for Community Development Block Grant Disaster Recovery (CDBG) and Mitigation programs, which could reduce delays by removing the need for separate notices from HUD after each supplemental appropriation.

EXAMPLES

Congress approved two emergency aid packages to address the destruction in **Puerto Rico and the U.S. Virgin Islands** after Hurricane Maria in 2017, including U.S. Department of Housing and Community Development CDBG to help rebuild homes, schools, and transportation and electricity infrastructure and make them more resilient to natural disasters. Despite Congressional oversight, less than 30 percent of these funds have been distributed after three years. Conversely, the U.S. Coast Guard's assistance to Puerto Rico was seen as very effective. According to a Puerto Rico Department of Natural and Environmental Resources official, the Coast Guard's Standard Operating Procedures could be a good model for other agencies.

Hurricane damage in Puerto Rico. Photo from: Puerto Rico Department of Natural and Environmental Resources

5.4

CONGRESS SHOULD MAKE RESILIENCE A PRIORITY WHEN DEVELOPING AND PRESERVING SAFE AND AFFORDABLE HOUSING.

Categories:
Federal investment; Mitigation co-benefits

Federal policy levers:
Appropriate funding; Amend an existing agency, office, or program authorization

Key Committees of Jurisdiction:
Senate and House Appropriations; Senate Finance; Senate Banking, Housing and Urban Affairs; House Ways and Means; House Financial Services

SUMMARY

Safe and affordable housing is central to community resilience. Island communities and those in floodplains are on the front line of wind and water damage: blue tarpaulins still cover missing roofs and walls in Puerto Rico and the U.S. Virgin Islands three years after Hurricane Maria swept through and damaged 370,000 homes. The preservation of existing affordable housing units should be a priority for federal funding for pre-disaster mitigation as well as post-disaster rebuilding assistance. Existing initiatives to develop affordable housing, including programs administered by the U.S. Department of Housing and Urban Development and the state-administered Low-Income Housing Tax Credit, could promote coastal resilience with increased funding and higher design standards. Current model codes and above-code standards must be applied in equal measure to affordable housing and market-rate housing. Policymakers have an opportunity to address multiple goals—adaptation and resilience, climate mitigation (e.g., energy efficiency and renewable energy), and equity—as part of a comprehensive and sustainable development strategy.

EXAMPLES

Enterprise Community Partners began addressing disaster resilience, recovery, and rebuilding in affordable housing after Hurricane Katrina, which damaged 800,000 homes, including many in low-income areas. The Keep Safe guidebook is a community-based strategy for adaptation and resilience for affordable housing and low-income communities that covers the initial identification of risks to the final steps of developing community-wide emergency response plans. Keep Safe has informed designs for a community resilience center that have been used by the organization Resilient Power Puerto Rico.

> "WHEN WE THINK ABOUT HOUSING, WE MUST CONSIDER THE CONTEXT IN WHICH HOUSING IS BUILT, OPERATED, AND MAINTAINED...WE MUST CONSIDER THAT HOUSING FOR ONE FAMILY TODAY MAY ALSO MEAN HOUSING FOR MULTIPLE GENERATIONS GOING FORWARD. WHEN WE THINK ABOUT CLIMATE RISK AND MITIGATING RISK, WE MUST CONSIDER OUR CURRENT GENERATIONS AND FUTURE GENERATIONS."
>
> PUERTO RICO AND THE U.S. VIRGIN ISLANDS BRIEFING

06

FINANCING ADAPTATION AND RESILIENCE

The demand for funding for adaptation and resilience projects is much greater than the limited number of grants currently available. For some programs, like National Oceanic and Atmospheric Administration's National Coastal Resilience Fund, current appropriations already fall far short, and more urgent needs are expected in coming years as more coastal communities undertake resilience projects. Because federal grant funding is inadequate, more states and local governments are turning to alternatives to finance adaptation and resilience projects. Many states have managed infrastructure financing programs for decades to build and maintain water and wastewater facilities; these can serve as useful models for resilience. Many have also developed innovative financing mechanisms to harness public- and private-sector capital to encourage clean energy projects and create new opportunities for communities that face systemic underinvestment.

This section includes recommendations on how the federal government can allocate resources to state, tribal, and local governments to carry out adaptation and resilience work. The importance of equity-focused program design elements will be increasingly apparent as efforts expand, diversify, and reach scale. This section also covers how federal agencies can use adaptation planning to use their appropriated funds efficiently.

Kahauiki solar powered micro-grid in Hawaii. Photo from: Hawaii Green Infrastructure Authority

6.1

CONGRESS SHOULD ENSURE THAT CLIMATE JUSTICE AND EQUITY CONSIDERATIONS APPLY TO ADAPTATION AND RESILIENCE PROGRAMS AND PROJECTS FINANCED OR LEVERAGED WITH FEDERAL FUNDS, WITH SPECIAL ATTENTION TO COMMUNITIES THAT FACE SYSTEMIC UNDERINVESTMENT.

Categories:
Federal investment; Capacity building

Federal policy levers:
Appropriate funding

Key Committees of Jurisdiction:
House and Senate Appropriations; Senate Energy and Natural Resources; Senate Environment and Public Works; House Energy and Commerce; House Transportation and Infrastructure

SUMMARY

Equity and climate justice must be a central consideration in all adaptation and resilience programs. As coastal resilience needs grow, scarce grant funding will increasingly be complemented by financing programs that leverage public-sector resources to scale up the capital flowing to these projects. Federal agencies that manage funding sources for adaptation and resilience work (see Appendix A) should revisit their processes to ensure requests for proposals and federal contracts include the integration of equity and climate justice as requirements for funding as well as in monitoring and reporting. As public funding is used to leverage private financing, the same requirements should be in place to expand the reach of equity and climate justice provisions. Program managers must be careful to ensure financing is fully accessible to communities that face systemic underinvestment and that projects in such areas are prioritized in program design and implementation.

