



# Guide to Expanding Mitigation

MAKING THE CONNECTION TO THE COAST



FEMA





Photo: High angle view of river in Houston, Texas

Cover Photo: View of North Shore neighborhood and surf coastline in Oahu, Hawaii



Photo: Blackwater National Wildlife Refuge, Cambridge, Maryland

Coastal communities are different from inland communities in many ways. They face unique risks, such as storm surge, land subsidence, and coastal erosion. There are also many benefits, including economic, to living and working on the coasts. Coastal communities can be very different from each other. The U.S. coast includes the Caribbean and Pacific Islands, the East and West coasts, the Alaskan coast, the Gulf Coast and the Great Lakes. Each of these regions has different cultures, demographics, geographies, economies, hazards, and challenges.

This *Guide to Expanding Mitigation* is meant to encourage emergency managers, community planners, coastal and floodplain managers, and other decisionmakers to work together. When plans and projects are developed in collaboration, coasts can be managed more holistically. Goals like economic development, environmental protection, and public safety can be better met. This guide explains issues that affect coastal communities and offers resources to help spark ideas for holistic solutions. It shows how working together can make gains on both our individual goals and shared goals. This guide can help community officials start conversations about mitigation solutions that can make coastal communities more equitable and resilient.



#### DID YOU KNOW?

- Over 128 million people, or about 40% of the U.S. population, lives on the coast.
- Coastal counties account for nearly half of the nation's gross domestic product.
- Annually, coastal counties employ 58.3 million people.

To learn more about social vulnerability and its impacts in coastal areas please see: [Coasts | National Climate Assessment](#); [Social Vulnerability Report | EPA](#); and [Social Vulnerability – National Risk Index | FEMA](#).

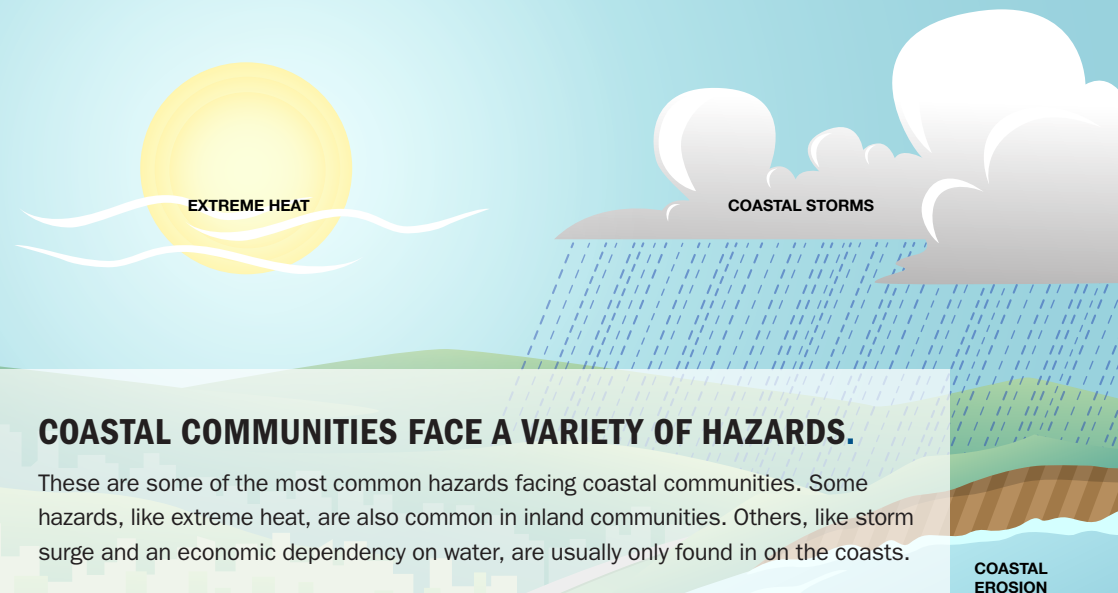


This *Guide to Expanding Mitigation* is part of a [series](#) highlighting innovative and emerging partnerships for mitigation.





