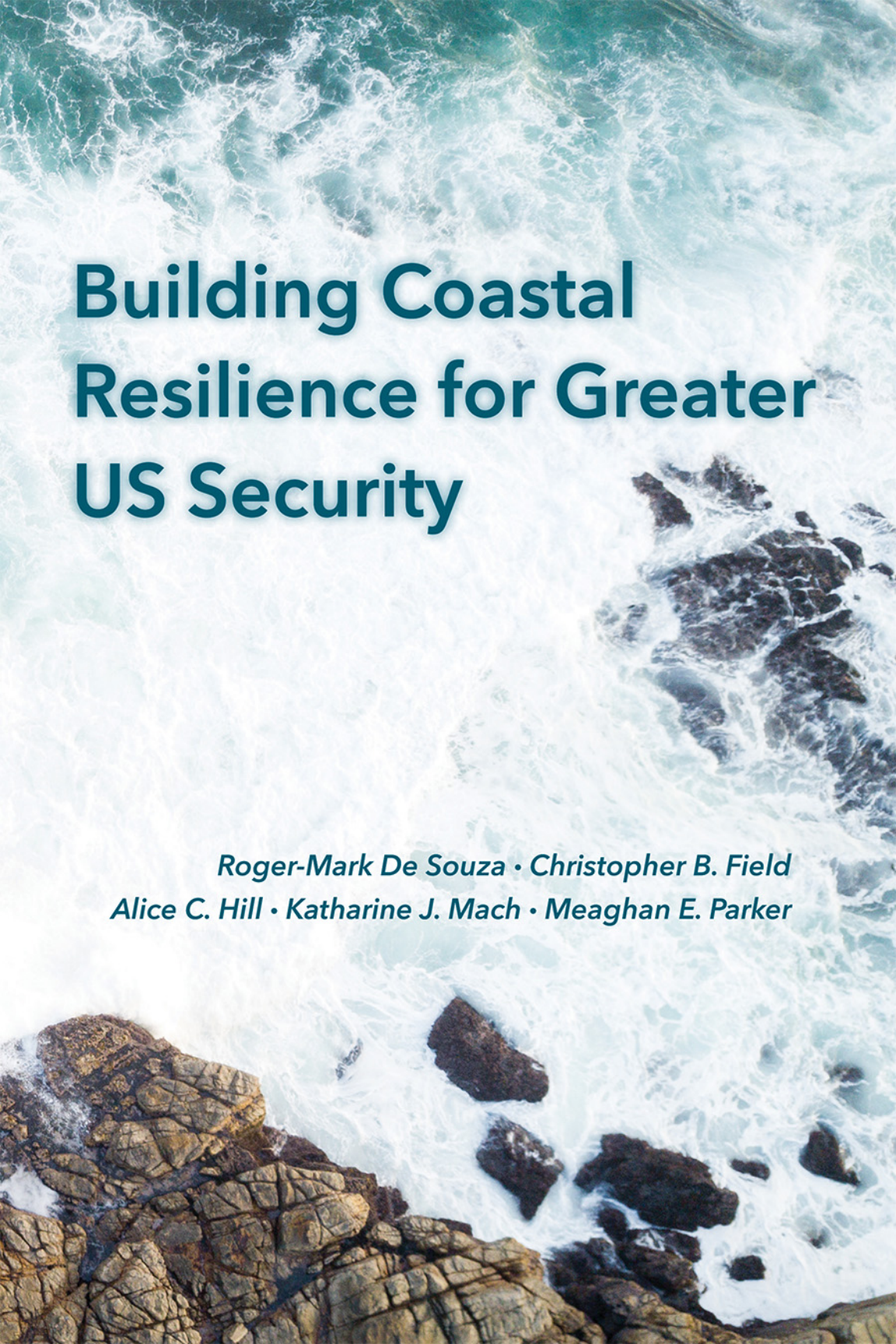

Building Coastal Resilience for Greater US Security

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Contents

Executive Summary

Coastal communities are on the front lines of a changing climate. Rising, warming seas are contributing to stronger storms, higher extreme sea levels, and associated coastal flooding, along with increasing "sunny day" nuisance flooding. These shifting hazards amplify risks for people, valuable assets, essential infrastructure, and important economic industries such as energy production and shipping. They also pose risks for human security, for example through impacts on migration, culture, territorial integrity, and national security. To prepare for and respond to such risks, US policy makers across all levels of government, national to local, need sound, actionable evidence in support of critical decisions.