EXAMPLES

The Hawaii Green Infrastructure Authority, Hawaii's green bank, provides an established example of integrating climate justice and equity into funding opportunities—both in mitigation and in adaptation and resilience. Hawaii's Green Energy Money $aver (GEM$) **on-bill financing program's** inclusive design enables renters and the most vulnerable ratepayers, previously unable to benefit from solar photovoltaic panels, to participate in clean energy projects. Applicants must be low- to moderate-income homeowners or renters, and qualification is based on utility bill payment history and meeting a minimum estimated bill savings threshold of 10 percent (including the loan repayment). The energy project reduces energy consumption, which lowers the ratepayer's utility bill, even after the repayment of the cost of the retrofit. GEM$ facilitated a project to build resilient housing for previously homeless families at Kahauiki Village. Due to unforeseen construction delays faced by the utility to install a meter, this community's solar-powered microgrid independently provided power to the homes, preschool, daycare center, and management office for six months prior to being connected to the utility's grid. GEM$ underscores Hawaii's effort to democratize clean energy that integrates resilience considerations.

6.2

THE FEDERAL GOVERNMENT SHOULD INCREASE SUPPORT FOR COASTAL ADAPTATION THROUGH FINANCING MECHANISMS, INCLUDING REVOLVING LOAN FUNDS.

Categories:
Federal investment; Capacity building

Federal policy levers:
Appropriate funding; Create a new agency, office, or program

Key Committees of Jurisdiction:
Senate and House Appropriation; Senate Environment and Public Works; House Energy and Commerce; House Transportation and Infrastructure; House Natural Resources

SUMMARY

A revolving loan fund (RLF) is a self-replenishing financing mechanism that can be used to fund a variety of programs, ranging from small business development to clean water infrastructure. For example, U.S. Environmental Protection Agency revolving loans have for years helped states fund clean-water and drinking-water infrastructure projects. Though RLFs can vary greatly depending on their mission and scope, they all share the same basic structure: a base level of capital, often consisting of private investment or grants from the state or federal government, that is loaned out to several borrowers. Over time, as these borrowers make repayments and pay interest on their loans, the capital is replenished. When enough repayments are made, the fund uses its reaccumulated capital to issue new loans. By providing low-interest loans with long repayment periods, RLFs can help those who may not have the funds available to pay for improvements up front. In this way, RLFs can be used as a tool for building community resilience to environmental hazards. Two proposed legislative approaches to address elements of this recommendation are the *Resilience Revolving Loan Fund Act of 2019* (**H.R.3779**), which would amend the Stafford Act to allow grants establishing revolving loan funds to reduce disaster risks, and the *Coastal Communities Adaptation Act* (**H.R.1317**), which would encourage coastal states to establish community resilience revolving funds in order to access federal funding for resilience programs, especially those promoting nature-based solutions.

EXAMPLES

The **Shore Friendly** program in Washington State is working to establish a revolving loan fund to help Puget Sound waterfront homeowners finance the removal of damaging armor and instead install nature-based erosion control that benefits fish and wildlife and is more resilient to storms. The program will be based on existing model programs—the Maryland Shore Erosion Control Revolving Loan Fund; Washington's **Clean Water Loans** program, which provides loans to repair or replace failing septic tanks to protect water quality; and the Shore Up Connecticut Program, which financed projects to raise homes to protect them from flooding. However, capitalizing the fund has been a challenge because most existing funding sources fund larger-scale projects via a grant and cost-share match. In addition, existing programs prioritize community-scale projects rather than groups of smaller-scale projects. Both are needed, but individual assistance efforts are generally less cost-competitive relative to larger projects.

6.3

CONGRESS SHOULD ESTABLISH A NATIONAL "GREEN BANK" TO DEPLOY CAPITAL FOR COASTAL ADAPTATION AND RESILIENCE PROJECTS AT SCALE.

Categories:
Federal investment; Capacity building

Federal policy levers:
Appropriate funding; Create a new agency, office, or program

Key Committees of Jurisdiction:
Senate and House Appropriation; Senate Environment and Public Works; Senate Banking, Housing, and Urban Affairs; House Ways and Means; House Energy and Commerce; House Transportation and Infrastructure; House Science, Space, and Technology; House Oversight and Reform; House Financial Services; House Natural Resources

SUMMARY

Green banks are dedicated finance institutions, often public or nonprofit, that primarily work to connect clean energy projects with capital. Green banks tackle the toughest problems in the industry, serving as the glue that holds together an otherwise unfinanceable project in the eyes of the private sector. Green banks can be structured to prioritize investment in traditionally underserved and vulnerable communities. Mitigation activities, such as deploying clean electricity-generating resources, are easier to finance than adaptation projects because of the expected future cash flows that arise from the use of these technologies. Adaptation projects provide less quantifiable financial benefits than mitigation, meaning that lenders are more hesitant to make loans to these types of projects. A living shoreline might save property damage for homeowners who live on the coast, but as far as a traditional lender is concerned, that is a non-priced positive externality of the project. Green banks therefore play a critical role in initiating financing for these hard-to-finance projects. The *National Climate Bank Act* (**S.2057**/**H.R.5416**), which would finance mitigation and adaptation projects with specific emphasis on allowing low- and moderate-income communities to access clean energy and resilience initiatives, is one proposed approach to address elements of this recommendation.