Photo: Perigean Spring Tide breaches seawall in Boston's Seaport District



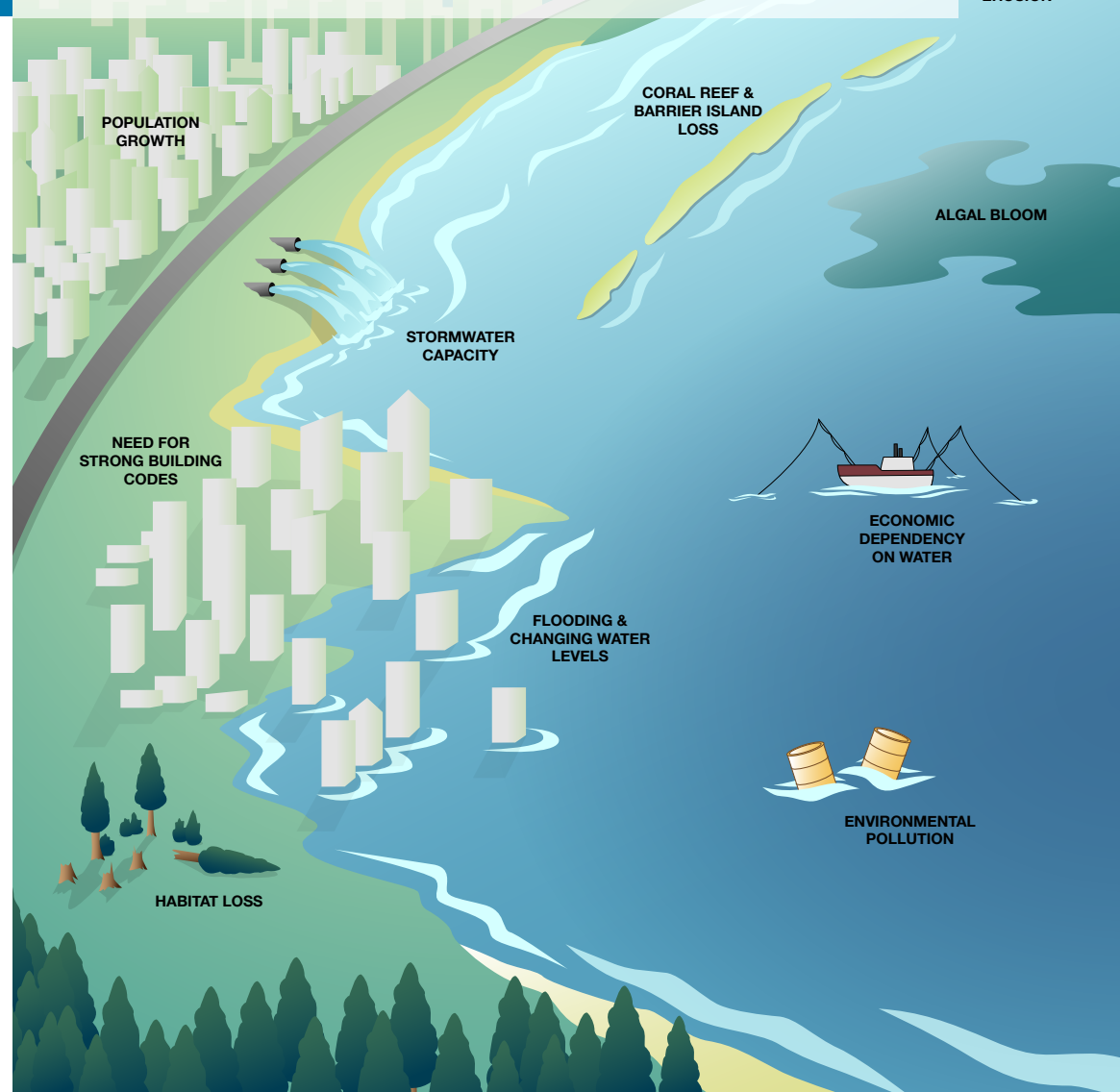
## COASTAL COMMUNITIES FACE A VARIETY OF HAZARDS.

These are some of the most common hazards facing coastal communities. Some hazards, like extreme heat, are also common in inland communities. Others, like storm surge and an economic dependency on water, are usually only found in on the coasts.

## WHAT IS THE CHALLENGE?

Coastal environments are a dynamic place. Left alone, they will change and reshape themselves over time. People often try to keep those changes from happening to protect buildings and infrastructure. They try to control the natural systems. Unfortunately, this has sometimes reduced an area's natural protection from coastal hazards. For example, levees can provide flood protection. However, they can also increase flood risk by damaging nearby wetlands and encouraging development.