The Hoover Institution, the Stanford Woods Institute for the Environment, and the Woodrow Wilson International Center for Scholars jointly convened a series of discussions focused on pathways to solutions for our coastal challenges. The dialogues sought to catalyze insights on best practices toward action on the ground. Across the conversations, the focus brought together a full range of perspectives, from cutting-edge science to ongoing policy and practice. The science included cross-disciplinary takes: the physics of the changing climate, resulting

impacts for nature, and the human consequences in affected communities and economies. Policy and practice perspectives were similarly diverse, including coastal resource planners, government officials across scales and contexts, military and national security experts, and industry and private-sector leaders. The conversation areas included understanding the state of scientific knowledge, identifying important gaps, and exploring relevant policies, decision-support tools, and decision-making approaches. The overall goals were to advance US resilience to climate impacts, strengthen the sustainability and economic security of coastal infrastructure, and enhance national security.

The organizers embarked on the collaborative project, *Building Coastal Resilience for Greater US Security*, well before 2017's devastating hurricane season. Through the course of the dialogue series, questions about sea-level rise, more severe storms, and increased flooding intensified as the major hurricanes Harvey, Irma, and Maria struck US shores. These massive storms occurred within a four-week period in August and September 2017. Their consequences, still far from remedied, have been severe. The storms killed hundreds (if not thousands) of people, destroyed hundreds of billions of dollars' worth of property and infrastructure, led to widespread power outages, disrupted supply chains, and did much more. These disasters brought added urgency to our meetings. The series began with an "Uncommon Dialogue" at the Hoover Institution in Washington, DC, which set up the topics and framing for the subsequent sessions. A public event was hosted by the Woods Institute at Stanford University in Palo Alto, California, and the Wilson Center held a full day of private and public discussions in Washington, DC.

The June "Uncommon Dialogue" hosted by the Hoover Institution sought to explore complex and intractable challenges, as well as opportunities around governance, relocation and equity, social and physical infrastructure, and security. As a trademark of the "Uncommon Dialogue" format, the meeting brought academics, government and elected officials, nonprofit and think tank representatives, and members of the private sector around the same table for an open, not-for-attribution discussion of the issues. Notable themes emerging in the conversation included recognition that, in most instances, inclusive approaches involving whole communities in the planning process will have the greatest buy-in and chances of success. These approaches must encompass the most vulnerable members of society, such as persons with disabilities, the elderly, the homeless, and those with low English proficiency. Financing and fiscal challenges were other running themes, with political will an essential enabler in identifying funds. Economic realities can be barriers to prudent decisions, such as when property-tax collection from high-value coastal properties creates a disincentive for options such as managed relocation.

A reinsurance roundtable followed the dialogue in August, bringing seventeen stakeholders together to discuss risk, including perception, market mechanisms, and natural and man-made solutions. The roundtable was not-for-attribution.

The dialogue continued in September with a series of public panel sessions at Stanford University. These conversations focused on sea-level rise, ocean health, and in-depth case studies of actions being taken in the San Francisco Bay Area toward greater resilience. The sessions raised important issues and questions facing decision-makers. Effective approaches for grappling

with substantial persistent uncertainties and associated risks were considered across policy-making, business, and other contexts. A glaciologist discussed the emerging, dynamic research on ice-sheet loss, including the increasing risks in the next few decades and beyond associated with potentially irreversible loss of portions of the Antarctic Ice Sheet. Other panelists called for actionable, coproduced science.

Finally, the discussions turned toward international perspectives with a third event at the Wilson Center in October. Participants and speakers in the public session represented coastal areas of island nations under grave threats from sea-level rise. Their stories were both chilling and inspiring. In some instances, the severity of the risks is bringing communities together to increase their resilience. In the Mariana Islands, innovative regulations require developers to consult with zoning and planning offices early in the development process to ensure more resilient buildings. Insurance companies are also developing novel financing structures and new products to fund resilient infrastructure, such as Munich Reinsurance's Coastal Resiliency Bonds. It was clear that one key step to building resilience is creating more opportunities for US and international coastal communities to share lessons and solutions.