EXAMPLES

Through the **Green Energy Money $aver** on-bill financing program, the Hawaii Green Infrastructure Authority financed a microgrid project, which provides resilience benefits to the low-income community it serves. The Florida Solar and Energy Loan Fund has created a program that takes advantage of the insurance premium savings enjoyed by homeowners that harden their roofs against the threat of hurricanes, and uses those anticipated savings to help secure a loan to finance the upfront cost of the entire project. Green banks are leading the charge to find creative ways to capitalize on future cash flows, or on savings that adaptations projects produce.

> "RESILIENCE HAS TO GO WITH INVESTMENT."
>
> PUERTO RICO AND THE U.S. VIRGIN ISLANDS BRIEFING

SUMMARY TABLES

Coastal Washington. Photo from: Climate Impacts Group, ©CIG; with aerial support from LightHawk

TABLE 1

RECOMMENDATIONS ORGANIZED BY CATEGORY

Category	Recommendations
Capacity building	1.2 Federal agencies should provide funding within adaptation and resilience grant opportunities for local leader training.
	1.3 Federal government funding for adaptation and resilience should be designed so that communities have more decision-making authority in project implementation.
	2.5 The federal government should develop a comprehensive approach to managing public lands that have already started, and will continue, to erode due to sea level rise and storm surge.
	2.10 Federal agencies should include tribal and indigenous communities early in the adaptation or relocation planning process so that concerns can be raised regarding tribal sovereignty.
	2.12 Congress should develop national policy to prepare for the movement of people as a result of coastal hazards and climate impacts.
	3.1 Congress should establish a named climate heritage federal coordination office to manage research, coordination, and policy regarding cultural heritage and climate change.
	4.2 Federal agencies need to communicate climate data in a format that is accessible to non-experts, and should provide avenues for state, local, and tribal entities to access technical support to interpret and apply this data to decision-making.
	4.3 The federal government needs to invest in more data collection of diverse data sets to understand localized climate impacts and responses.
	4.4 Congress should increase funding and other support for existing federal entities focused on coordinating and communicating climate information for public use.
	6.1 Congress should ensure that climate justice and equity considerations apply to adaptation and resilience programs and projects financed or leveraged with federal funds, with special attention to communities that face systemic underinvestment.
	6.2 The federal government should increase support for coastal adaptation through financing mechanisms, including revolving loan funds.
	6.3 Congress should establish a national “green bank” to deploy capital for coastal adaptation and resilience projects at scale.
Federal investment	1.2 Federal agencies should provide funding within adaptation and resilience grant opportunities for local leader training.
	1.3 Federal government funding for adaptation and resilience should be designed so that communities have more decision-making authority in project implementation.
	2.1 Congress should ensure that all land use planning is designed—and all infrastructure is built—to anticipate and withstand future climate conditions.
	2.2 The federal government should encourage, fund, and provide technical assistance for all coastal areas to conduct climate vulnerability assessments.
	2.3 Federal agencies should use climate vulnerability assessments to efficiently allocate resources.
	2.7 Federal agencies should account for environmental and social impacts in benefit-cost analysis (BCA) tools.
	2.9 Congress should facilitate and provide funding to buy-out high-risk or repeatedly damaged homes and other property.
	3.3 Cultural heritage considerations should be integrated into federal requests for proposals for climate adaptation and resilience work.

Category	Recommendations
Federal Investment	4.1 Federal agencies should encourage, through funding and program design, scientists and tribes to co-produce climate adaptation and resilience knowledge.
	4.2 Federal agencies need to communicate climate data in a format that is accessible to non-experts, and should provide avenues for state, local, and tribal entities to access technical support to interpret and apply this data to decision-making.
	4.3 The federal government needs to invest in more data collection of diverse data sets to understand localized climate impacts and responses.
	4.4 Congress should increase funding and other support for existing federal entities focused on coordinating and communicating climate information for public use.
	4.5 Federal agencies should study the long-term efficacy, cost-effectiveness, and co-benefits of nature-based solutions as these nature-based solutions experience storms and other impacts.
	5.1 Congress should direct more federal disaster assistance funding to pre-disaster mitigation (PDM) and require agencies to properly account for the benefits of nature-based solutions.
	5.2 Congress should update the National Flood Insurance Program (NFIP) to discourage construction in risk-prone areas, including by requiring that flood insurance rate maps consider climate projections and reflect actual risk, and continue to ensure the affordability of premiums.
	5.4 Congress should make resilience a priority when developing and preserving safe and affordable housing.
	6.1 Congress should ensure that climate justice and equity considerations apply to adaptation and resilience programs and projects financed or leveraged with federal funds, with special attention to communities that face systemic underinvestment.
	6.2 The federal government should increase support for coastal adaptation through financing mechanisms, including revolving loan funds.
	6.3 Congress should establish a national “green bank” to deploy capital for coastal adaptation and resilience projects at scale.
Knowledge sharing	2.11 The federal government should encourage research into the cost of climate vulnerable communities staying in place compared to adapting through relocation.
	2.12 Congress should develop national policy to prepare for the movement of people as a result of coastal hazards and climate impacts.
	3.2 The National Oceanic and Atmospheric Administration (NOAA) and the U.S. Global Change Research Program should include research on cultural heritage in the National Climate Assessment.
	4.1 Federal agencies should encourage, through funding and program design, scientists and tribes to co-produce climate adaptation and resilience knowledge.
Mitigation co-benefits	2.1 Congress should ensure that all land use planning is designed—and all infrastructure is built—to anticipate and withstand future climate conditions.
	2.3 Federal agencies should use climate vulnerability assessments to efficiently allocate resources.
	2.4 Federal agencies should ensure nature-based solutions are given equal, or preferential, consideration to gray infrastructure as long-term coastal resilience infrastructure solutions.
	2.8 Federal agencies should ensure, through provisions in federal contracts, that engineers and contractors are trained and qualified to incorporate nature-based solutions in infrastructure projects.
	3.3 Cultural heritage considerations should be integrated into federal requests for proposals for climate adaptation and resilience work.
	4.5 Federal agencies should study the long-term efficacy, cost-effectiveness, and co-benefits of nature-based solutions as these nature-based solutions experience storms and other impacts.
	5.1 Congress should direct more federal disaster assistance funding to pre-disaster mitigation (PDM) and require agencies to properly account for the benefits of nature-based solutions.
	5.4 Congress should make resilience a priority when developing and preserving safe and affordable housing.