We need to act now. Up to \$106 billion of coastal property could be below sea level by 2050.<sup>4</sup> Yet the population and development on our coasts continue to grow. Natural systems are still being degraded. These factors compound the effects of climate change. By being proactive, community officials can reach their mitigation goals and equitably protect communities from both the current impacts of climate change and the impacts of future conditions. These include the impacts of a changing climate, as well as changes in population, land use, and development.



## ADDRESSING FUTURE CHANGES THROUGH HAZARD MITIGATION PROGRAMS



As the number and intensity of disaster events grows, a community's hazard mitigation plan and projects should account for future conditions. For ideas and resources listen to this [recorded training](#). The training includes examples and ways to use future conditions information in your hazard mitigation planning process and projects to increase resilience.





Photo: The coastal fishing village of Ketchikan, Alaska



Photo: Aerial view of Florida Everglades

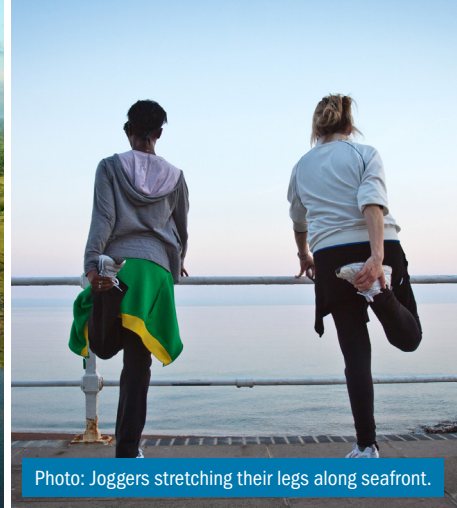


Photo: Joggers stretching their legs along seafront.

## A HOLISTIC AND COLLABORATIVE APPROACH TO PROBLEM SOLVING

Problems along the coast are often handled system-by-system. Some professionals may focus more on the environment, while others might prioritize protecting infrastructure or encouraging economic development and growth. On coasts, solutions need to consider both human and natural systems. Failures often occur at the places where social systems, natural systems, and the built environment connect. For instance, sea walls are built to protect buildings, but they can damage natural systems. Beach nourishment protects against erosion but can put a financial burden on social systems.

Solving these complex problems requires meaningful collaboration by the whole community. Equitable resilience strategies seek the best possible outcomes for as many sectors and stakeholders as possible. Coastal communities are also part of a larger regional system. The choices each community makes affects communities and ecosystems beyond its borders. This is sometimes called integrated coastal zone management.

In the long term, protecting the function of a natural system can be useful. Natural processes, such as the replenishment of wetlands, can help protect an area from storms. A healthy coastal ecosystem can also benefit tourism, fishing, and other activities.

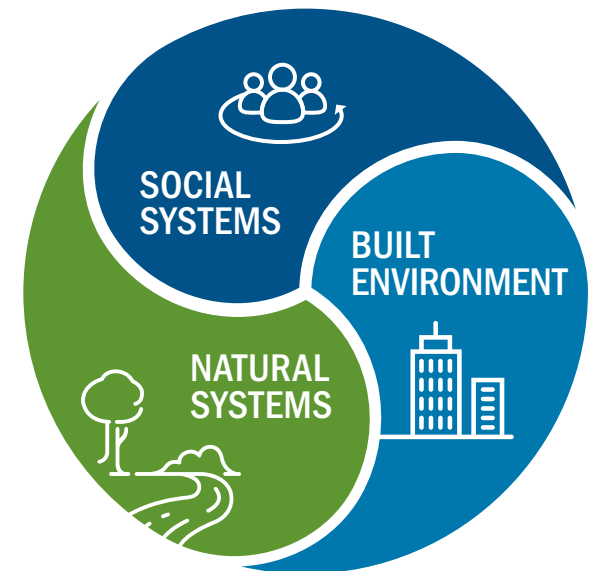
Learn more about the risk reduction benefits of protecting wildlife habitat, restoring ecosystems, and promoting biodiversity in mitigation projects by reading the [\*Guide to Expanding Mitigation: Making the Connection to Wildlife\*](#).



While natural systems are constantly changing, the built environment is often made to stay the same and to protect against these changes. When people live and work in the way of natural processes, like coastal erosion and dune migration, conflicts can arise. Each coastal community must find a balance between its natural and human systems. Solutions must maximize resilience while working with the community's limitations and priorities. We must take a long-term view of land use and future conditions.

In addition to natural hazards, holistic approaches should consider:

- Community and cultural values
- Social justice and equity
- Restoring natural systems and functions
- Economic considerations
- Climate change
- Designing with nature (nature-based solutions, biomimicry, green, and green-gray infrastructure, etc.)
- Managing ecosystems and wildlife



Holistic coastal zone management means finding a balance between natural systems, social systems, and the built environment.