Throughout the series, the dialogues were robust and candid in their approach to the serious challenges facing coastal communities. Governance, financing, and political will to overcome obstacles are among the notable tests for resilience, while community-driven efforts to date have made progress toward effective solutions.

Policy Options

For the United States,
Science and Risk, and the
International Community

Policy Options: United States

Building coastal resilience occurs on the ground in individual towns, cities, and counties around the United States. The following domestic policy options focus on ensuring that decision-makers at all levels of government have access to up-to-date, relevant resources for building resilient coastal communities. These communities need support in incorporating the future risks of climate change as they conduct critical short- and long-term risk assessments and engage in resilience and adaptation planning. The options below will help the nation plan today for the accelerating risks it will confront tomorrow.

Provide incentives to keep communities from building or staying in harm's way through forward-looking zoning and land-use choices.

All too often, coastal communities allow new construction as well as rebuilding in areas that have already suffered repetitive flooding or carry a high risk of doing so in the foreseeable future.

Even when people relocate away from flood risk, they sometimes move to equally vulnerable locations. To reduce future flood damages and promote public safety, communities need to make land-use and zoning decisions that account for future flood risk.

Communities can promote resilient building through sharing co-benefits and responsibility with public and private stakeholders. Often referred to as a "resilience dividend," co-benefits include economic, environmental, social, and quality-of-life benefits.[1] For instance, following Superstorm Sandy, communities initiated projects with green public recreation spaces atop underground parking garages with the capacity to retain flood water underground.

Listed below are additional federal actions that would assist coastal communities in achieving this goal.

Update our floodplain standards.

Congress should fund and prioritize the updating of federal floodplain maps to account for future projected sea-level rise. Diverse stakeholders ranging from urban planners to individual business and residential property owners would benefit from improved access to risk information. Without such information, community decision-makers may inadvertently permit investment in areas at risk of severe inundation.

Additionally, the Community Rating System for the National Flood Insurance Program (NFIP), while helpful in scoring communities on their resilience efforts, currently promotes continued building in vulnerable coastal areas as it provides discounted

insurance rates with more resilient community scores. This may lead to an incorrect impression of a "safe area" for home or commercial development.

The NFIP should also establish a buyout requirement for homes that repeatedly flood and stop issuing policies for new construction within the floodplain.

➢ *Congress can require the inclusion of future scenarios in Federal Emergency Management Agency floodplain map updates, limit coverage for repetitive flooding, and preclude policies for new construction in floodplains.*

Develop and promote coastal resilience planning tools, making them readily available for policy and decision-makers.

Although many scientific, data-driven, and economic tools already exist for decision-makers to meet the uncertainty surrounding climate changes, the federal government can improve its "menu" or "basket of options" by tailoring those tools more closely to specific areas with the explicit goal of assisting local decision-makers on the ground. Since not all solutions will work for every community and since local staff and resource availability vary greatly, the federal government should work to close the gap by ensuring the incorporation of the best available science into tools designed to improve decision-making. It should be easy for a decision-maker to access the tools and identify which will serve his or her purposes best.

The availability of a menu of recommended tools tailored for particular risks and geographic locations would allow communities to better identify their risks, assets, and vulnerabilities; evaluate existing and needed levels of protection; and assess the cost of their action or inaction. It would also allow for regional collaboration and communication and the sharing of failures as well as best practices.

Make downscaled data available.

Climate information, while helpful, can seem overwhelming in its breadth and scope. Decision-makers need data to be actionable for on-the-ground decisions. If individual, business, and community stakeholders can visualize how climate change will directly affect them, they can better assess individualized risk. This will assist in better mitigation and adaptation decisions.

The federal government should facilitate sharing its vast climate data and find ways to partner with academic institutions and private entities to develop impact analysis that is downscaled. Consistent and dedicated funding is needed to share research, innovation, and data.