Category	Recommendations
Nature-based solutions	2.1 Congress should ensure that all land use planning is designed—and all infrastructure is built—to anticipate and withstand future climate conditions.
	2.4 Federal agencies should ensure nature-based solutions are given equal, or preferential, consideration to gray infrastructure as long-term coastal resilience infrastructure solutions.
	2.5 The federal government should develop a comprehensive approach to managing public lands that have already started, and will continue, to erode due to sea level rise and storm surge.
	2.8 Federal agencies should ensure, through provisions in federal contracts, that engineers and contractors are trained and qualified to incorporate nature-based solutions in infrastructure projects.
	4.5 Federal agencies should study the long-term efficacy, cost-effectiveness, and co-benefits of nature-based solutions as these nature-based solutions experience storms and other impacts.
	5.1 Congress should direct more federal disaster assistance funding to pre-disaster mitigation (PDM) and require agencies to properly account for the benefits of nature-based solutions.
Research, development, and deployment	2.1 Congress should ensure that all land use planning is designed—and all infrastructure is built—to anticipate and withstand future climate conditions.
	2.11 The federal government should encourage research into the cost of climate vulnerable communities staying in place compared to adapting through relocation.
	3.1 Congress should establish a named climate heritage federal coordination office to manage research, coordination, and policy regarding cultural heritage and climate change.
	3.2 The National Oceanic and Atmospheric Administration (NOAA) and the U.S. Global Change Research Program should include research on cultural heritage in the National Climate Assessment.
	4.1 Federal agencies should encourage, through funding and program design, scientists and tribes to co-produce climate adaptation and resilience knowledge.
	4.3 The federal government needs to invest in more data collection of diverse data sets to understand localized climate impacts and responses.
	4.4 Congress should increase funding and other support for existing federal entities focused on coordinating and communicating climate information for public use.
	4.5 Federal agencies should study the long-term efficacy, cost-effectiveness, and co-benefits of nature-based solutions as these nature-based solutions experience storms and other impacts.
Technical assistance	1.1 In order to establish and strengthen long-term relationships, federal agencies should consult with communities to ensure that projects and programs are designed with the community and specifically address community needs.
	2.2 The federal government should encourage, fund, and provide technical assistance for all coastal areas to conduct climate vulnerability assessments.
	2.6 Federal agencies should extend the work of Department of Agriculture (USDA) conservation districts to include climate resilience services for private landowners, or use USDA conservation districts as a model for a 'climate resilience districts' program.
	4.2 Federal agencies need to communicate climate data in a format that is accessible to non-experts, and should provide avenues for state, local, and tribal entities to access technical support to interpret and apply this data to decision-making.
	5.1 Congress should direct more federal disaster assistance funding to pre-disaster mitigation (PDM) and require agencies to properly account for the benefits of nature-based solutions.
Training	1.2 Federal agencies should provide funding within adaptation and resilience grant opportunities for local leader training.
	2.8 Federal agencies should ensure, through provisions in federal contracts, that engineers and contractors are trained and qualified to incorporate nature-based solutions in infrastructure projects.
	5.1 Congress should direct more federal disaster assistance funding to pre-disaster mitigation (PDM) and require agencies to properly account for the benefits of nature-based solutions.

TABLE 2

RECOMMENDATIONS ORGANIZED BY FEDERAL POLICY LEVER

Federal policy lever	Recommendations
Amend an existing agency, office, or program authorization	1.1 In order to establish and strengthen long-term relationships, federal agencies should consult with communities to ensure that projects and programs are designed with the community and specifically address community needs.
	1.2 Federal agencies should provide funding within adaptation and resilience grant opportunities for local leader training.
	1.3 Federal government funding for adaptation and resilience should be designed so that communities have more decision-making authority in project implementation.
	2.1 Congress should ensure that all land use planning is designed—and all infrastructure is built—to anticipate and withstand future climate conditions.
	2.2 The federal government should encourage, fund, and provide technical assistance for all coastal areas to conduct climate vulnerability assessments.
	2.3 Federal agencies should use climate vulnerability assessments to efficiently allocate resources.
	2.4 Federal agencies should ensure nature-based solutions are given equal, or preferential, consideration to gray infrastructure as long-term coastal resilience infrastructure solutions.
	2.6 Federal agencies should extend the work of Department of Agriculture (USDA) conservation districts to include climate resilience services for private landowners, or use USDA conservation districts as a model for a 'climate resilience districts' program.
	2.7 Federal agencies should account for environmental and social impacts in benefit-cost analysis (BCA) tools.
	2.8 Federal agencies should ensure, through provisions in federal contracts, that engineers and contractors are trained and qualified to incorporate nature-based solutions in infrastructure projects.
	2.9 Congress should facilitate and provide funding to buy-out high-risk or repeatedly damaged homes and other property.
	3.3 Cultural heritage considerations should be integrated into federal requests for proposals for climate adaptation and resilience work.
	5.1 Congress should direct more federal disaster assistance funding to pre-disaster mitigation (PDM) and require agencies to properly account for the benefits of nature-based solutions.
	5.2 Congress should update the National Flood Insurance Program (NFIP) to discourage construction in risk-prone areas, including by requiring that flood insurance rate maps consider climate projections and reflect actual risk, and continue to ensure the affordability of premiums.
	5.4 Congress should make resilience a priority when developing and preserving safe and affordable housing.
Appropriate funding	1.2 Federal agencies should provide funding within adaptation and resilience grant opportunities for local leader training.
	1.3 Federal government funding for adaptation and resilience should be designed so that communities have more decision-making authority in project implementation.
	2.2 The federal government should encourage, fund, and provide technical assistance for all coastal areas to conduct climate vulnerability assessments.
	2.9 Congress should facilitate and provide funding to buy-out high-risk or repeatedly damaged homes and other property.
	2.10 Federal agencies should include tribal and indigenous communities early in the adaptation or relocation planning process so that concerns can be raised regarding tribal sovereignty.
	4.1 Federal agencies should encourage, through funding and program design, scientists and tribes to co-produce climate adaptation and resilience knowledge.
	4.3 The federal government needs to invest in more data collection of diverse data sets to understand localized climate impacts and responses.
	4.4 Congress should increase funding and other support for existing federal entities focused on coordinating and communicating climate information for public use.
	5.1 Congress should direct more federal disaster assistance funding to pre-disaster mitigation (PDM) and require agencies to properly account for the benefits of nature-based solutions.