Source: [What is coastal zone management? \(noaa.gov\)](https://www.noaa.gov/what-is-coastal-zone-management/)





Photo: Andrea Booher/FEMA

## WORKING TOGETHER

The expected impacts of future conditions will not be the same in every coastal community. Their resources for planning and addressing risks will also vary. Involving partners early in the planning process can bring more expertise and resources to the table. It can also reduce the duplication of planning efforts. Collaborative planning may also identify co-benefits. Co-benefits are positive effects that a policy or action has on other objectives. For example, setback levees can protect communities from flooding and also create valuable habitat and migration corridors for native species.



### A GOOD PLACE FOR IDEAS – THE LEVEL UP PROJECT

FEMA Region 9 and its partner, the Georgetown Climate Center, produced the Level Up Audio Project. This online resource shares stories, case studies and best practices. The series was designed to inspire hazard mitigation action and strengthen the hazard mitigation and climate adaptation community. Listen to episodes [here](#).

**Partners and Risk Identification:** Communities must decide which risks to reduce and how to reduce them. This is a hard conversation, but an important one. Community planning meetings are often a good place to discuss risk and risk reduction. You may identify co-benefits by broadening and integrating planning efforts.

Coastal communities may have plans across the same sectors as other communities, but may also have plans that are specific to their coastal areas. Encourage collaboration by bringing key planners and stakeholders together whenever these plans are updated. Consider inviting representatives of your community’s economic sectors. These could be tourism, fishing, or agriculture. Also include members of underserved populations or organizations that work closely with them. Even if you are not leading the planning process, you can build relationships across different initiatives and engage with these stakeholders. For example, the Mississippi-Alabama Sea Grant Consortium has created [resilience indices](#) specific to its region. These focus on how well coastal communities are prepared for natural hazards, and the resilience of their fisheries, tourism, and ports. Community leaders work together to complete these indices. Other regions have adapted the indices to fit their own needs.

Examples of potential partners who bring valuable knowledge and resources may include:

- State coastal zone managers;
- Tribal and cultural organizations;
- Watershed organizations;
- Natural resource managers and environmental organizations;
- University extension (e.g., Sea Grant programs);
- State Silver Jackets teams;
- Faith-based or other community-based organizations;
- Grassroots representatives of local community groups; and
- Regional climate groups (e.g., Pacific Islands Regional Climate Assessment and Regional Integrated Sciences and Assessments Program).

## COMMUNITY VALUES AND RESOURCE IDENTIFICATION

A community’s values are important (natural resources, history, social norms, economy, etc.). Baseline data can help identify these values. This information can show how people have used or are using natural resources. For example, local fisheries data can highlight the value of clean water. Build a baseline of recreational and tourism data. It is important to remember that the community being served should always be the primary source of information and always be actively involved. These federal resources can help provide data to guide conversations within a community. For more information, visit the U.S. Census and read the [National Survey of Fishing, Hunting, and Wildlife-Associated Recreation](#). Additional resources to read include the [NOAA Coastal County Snapshots](#), [NOAA Digital Coast](#) and [Fisheries of the United States, 2018](#).







Coastal communities face complex problems. We need new ways of planning to address them. When we consider future conditions, equity, and environmental co-benefits in our solutions, we build partnerships that benefit the whole community.

**Community Engagement:** Equitable engagement is important. This means understanding that people respond in different ways. Not everyone has the resources readily available to respond or participate in the same way as others. Consider working with regional organizations with community engagement experience. Think about partnering with community organizations which represent underserved groups. Also consider reaching out directly to people who may be at risk to natural hazards. To learn more about community-driven engagement processes and equitable climate adaptation, visit the Georgetown Climate Center to read the [Community-Driven Engagement Processes - Equitable Adaptation Legal & Policy Toolkit](#).

For more information on how to boost stakeholder engagement, please visit FEMA's website for [Stakeholder Engagement](#), NOAA's website for an [Introduction to Stakeholder Participation](#), and their [Stakeholder Analysis Worksheet](#).

Look for community interest groups or regional and state communities of practice. These groups can provide valuable information and best practices. An example of a community of practice is the [Washington Coastal Hazards Resilience Network](#). This group aims to strengthen the state's coastal resilience through collaboration, education, and knowledge sharing.