➢ *The National Oceanic and Atmospheric Administration (NOAA) and the US Global Change Research Program can provide online, publicly available access to downscaled data.*

Invest in both natural and built infrastructure solutions now to prepare for the long term.

We must prepare for the long term by designing and building our infrastructure to withstand projected impacts of climate change over the course of its service life. Building, rebuilding, and hardening infrastructure with future risks in mind, as well as accounting for cascading infrastructure interdependencies, is now more critical than ever as seen after hurricanes Harvey, Irma, and Maria. A National Institute of Building Sciences (NIBS) study recognizes that for every $1 spent on infrastructure mitigation, $6 is saved.[2] We can no longer afford "just-in-time" infrastructure investments.

Additionally, ecological solutions along with built infrastructure strengthen coastal resilience. Green or natural infrastructure—such as marshes, oyster beds, and coral reefs—can also be economically evaluated in their role in building coastal resilience. Living shorelines assist in protecting against erosion and blocking storm surges.

One means to accomplish improved building practices is to require that communities build back better after disasters. Access to federal recovery dollars could be conditioned on making sure that any funds spent on rebuilding are spent resiliently. In advance of events, the federal government could increase the requirement for states to invest in resilience to reduce future damages. The less a state invests pre-disaster, the less it would receive post-disaster.

➢ *Congress can dedicate planning and recovery funds to mitigation of risk, requiring federal projects to look at future scenarios. State governments can incentivize resilient building and mitigation with projects that receive state funding as well. Private investors can do the same.*

Provide incentives to encourage compliance with stronger building codes and increased enforcement.

Future infrastructure damage due to more intense and frequent weather events will prove costly. Flooding, strong winds, warmer temperatures, and drought can all affect structure safety and value. Current building codes do not adequately protect structures from current weather events, let alone future weather.

Building codes need to evolve to reduce risk, mitigate property damage, and promote resilience. The federal government should work with the insurance industry and state insurance commissioners as well as the building industry to find ways to provide incentives that favor more resilient building codes. One possibility is the widespread acceptance of resilience certification similar to Leadership in Energy and Environmental Design (LEED) certification.

➢ *Federal and state governments can incentivize adoption and enforcement of up-to-date building codes. Private industry, such as insurers, can also provide incentives for adoption and strong enforcement.*

➢ *Organizations responsible for the creation and revision of building codes should regularly update model building codes to account for future climate and extreme weather scenarios.*

Promote private-sector market signals that encourage coastal communities to mitigate climate risk.

Credit ratings for state and local bonds should incorporate the risk for changes in climate. Accounting for future risk allows for investors and government jurisdictions to show value in projects as well as downgrades for inaction or maladaptation.

For federally backed mortgages, the federal government should explore mechanisms to ensure that property owners maintain sufficient insurance for climate risks the property may face from flood and wildfire, for example.

➢ *The private sector can improve risk analysis by incorporating climate risk. The government can work with the private sector to create incentives to improve insurance coverage against climate risks.*

➢ *The private sector can provide products that increase protection, such as "resilience bonds." Insurers can drive greater preparedness by introducing premium savings reflecting reduced risk resulting from mitigation measures. At the community level, reduced premiums may assist jurisdictions in funding other resilient projects.*

➢ *The private sector can incentivize homeowners and commercial property owners to harden their structures both at the time of purchase and when they are sold. They can also incentivize the disclosure of flood and fire risk, and other climate risks, for home buyers and home sellers.*

Maintain early warning systems, and continue research and development opportunities.

Early warning system (EWS) technology assists decision-makers with short-term and long-term response to weather and climate-related events. These systems include warning for flooding, hurricanes, tsunamis, extreme heat, wildfires, and droughts, as well as emerging and reemerging infectious diseases.

➢ *Congress has the authority to prioritize funding for early warning systems.*

➢ *Private industry owners and operators of critical infrastructure have the ability to develop and utilize early warning system technology for critical infrastructures, such as transportation and health care sectors.*

Policy Options: Science and Risk

Continue advances in understanding sea-level rise and its associated risks, focusing on both best estimates and the full range of possible outcomes in the short and long term.