Federal policy lever	Recommendations
Appropriate funding	5.2 Congress should update the National Flood Insurance Program (NFIP) to discourage construction in risk-prone areas, including by requiring that flood insurance rate maps consider climate projections and reflect actual risk, and continue to ensure the affordability of premiums.
	5.3 Congress should carry out robust oversight to ensure federal agencies' timely disbursement of appropriations for disaster recovery and approval of hazard mitigation plans.
	5.4 Congress should make resilience a priority when developing and preserving safe and affordable housing.
	6.1 Congress should ensure that climate justice and equity considerations apply to adaptation and resilience programs and projects financed or leveraged with federal funds, with special attention to communities that face systemic underinvestment.
	6.2 The federal government should increase support for coastal adaptation through financing mechanisms, including revolving loan funds.
	6.3 Congress should establish a national "green bank" to deploy capital for coastal adaptation and resilience projects at scale.
Commission a report	2.5 The federal government should develop a comprehensive approach to managing public lands that have already started, and will continue, to erode due to sea level rise and storm surge.
	2.11 The federal government should encourage research into the cost of climate vulnerable communities staying in place compared to adapting through relocation.
	2.12 Congress should develop national policy to prepare for the movement of people as a result of coastal hazards and climate impacts.
	4.5 Federal agencies should study the long-term efficacy, cost-effectiveness, and co-benefits of nature-based solutions as these nature-based solutions experience storms and other impacts.
Create a new agency, office, or program	2.6 Federal agencies should extend the work of Department of Agriculture (USDA) conservation districts to include climate resilience services for private landowners, or use USDA conservation districts as a model for a 'climate resilience districts' program.
	3.1 Congress should establish a named climate heritage federal coordination office to manage research, coordination, and policy regarding cultural heritage and climate change.
	4.1 Federal agencies should encourage, through funding and program design, scientists and tribes to co-produce climate adaptation and resilience knowledge.
	6.2 The federal government should increase support for coastal adaptation through financing mechanisms, including revolving loan funds.
	6.3 Congress should establish a national "green bank" to deploy capital for coastal adaptation and resilience projects at scale.
Establish Interagency and intra-agency coordination	1.1 In order to establish and strengthen long-term relationships, federal agencies should consult with communities to ensure that projects and programs are designed with the community and specifically address community needs.
	2.1 Congress should ensure that all land use planning is designed—and all infrastructure is built—to anticipate and withstand future climate conditions.
	2.5 The federal government should develop a comprehensive approach to managing public lands that have already started, and will continue, to erode due to sea level rise and storm surge.
	2.7 Federal agencies should account for environmental and social impacts in benefit-cost analysis (BCA) tools.
	2.10 Federal agencies should include tribal and indigenous communities early in the adaptation or relocation planning process so that concerns can be raised regarding tribal sovereignty.
	2.12 Congress should develop national policy to prepare for the movement of people as a result of coastal hazards and climate impacts.
	3.2 The National Oceanic and Atmospheric Administration (NOAA) and the U.S. Global Change Research Program should include research on cultural heritage in the National Climate Assessment.
	3.3 Cultural heritage considerations should be integrated into federal requests for proposals for climate adaptation and resilience work.
	4.2 Federal agencies need to communicate climate data in a format that is accessible to non-experts, and should provide avenues for state, local, and tribal entities to access technical support to interpret and apply this data to decision-making.

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Coastal Alaska. Photo from: Alaska Conservation Foundation

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APPENDIX A

PROGRAMS AND FUNDING

RELEVANT FEDERAL AGENCY PROGRAMS AND FUNDING SOURCES

Department of Agriculture (USDA)

- Climate Hubs - USDA's Climate Hubs link USDA research and programs to deliver timely and authoritative tools and information to agricultural producers and professionals at 10 regional locations. The work is a collaboration of the Agricultural Research Service, Forest Service, Natural Resources Conservation Service, Farm Service Agency, and other USDA agencies.

Department of Commerce (DOC)

- National Oceanic and Atmospheric Administration (NOAA)

» Atlas 14 - This series of documents from the National Weather Service's Hydrometeorological Design Studies Center (HDSC) provides precipitation frequency estimates for the United States and U.S. affiliated territories. Information can be accessed on the Interactive Precipitation Frequency Data Server. Atlas 14 volumes are based on geographic sections of the country and used by FEMA to develop flood risk maps for the National Flood Insurance Program (NFIP) and by the construction industry to inform development decisions. Information is updated as funding becomes available, typically through individual states.