## EQUITY

Equity must be taken into account, both within and among coastal communities. It ensures outcomes are fair and proportionate to need. Many coastal areas have a history of inequity. Some inequities still affect communities today. Mitigation programs must consider these impacts to meet the whole community's needs. Find more information here: [Guide to Expanding Mitigation: Making the Connection to Equity](#).



Photo: Community meeting.





Photo: Dune grass planting to reduce erosion of sand dunes in Surf City, New Jersey.



Photo: Coastal village in Alaska at risk from sea level rise.



Photo: Road to Isle de Jean Charles, Louisiana

## COLLABORATIVE SOLUTIONS

**Nature-Based Solutions:** Emergency managers, coastal managers and other officials should know the natural and human-made systems of a community. They also need to know how those systems affect each other. It is sometimes best to focus on a suite of ideas to reduce risk, rather than a single large solution. Nature-based solutions are a critical tool in this process.

Nature-based solutions are sustainable planning, design, environmental management, and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience. For example, land conservation projects are a type of nature-based solution that requires land acquisition and preserves interconnected open space. FEMA has resources on its [Nature-Based Solutions website](#) to help communities start projects of this kind. These include information on types of solutions, planning, and funding.

Nature-based solutions may not always provide the same level of protection as gray infrastructure, but they have valuable environmental and social benefits. Nature-based solutions include varied practices that can be applied at many different scales, for example, to an entire watershed or a specific site. Forming coalitions with many communities and kinds of organizations may be the first step to starting a large-scale project.

Communities will never be able to completely engineer away their risk. Risk can be reduced, but people must still prepare to manage the remaining risk. One option is to conserve and restore natural systems, like coastal wetlands and reefs. This option benefits both the environment and economies, as well as mitigating risks. Natural infrastructure acts as a barrier to waves and reduces flooding. Nationwide, it saves hundreds of millions of dollars in storm damage. For example, coastal wetlands are estimated to provide \$23.3 billion in storm protection services each year. More information about [natural infrastructure](#), [coral reefs](#), wetlands and [nature-based solutions for coastal hazards](#) can be found on NOAA's website. In addition, you can also review the [Nature Conservancy's Promoting Nature-Based Mitigation through FEMA Grants](#) document.

**Community-Led Relocation:** Community-led relocation, also known as managed retreat, is not a new idea. FEMA's earliest project of this type was in 1993. The community of Valmeyer, Illinois, moved out of the path of severe riverine flooding. A more recent example is the resettlement of Isle de Jean Charles in coastal Terrebonne Parish, Louisiana. Using Department of Housing and Urban Development grant funding the state is working with residents of Isle de Jean Charles to support voluntary resettlement from the island. This includes developing "The New Isle," a planned community about 40 miles north of Isle de Jean Charles that will include more than 500 homes, walking trails, a community center, commercial and retail space, and other amenities designed in collaboration with island residents.

The Georgetown Climate Center defines managed retreat as the voluntary transition of people and ecosystems away from vulnerable areas. This option is now a bigger part of the conversation in coastal communities and states. They are facing difficult questions about how to protect people and places from growing risks. [The Georgetown Climate Center's Managed Retreat Toolkit](#) provides legal and policy tools, best and emerging practices, and case studies. These can support decisions on community-led relocation and climate adaptation.

Acquisition and relocation can be seen as a form of community-led relocation. Acquisition programs move structures and infrastructure out of the floodplain over time. Incorporating higher standards into a community's floodplain ordinance can prevent new buildings from being built in high-risk areas. They can also expand the areas covered by the regulations. The goal is to reduce the number of structures and infrastructure in high-hazard areas over time.

Communities that use this approach should guard against "climate gentrification." This term is used to describe what may happen when higher-income residents move away from floodprone areas. Lower income residents may be gradually forced out of their neighborhoods by rising property values and fewer affordable housing options.



**Integration and Alignment:** Aligning a community's plans—such as hazard mitigation, land use, and other types of plans—begins with knowing what plans have been or are being developed. A good place to start is by looking at programs that work within a similar space. Explore their possible common goals, priorities, and funding sources. These programs and their associated planning processes give local planners valuable information about specific current or future risks. This knowledge can strengthen a hazard mitigation plan.

California, with NOAA, FEMA, and others, developed the [Coastal Plan Alignment Compass tool](#) to help communities integrate their planning efforts. The tool helps the state's coastal communities coordinate multiple local plans (e.g., local hazard mitigation plans, general plans, local coastal plans, and climate adaptation plans).