Analysis of risks from sea-level rise involves consideration of the physical hazards. These dimensions include the multiple contributors to sea-level rise, from warming waters to ice-sheet loss, as well as simultaneous changes in storm intensities and patterns and extreme sea levels. There are great certainties, especially that the risks overall will increase with continued high emissions of heat-trapping gases. At the same time, there are important nuances and uncertainties, particularly the rate and timing of potentially irreversible ice-sheet loss and the complex dynamics of changing storm patterns. Coastal resilience will strongly benefit from continued advances in scientific understanding across these dimensions. Effective risk assessment includes best estimates of what might occur and the full range of possible outcomes across the next few decades and longer.

But consequences that matter do not depend only on the physical hazards; it is how these hazards combine with people and assets that are vulnerable and exposed. Analysis and research on sea-level rise risks therefore must consider what's at stake in coastal areas, not only today but also in the decades to come, as people migrate, economies develop, and societies change.

➢ *This priority applies across contexts of climate change research and analysis, from global coordination to local evaluations.*

Make actionable the best available scientific understanding of sea-level rise and its associated risks through interactive processes, approaches, and tools geared toward decision-making.

To make scientific knowledge of sea-level rise relevant to ongoing decision-making, efforts must extend beyond basic research. The importance of interactive decision support is particularly stark for sea-level rise because of the large risks and substantial uncertainties into the second half of the century and beyond. Such risks necessitate adaptive pathways of solutions responsive to evolving hazards through time. Interactive deliberation on sea-level rise risks can include decision-support tools visualizing inundation and flooding at the community level. It can also involve scenario-based evaluations of possible futures where decision-making goals would be missed.

Beyond decision aids or robust decision-making approaches developed to date, there is substantial room for experimentation with new approaches. Such approaches could include the engagement of citizen scientists participating in research, for example by taking photographs of nuisance flooding at high tide or collecting water samples. Further, interactions between researchers and policy makers can help clarify, for researchers, what information is most salient to ongoing decisions and, for

policy makers, what goals might be feasible. Policy makers often operate on shorter time scales than scientists, with pressing decisions sometimes leaving little time for deep dives into scientific studies. Communication, dialogue, and engagement that work for decision-makers are essential in transforming knowledge into action.

➢ *Interactive engagement making science actionable is relevant to basic and applied researchers, as well as diverse science-policy boundary organizations, together creating the knowledge systems necessary for resilient decision-making.*

Policy Options: International Community

Efforts to strengthen coastal resilience outside the United States must reflect the wide diversity of coastal environments around the world and the wide variety of political, social, and financial capacities of coastal communities. Mitigating the impacts of rising sea levels, intensifying storms, changing rainfall patterns, and degrading ecosystems in countries with limited resources will require comprehensive and collaborative policy-making processes that proactively include a broad, diverse range of stakeholders.

Despite significant achievements in climate adaptation and mitigation, we are still a long way from preventing climate change from disrupting social-ecologic systems along the world's coastlines. How much these disruptions will threaten a local coastal community depends on its resilience: its ability to prevent, prepare

for, respond to, and recover from rapid shocks and slow-onset disasters. Some key challenges to building the resilience of vulnerable communities against climate change include the uneven and multidimensional distribution of environmental risks, exclusion from decision-making processes, fragmented incentives across siloed sectors, limited access to funding, and policies that impede mobility.

The following international policy recommendations are intended to aid both American and other global actors in their efforts to build the capacity for resilience in the coastal regions outside the United States that are most vulnerable to the impacts of climate change, including small-island developing states and low-lying coastal communities. These recommendations apply to local and national governments, donors, multilateral organizations, international financial institutions, private-sector corporations, and civil society. They outline ways to deliberately tackle these issues through addressing multiple sources of vulnerability, encouraging community-driven initiatives, facilitating multi-actor coalitions, improving access to financial capital, and facilitating mobility.

Work across sectors and integrate programs to mitigate multiple sources of vulnerability.