» Coastal Zone Management Program - This program was authorized by the Coastal Zone Management Act (CZMA) of 1972 to address national coastal issues as a voluntary partnership between the federal government and U.S. coastal and Great Lakes states and territories. Issues include coastal development, water quality, public access, habitat protection, energy facility siting, ocean governance and planning, coastal hazards, and climate change.

» Community Resilience Building Program - This is a workshop for municipalities, agencies, organizations, and corporations (local to global) that provides a "friendly, anywhere, at any scale" process for developing resilience action plans. The program is a collaboration of The Nature Conservancy, NOAA's Office for Coastal Management, and numerous partners.

» Digital Coast - This is a web-based resource that includes tools, training, and stories from a variety of sources, vetted by NOAA, to assist coastal managers. In addition, the Digital Coast Partnership brings user groups together to address coastal issues.

» Great Lakes Integrated Sciences and Assessments Program (GLISA) - GLISA is one of 11 national centers for Regional Integrated Sciences and Assessments (RISAs) that help the nation prepare for and adapt to climate change through climate literacy education and decision making. GLISA serves the eight Great Lakes states (Minnesota, Wisconsin, Illinois, Indiana, Ohio, Michigan, New York, and Pennsylvania) and the province of Ontario.

» National Coastal Resilience Fund (NCRF) - The National Coastal Resilience Fund is a program of the Congressionally-chartered National Fish and Wildlife Foundation (NFWF). The Fund was established in 2018 to restore and strengthen natural infrastructure ("landscapes that absorb the impacts of storms and floods") to protect coastal communities while also enhancing habitats for fish and wildlife. NCRF supports conservation projects for coastal marshes and wetlands, dune and beach systems, oyster and coral reefs, forests, coastal rivers and floodplains, and barrier islands that minimize the impacts of storms and other naturally occurring events on nearby communities.

» National Weather Service (NWS)- The NWS provides weather, water, and climate data, as well as forecasts and warnings for the protection of life and property and the enhancement of the national economy. Services include Forecasts and Observations, Warnings, Impact-based Decision Support Services, and Education and aim to build a weather-ready nation.

» Regional Climate Centers (RCCs) - Managed by NOAA's National Centers for Environmental Information (NCEI), the RCC program provides climate services to the six major regions of the United States. RCCs provide sector-specific data products and services; robust computer-based infrastructure for providing climate information; and integration of non-NOAA climate data with traditional NOAA data sources.

» Regional Integrated Sciences and Assessments (RISA) - The Regional Integrated Sciences and Assessments (RISA) program supports research teams that help expand and build the nation's capacity to prepare for and adapt to climate variability and change. RISA teams use their understanding of different decision contexts to develop knowledge tailored for specific needs and contexts.

» Sea Grant - The National Sea Grant College Program is a federal-university partnership between NOAA and 34 university-based programs in every coastal and Great Lakes state, Puerto Rico, and Guam. It was established in 1966 to create and maintain healthy coastal environments and economies. Funding supports work in four focus areas: Healthy Coastal Ecosystems, Sustainable Fisheries and Aquaculture, Resilient Coastal Communities and Economies, and Environmental Literacy and Workforce Development.

Department of Defense (DOD)

- Army Corps - The U.S. Army Corps of Engineers provides military and civilian engineering services, including maintenance of waterways and natural disaster response. Congressional authority is through the biennial Water Resources and Development Act (WRDA). Projects are funded through annual appropriations.

- Department of Defense Readiness and Environmental Protection Integration (REPI) Program - DOD's Readiness and Environmental Protection Integration (REPI) program was created to ensure military mission sustainability by limiting incompatible development near installations and ranges. Related to this, the Department funds cost-sharing agreements with state and local governments and conservation organizations to promote compatible land uses and preserve habitats that are near or ecologically related to military installations and ranges.

Department of Homeland Security (DHS)

- Coast Guard - The United States Coast Guard (USCG) has statutory authority to assist in a variety of rescue and recovery operations, including oil spills and natural disasters. For example, the Coast Guard assisted in coastal recovery operations in Puerto Rico after Hurricane Maria in 2017. One specific area of responsibility is responding to "Pollution Incidents of National Significance" caused by industrial accidents; natural disasters such as hurricanes, floods, and earthquakes; terrorist acts; or weapons of mass destruction. Opportunities for Coast Guard assistance and funding are outlined in its National Pollution Funds Center (NPFC). The center provides funding to respond to "everyday oil spills" and is authorized under the Stafford Act to provide additional funding to remediate a "Spill of National Significance."

- Federal Emergency Management Agency (FEMA)

  » Building Resilient Infrastructure and Communities (BRIC) - BRIC is the new FEMA pre-disaster hazard mitigation program authorized by Section 1234 of the Disaster Recovery Reform Act (DRRA) of 2018, which replaced the agency's Predisaster Mitigation (PDM) program. Instead of an annual appropriation, BRIC is funded through an annual six percent set-aside from the Disaster Relief Fund. Through its first Notice of Funding Opportunity, the BRIC program is making $500 million available to states, U.S territories, Native American tribal governments, and local communities to implement pre-disaster mitigation projects that reduce risks posed by natural hazards.

  » Community Rating System (CRS) - The CRS is part of the National Flood Insurance Program (NFIP). The NFIP offers flood insurance to all properties in communities that comply with minimum standards for floodplain management, and the CRS provides incentives for communities to go beyond those minimum standards by offering reduced flood insurance premiums to the community's property owners.

  » Hazard Mitigation Grant Program - This program assists state, local, tribal, and territorial governments with rebuilding after a presidentially-declared disaster. Grants provide co-funding for mitigation projects that can reduce future disaster losses. Policy guidance published in September 2020 on ecosystem service benefits recognized the resilience value of nature-based mitigation solutions by eliminating a previous benefit-cost ratio (BCR) requirement. https://www.fema.gov/sites/default/files/2020-09/fema_ecosystem-service-benefits_policy_september-2020.pdf

  » National Flood Insurance Program (NFIP) - The NFIP is administered by the Federal Insurance and Mitigation Administration (FIMA) under FEMA. The program has the dual purpose of offering "reasonably priced" primary flood insurance to properties with significant flood risk and encouraging communities to adopt floodplain management standards. Flood mapping is an important part of the program as it informs NFIP regulations and non-regulatory resources such as coastal flood maps and coastal flood risk studies. Efforts are underway to reform NFIP so that rates reflect actual flood risk with measures to mitigate premium spikes for current policyholders.

Department of Housing and Urban Development (HUD)

- Community Development Block Grants (CDBG) for Disaster Recovery (DR) and Mitigation (MIT) - Unlike other forms of federal disaster recovery assistance, CDBG–DR and CDBG–MIT grants are required by statute to benefit vulnerable, lower-income people and communities in the most distressed areas.

  » Community Development Block Grants for Disaster Recovery (CDBG-DR) - When the president declares a major disaster, Congress may appropriate funds to the Department of Housing and Urban Development (HUD) when there are significant unmet needs for long-term recovery. The special appropriation provides funds to the most distressed areas for disaster relief, long term-recovery, restoration of infrastructure, housing, and economic revitalization.

  » Community Development Block Grants for Mitigation (CDBG-MIT) - Congress may provide funding for CDBG–MIT in a supplemental appropriation to the Community Development Block Grant (CDBG) program. HUD must then publish a notice of funding availability and grant requirements. Eligible grantees may use this assistance "in areas impacted by recent disasters to carry out strategic and high-impact activities" to mitigate disaster risks and reduce future losses. As a supplemental appropriation to the CDBG program, CDBG–MIT projects must also align with the CDBG program objectives: "providing benefit to low- and moderate-income persons; preventing or eliminating slum and blighting conditions; or addressing a severe and recently arising urgent community welfare or health need."

- National Disaster Resilience Competition - This HUD program was modeled after the Rebuild by Design Competition based on recommendations of the Hurricane Sandy Rebuilding Task Force. Awards were announced in 2016. The thoughtful and innovative HUD request for proposals was unique in its requirement for applicants to consider the value of nature-based mitigation strategies, affordable housing, and other elements of resilient communities in their proposals, and the applications were equally innovative. The awardees' projects offer the potential to provide important resilience solutions for their communities and serve as models for other communities. They have made significant progress, but projects are now at risk from losing the remaining funding. This is due in part to the pandemic and to an administrative rule that requires CDBG-DR projects to be completed in five years. (CDBG-DR was selected to receive the appropriation and manage the grants.) Awardees are requesting Congressional action to extend the deadline.

Department of the Interior (DOI)

- Bureau of Indian Affairs (BIA)

  » Tribal Resilience Program Tribal Resilience Program - This program offers competitive awards for federally-recognized Tribal Nations and Alaska Native Villages to build resilience through training and planning for adaptation and ocean and coastal management, as well as relocation, managed retreat, or protect-in-place.

- Fish and Wildlife Service (FWS)

  » Coastal Program - The FWS Coastal Program is a voluntary, community-based program that provides technical and financial assistance through cooperative agreements to coastal communities, conservation partners, and landowners to restore and protect fish and wildlife habitat on public and private lands. Projects are developed in collaboration with partners, and with substantial involvement from FWS field staff to identify geographic focus areas where the Coastal Program can direct resources to conserve habitat for federal trust species. Applicants seeking technical or financial assistance from the Coastal Program are requested to consult with the regional Coastal Program office and review the appropriate strategic plan before developing or submitting an application.

- Landscape Conservation Cooperatives (LCCs) - Landscape Conservation Cooperatives (LCCs) were established to provide science capacity and technical expertise for meeting shared natural and cultural resource priorities. Each LCC brings together federal, state, and local governments along with Tribes and First Nations, non-governmental organizations, universities, and interested public and private organizations. Though funding changes in 2017 eroded the extent of the Network, many individual LCC partnerships remain active along the coasts under different names and funding models.

- National Park Service (NPS) - The National Park Service is the caretaker of U.S. national parks with the help of volunteers and partners. The NPS works with tribes, local governments, nonprofit organizations, businesses, and individual citizens to help revitalize communities, preserve local history, celebrate local heritage, and provide outdoor enjoyment. The Park Service provides funding to non-federal entities to undertake projects with a distinct public purpose, such as researching natural and cultural resource conservation techniques, providing educational opportunities, and funding community engagement projects. https://www.nps.gov/getinvolved/communities.htm

- U.S. Geological Survey (USGS)

  » Climate Adaptation Science Centers (CASC) - ASCs develop data and tools for natural and cultural resource managers. Projects address the impacts of climate change on fish, wildlife, ecosystems, and the communities they support.

  » Coastal and Marine Hazards and Resources Program - USGS program scientists and staff study coastal and ocean resources and processes including shorelines, estuaries, and the continental shelf and deep sea. Science Centers in Santa Cruz, California; St. Petersburg, Florida; and Woods Hole, Massachusetts, conduct research to increase understanding of coastal and marine environments, including coastal ecosystems and coastal change, risk, and vulnerability. Studies include shoreline change and the geologic structure and history of coastal regions, sediment supply and transport, sea-level rise, and how extreme storm events affect rates and impacts of coastal change

Environmental Protection Agency (EPA)

- Great Lakes Restoration Initiative (GLRI)

  » Tribal Great Lakes Restoration Initiative - The Great Lakes Restoration Initiative (GLRI) is an interagency collaboration to protect and restore the Great Lakes. With the support of GLRI, tribes are more involved in intergovernmental resource management activities. GLRI is a significant source of funding for tribal communities to lead on-the-ground work to protect and restore the Great Lakes, including restoring stream passage and riparian habitats for native fish populations and protecting Great Lakes coastal wetlands. As noted in this brochure about the program, "Tribes provide unique expertise for Great Lakes resource protection, including serving as the premier experts in wild rice management. As the original caretakers of the Great Lakes, tribes have critical place-based insight and traditional ecological perspectives for understanding and protecting the Great Lakes for generations to come."