Environmental risks have multiple dimensions and are rarely single-source problems. The economic status of individual community members and their social roles in society, for instance,

can influence the way climate change affects their livelihoods, health, and well-being. Overarching trends in population growth, development, and migration interact with environmental change more severely within concentrated coastal areas, which are inherently fragile and disproportionately vulnerable to natural disasters. Climate initiatives should seek to mitigate these multifaceted environmental risks to protect lives and livelihoods and to avoid maladaptation. Conflict prevention and gender equality concerns, for example, should be integrated into climate adaptation strategies to more effectively reduce underlying sources of vulnerability, diversify livelihoods, reduce insecurity, and empower coastal communities to prepare, respond, and recover.

➢ *Climate adaptation funders can require programs to integrate crosscutting concerns, such as gender, migration, and conflict, using toolkits like the US Agency for International Development (USAID) Climate Change and Conflict annex.*[3] *At the same time, funders can use climate risk screening and management tools to review the risks and impacts of non-climate development assistance.*[4]

Let coastal communities take the lead and fund community-driven initiatives.

Empowering coastal community members to develop their own climate resilience initiatives can produce co-benefits for

both people and ecosystems. Community-centered initiatives integrate local knowledge into resilience-building projects and result in solutions that are better suited to the local context. Climate action at the community level can also foster cross-sector collaboration, community cohesion, innovative planning, and economic entrepreneurship. Donors, governments, businesses, and financial institutions should prioritize funding and support for community-level climate programs to reduce localized disaster risks and increase the diversity of local stakeholders in environmental governance.

➢ *Donors and funders (including the private sector and financial institutions) can use mechanisms like participatory community risk-mapping, stakeholder consultation processes, and joint collaborations to engage local communities. They can require that coastal climate resilience funding support community-level programs, rather than just national or global organizations.*

Build multi-actor coalitions within communities and across borders.

Coalitions are increasingly influential in addressing climate change. Collaboration among a wide range of actors—including businesses, insurance companies, researchers, subnational groups, development organizations, intergovernmental organizations

(IGOs), and advocacy networks—has generated a strong political push for innovations and advances in climate adaptation and mitigation. Representatives from vulnerable coastal communities should participate in these coalitions to share knowledge and resources. Partnering with the private sector can foster entrepreneurship, fund innovative infrastructure, and support more resilient community development projects. American and international actors in both the public and private spheres can facilitate coalition-building that not only gives vulnerable coastal communities a seat at the table but also stimulates creative, multi-stakeholder, cross-border approaches to climate resilience. Initiatives can also promote cross-border understanding of similar challenges so that lessons learned in other countries can be adapted to local contexts.

➢ *Coastal coalitions like the Small Island Developing States (SIDS) Partnership Framework, international partnerships like Sister Cities International, and forums like the Global Multi-stakeholder SIDS Partnership Dialogue can help to engage coastal stakeholders and support innovative cross-border exchange.*[5]

Increase funding and build capacity to access financing and risk-management tools.

All stages of dealing with environmental disasters—prevention, preparation, response, and recovery—require access to abundant

and flexible financial capital and financial risk-management tools. Limited access to financial resources and financial tools like insurance can severely compromise the capacity of vulnerable coastal communities to prepare for and recover from intensifying climate shocks. Many vulnerable coastal communities not only lack financial resources, they also lack the capacity to access and absorb the financing that is available. Managing evolving climate risks through innovative insurance mechanisms, including micro-insurance schemes and risk pools, can lower the cost of premiums and lessen the financial burden on communities in the post-disaster recovery phase. Donors should require that financing programs include capacity-building assistance to ensure that those who need the money most are able to both apply for and absorb it. Financial support from sustainable economic development of local industries, such as tourism, can help preemptively develop more resilient communities. By working with vulnerable communities to better predict loss and damage from climate change, public and private funding initiatives can align financial resources to mitigate losses.

➢ *Donors can support vulnerable coastal countries by providing guidance and capacity-building support for the National Adaptation Planning processes and by increasing access to financing mechanisms such as the Green Climate Fund.*

➢ *Tourism organizations and businesses can work with regional entities, such as the Coping with Climate Change in the Pacific Islands Region (CCCPIR) program or Center for Responsible Travel (CREST) in the Caribbean, to increase the sustainability of their business activities.*

➢ *Public and private funding initiatives should increase their focus on adaptation as well as improved prediction of "loss and damage" from climate change. The Warsaw International Mechanism could help determine approaches for loss and damage payments and whether a separate fund is called for.*[6]

Plan proactively for displacement, and facilitate mobility.