- National Estuary Program (NEP) - EPA's National Estuary Program is a place-based program to protect and restore the waters, habitats and living resources of 28 estuaries across the country. Currently, 28 estuaries located along the Atlantic, Gulf, and Pacific coasts and in Puerto Rico are designated as estuaries of national significance. EPA provides annual funding, national guidance, and technical assistance to the local NEPs.

- Tribal Operations Committee - EPA established the National Tribal Operations Committee (NTOC) in 1994 to improve communication and build stronger partnerships between the Agency and federally recognized tribes on matters related to tribal capacity building and environmental programs in Indian country. The NTOC is composed of 19 tribal members from nine EPA Regions and EPA's senior leadership team.

National Science Foundation (NSF)

- Disaster Resilience Research Grants (DRRG) - This is a joint funding program between the National Science Foundation and the National Institute for Standards and Technology (NIST) for research to advance fundamental understanding of disaster resilience in support of improved, science-based planning, policy, decisions, design, codes, and standards.

U.S. Global Change Research Program (USGCRP) - The U.S. Global Change Research Program (USGCRP) was mandated by Congress in the Global Change Research Act (GCRA) of 1990 to develop and coordinate "a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change."

- National Climate Assessment (NCA) - The GCRA requires the USGCRP to prepare and submit to the president and Congress a quadrennial assessment, referred to as the National Climate Assessment (NCA). The NCA collects, integrates, and assesses observations and research from around the country on the impacts of climate change on human health, water, energy, transportation, agriculture, forests, and ecosystems. The report also assesses key impacts on all U.S. regions: Northeast, Southeast and Caribbean, Midwest, Great Plains, Southwest, Northwest, Alaska, Hawai'i and Pacific Islands, as well as the country's coastal areas, oceans, and marine resources. Development of the Fifth National Climate Assessment (NCA5) is currently underway, with anticipated delivery in 2023. Fourth National Climate Assessment (2018)

APPENDIX B

METHODS

EESI hosted 16 Congressional briefings on coastal resilience from June 2019 to June 2020. The briefings explored each coastal area of the country by geographic region: Alaska, Great Lakes, Gulf Coast, Hawaii, Louisiana, Northeast, Southeast, Puerto Rico and the U.S. Virgin Islands (3-part series), and West Coast. EESI also held a five-part briefing series on climate adaptation data. The briefings featured 42 coastal resilience experts and practitioners. We transcribed each briefing verbatim using YouTube's transcript function, and the transcripts were edited for accuracy by EESI staff.

We used QSR International's NVivo software to analyze the briefing transcripts. We set a framework for analysis before beginning the review of the transcripts in NVivo. Using this framework, we read each transcript and assigned codes (one or more of the categories in the framework) to all applicable sections of the text. For example, a panelist's comments on receiving federal funding to construct living shorelines to deal with flooding and erosion after holding a series of workshops would be assigned to the codes "living shoreline," "federal funding," "erosion," "flooding," and "workshops." After coding each transcript, we then could look at the transcript sections that fell into each of the framework categories.

Looking across the categorization created by the coding exercise, we then identified and grouped the ideas, principles, and policy recommendations that emerged from the briefings. We did this by reading all the transcripts for a second time as organized by category. This step produced a document of all compiled ideas, principles, and policy recommendations, which we provided to the 42 coastal resilience panelists. In July 2020, we hosted two 1.5-hour panelist feedback Zoom calls to gather verbal input on that document and facilitate conversation across panelists to fill gaps in our analysis. Twenty-one panelists called into the meetings, representing seven of the eight regional briefings, three of the five adaptation data week briefings, and one of the three Puerto Rico and U.S. Virgin Islands briefings. We also received over 40 written comments on the document from additional panelists who did not attend the feedback calls.

The 42 panelists also had the opportunity to prioritize the policy ideas included in the written document through a companion survey. Ten panelists representing nine different briefings provided responses, which guided the organization of the final report.

Based on the feedback from the panelists, we wrote a first draft of the guiding principles and policy recommendations (including the categories, federal policy levers, key committees of jurisdiction, summaries, examples, and relevant legislation). We shared this draft with the 42 panelists as well as additional EESI and external reviewers to collect feedback on the fleshed out recommendations. At least 19 panelists (some participated anonymously) provided detailed feedback, which was then incorporated into the next version of the document.

We designed this robust engagement and iterative editing process with the panelists to ensure the report is an accurate, useful, and well-vetted product that puts forward the key policy ideas that emerged from EESI's coastal resilience briefing series.

APPENDIX C

RESOURCES

REGIONAL CLIMATE IMPACT REPORTS

"Climate Change Vulnerability Assessment," Great Lakes Indian Fish & Wildlife Commission, April 2018.

"National Assessment of Coastal Change Hazards," U.S. Geological Survey.

"New York's Great Lakes Coastal Resilience Index: A Community Self-Assessment," New York Sea Grant, 2019.

"Projected Sea Level Rise for Washington State: A 2018 Assessment," University of Washington Climate Impacts Group, last updated July 2019.

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Washington State of Knowledge Report: Climate Change Impacts and Adaptation in Washington State: Technical Summaries for Decision Makers (2013)

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Washington State of Knowledge Report: Climate Change in Puget Sound (2015)

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