Extreme weather-related events temporarily displace coastal communities. Some communities facing existential threats may seek to permanently relocate. Displacement and migration can be coping mechanisms, whether communities are forced to move or choose to do so as a positive adaptation to changing conditions.

The policy and practical challenges of climate-induced relocation are enormous, including identifying the land to which people can relocate, providing continued access to subsistence foods, and providing funding. Despite these challenges, community-based relocation strategies can respond to the climate-induced biophysical changes threatening people's lives.

Deliberate planning and policies that facilitate mobility are crucial for handling the socioeconomic and demographic shifts that accompany displacement and migration flows. Building the capacity to move among potentially "trapped" populations and fostering community engagement in shaping relocation

strategies can ease the transition for both migrants and recipient countries. Governments, donors, and private-sector actors should invest in enhancing social cohesion across diverse populations, while deliberately and thoughtfully working with coastal communities to develop relocation policies and programs to ensure that human and resource rights are protected. And all actors should work toward solutions that can prevent forced displacement and migration.

➢ *Federal and international agencies can analyze the existing international and national policy and legal options to help guide tribal, local, regional, and national governments relocating vulnerable communities and to resolve questions of legitimacy and sovereignty when territory is lost due to climate change. Governments leading relocation must design and implement these plans in direct coordination with the affected communities.*

Science and Risk

As global temperatures increase, ocean waters warm and expand, glaciers melt, and the ice sheets collapse. As a result, sea levels increase. The latest US assessment of sea-level rise was recently published in the *Climate Science Special Report*, which is volume 1 of the Fourth National Climate Assessment. This report, developed by a team of leading scientists, underwent seven drafting stages, with the iterations undergoing expert review by government agencies, a federal science steering committee, the general public, and the National Academies of Sciences, Engineering, and Medicine. This authoritative assessment found that, globally, sea level has increased by about seven to eight inches since 1900, with almost half of this increase having occurred since 1993. Global sea-level rise will continue, with another several inches in the next fifteen years and a best estimate of one to four feet by 2100. As much as eight feet by 2100 could be possible. Sea-level rise is not fully uniform globally: increases on the East and Gulf coasts of the United States will be greater than the global average. Impacts are already being felt, given higher storm surges and extreme seawater levels. Additionally, "sunny day" nuisance flooding has increased five- to tenfold since the 1960s in several US coastal cities.[7]

According to NOAA, 123 million people, or 39 percent of the US population, lived in coastal counties as of 2010. Coastal populations have been growing rapidly over the last few decades and are expected to increase by an additional 10 million people by 2020.[8] These trends mean that increasing numbers of people are at risk of coastal flooding and other hazards exacerbated by climate change.

Risks associated with sea-level rise threaten US infrastructure and security. Three feet of sea-level rise by 2100 could place the homes of 4.2 million Americans at risk of inundation.[9] Six feet of sea-level rise could inundate the homes of 13.1 million people, taking into account ongoing population growth. Zillow estimates that 1.9 million homes that could be underwater by 2100 have a combined value of $916 billion in housing stock across the nation.[10] At present, such homes provide property taxes vital to local governments' revenue streams. Other coastal infrastructure is also at risk. The Union of Concerned Scientists has analyzed the implications of sea-level rise for coastal US Department of Defense installations. Three feet of sea-level rise would threaten 128 installations, with consequences for the many military personnel and civilians who depend on them. For such reasons, the US military and security community considers climate change a threat multiplier, amplifying risks associated with extreme weather events and coastal flooding.[11] Affected coastal systems include nature, economies, and communities, including infrastructure key to energy, transportation, public utilities, livelihoods, and security. All these assets are critical for the health and well-being of Americans.

Risks from sea-level rise do not smoothly and incrementally increase with additional climate change. Instead, there are

important thresholds. These thresholds include dimensions of physical risk, such as the potential lock-in of consequential loss of the West Antarctic Ice Sheet. They also include carbon-cycle feedbacks, such as the additional climate change that will occur as greenhouse gases are released from melting permafrost. But there are also thresholds relevant to the vulnerability and exposure of people and assets. For example, beyond certain levels of sea-level rise or extreme high-water levels, downtown areas or critical transportation infrastructures flood substantially more often. With continued high emissions of heat-trapping gases, the likelihood of traversing thresholds, some with irreversible consequences, increases substantially.

Even with ambitious reductions in heat-trapping emissions, adaptation is essential. Additional sea-level rise will happen in the years and decades to come even with ambitious reining-in of emissions. Communities around the United States are just starting to address these increasing risks. In many cases, preparation for coastal risks builds climate resilience that will benefit societies and economies no matter how much climate change occurs. Actions with co-benefits include updating building codes to ensure resilience to high winds and flooding and addressing the losses associated with properties that repeatedly flood. However, for climate change mitigation, the next few decades also represent substantial responsibility: the amount of climate change that happens in the second half of the twenty-first century and beyond critically depends on emission reductions achieved today and into the next few decades.

Conclusion

The front lines of climate change are the world's shorelines—and for the world's coastal communities, shorelines are the front lines of their economy, environment, and culture. As rising temperatures and changing rainfall patterns reshape human-environment relationships along new and unknown lines, how can we build resilience to protect the people who depend on the coast?

The *Building Coastal Resilience for Greater US Security* project sought to answer this question by listening to coastal experts from across the United States and around the world who are grappling with flooding, drought, and rising seas. From Florida to Fiji, from Norfolk to Nauru, from San Jose to Saipan, we learned that climate is not just changing the water levels—it is also disrupting agriculture, fishing, energy infrastructure, transportation methods, and national security assets. And these problems may get much worse, with predictions that dramatic sea-level rise will disrupt life around the globe and climate change impacts will exacerbate political instability and potentially spur violent conflict.

Jurisdictional boundaries and regulatory inefficiencies have impeded effective solutions. Major gaps in governance, legal

regimes, communication, and data threaten efforts to increase resilience. But our consultations identified a rich set of recommendations for concrete actions to enhance resilience in vulnerable coastal communities. Three clear principles emerged:

Context matters.

We can share lessons across different coastal locations, but the solutions must be tailored to the specific time and place. To do this, we must listen to—and proactively engage—a wide range of stakeholders in coastal communities.

An integrated approach is imperative.

Multiple industries depend on the coast—fishing, recreation, defense, energy, trade—and the threats facing coastal residents and businesses are multifactorial, so it is imperative to work across sectors and across disciplines to understand the dynamic interactions at work and to develop practical solutions.

Partnerships are progress.

Developing context-specific solutions for coastal regions' cross-sectoral challenges is not a small task. Smart partnerships will be key. By working together through coalitions, shared frameworks, and integrated action plans, we can better leverage our expertise, political capital, and investment to meet the shared goals of a more secure coast.

These steps are not just about protecting the environment. They are fundamental to ensuring the safety and security of communities at great risk. To ignore them is to force people to make unbearable choices. "I don't want to leave my country for anything. Only when it's really been wiped off the map or sunken [will I leave]," said a Marshall Island resident to one of our participants. To ensure that no one has to face that dilemma, we must act now.

As we demonstrated through our process and our principles, collaborative interaction among coastal stakeholders and across levels of governance—local, national, and global—is necessary to mitigate the future impacts of climate change. Whether we are repairing bridges, rebuilding fragile states, or restoring hope, we can only become resilient together.

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Endnotes

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At the Wilson Center, Roger-Mark De Souza led programs on climate change resilience, health, environmental security, and livelihoods, including the Global Sustainability and Resilience Program and the Environmental Change and Security Program. Before joining the Wilson Center in 2013, he served as vice president of research and director of the climate program at Population Action International, where he provided strategic guidance, technical oversight, and management of programs on climate change, population, gender, and the environment. From 2007 to 2010, as the director of foundation and corporate relations at the Sierra Club, he led a multimillion-dollar foundation and corporate fund-raising program on climate recovery. Before working at the Sierra Club, he directed the Population, Health, and

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