Photo: Levee in San Francisco bay, Coyote Hills Regional Park, California

#### EXAMPLES OF COLLABORATIVE SOLUTIONS:

- **National Coastal Zone Management Program (National Oceanic and Atmospheric Administration – NOAA)** One of the focuses of the [National Coastal Zone Management Program](#) is community and ecosystem resilience. This program is a voluntary partnership between the federal government and coastal states (including Great Lakes states) and territories to address some of today's most pressing coastal issues, including climate change, habitat restoration and community resilience. The program encourages states and territories to develop five-year strategies to strengthen and improve their federally approved coastal management programs in various coastal issue areas. These areas include wetlands, coastal hazards, public access, marine debris, and others. By aligning priorities and identifying synergies, coastal management programs and hazard mitigation efforts can be strengthened.
- **Clean Water Act Section 319 Nonpoint Source Management Program (Environmental Protection Agency – EPA)** The [Section 319 Nonpoint Source Management Program's](#) goal is to help communities identify and reduce sources of polluted runoff through watershed-level approaches, policies, and projects. The water quality protection planning process encourages communities to consider a suite of solutions including prevention, protection, and restoration. By including water quality and water resource management issues, communities strengthen their hazard mitigation plans. In addition, by collaborating, both programs can complement and strengthen program results.
- **Coastal Nonpoint Pollution Control Program** NOAA and the EPA run the [Coastal Nonpoint Pollution Control Program](#). Its goal is to reduce polluted runoff to coastal waters. The program establishes a set of management measures for states to use to control runoff. Runoff can come from agriculture, forestry, urban areas, marinas, and changes to shorelines and stream channels. It also has management measures for wetlands, riparian, and vegetated treatment systems. State authorities ensure these measures are applied. Implementation of these management measures can reduce hazard risk, enhance community resiliency, and protect and restore critical coastal ecosystems and functions.

These are just a few examples of programs that can provide information and funding for projects that can advance hazard mitigation goals.

#### BUILDING CODES

One of the most cost-effective ways to safeguard a community from disasters is to adopt and enforce hazard-resistant building codes. Current building codes can prevent physical harm and property loss. They also reduce business interruptions and lost income. By doing so, they help communities recover from disaster more quickly. Adopting strong building codes helps communities prepare for increasing risks in the future. Read the [Guide to Expanding Mitigation: Making the Connection to Codes and Standards](#) and visit FEMA's [building code resource](#) website to learn more.





## EXAMPLES OF MULTI-BENEFIT COASTAL MANAGEMENT PROJECTS

**Puerto Rico** – After hurricanes Irma and María, the U.S. Geological Survey (USGS) funded a project to study how coral reefs affect waves and flooding. USGS is working with NOAA, the University of Puerto Rico – Mayagüez Campus, and Arrecifes Pro Ciudad. They will support reef restoration efforts in the Isla Verde Coral Reef Marina and reduce flooding hazards to San Juan and its international airport. Learn more at about the [Coral Reef Project](#) in Puerto Rico on the U.S. Geological Survey's website

**Oregon** – The multi-year Southern Flow Corridor Flood Reduction and Habitat Restoration Project has funding from many sources. These include FEMA, NOAA, the U.S. Fish and Wildlife Service, the Oregon Watershed Enhancement Board, state lottery funds and other local sources. The project revitalized tidal wetlands for threatened salmon. It also reduced flooding in nearby communities and farmlands. It removed fill, old levees and tide gates, and created tidal estuary habitat. By doing so, it reconnected 443 acres of marsh habitat and opened tidal channels for migratory fish. The design allows water to move freely through a “flow corridor,” which reduces flooding in the town of Tillamook. For more information, read [Habitat Restoration Projects Offer Protection from Flooding](#) on NOAA's Fisheries webpage and [The Southern Flow Corridor Flood Reduction and Habitat Restoration Project](#) on FEMA's website.

**Georgia** – The University of Georgia Marine Extension and Georgia Sea Grant lead oyster reef restoration through the G.E.O.R.G.I.A. project. Oyster shells are collected from private oyster roasts and restaurants. These are planted in estuaries to build an environment where oyster spat can grow. Oyster reefs, when placed between shores and marshes, can protect salt marshes and prevent erosion. They form a barrier to tidal currents and waves. Oysters also filter pollutants from water and play a critical role in essential fish habitats. Coastal economies benefit from recreational and commercial fishing. To learn more about this project visit [Oyster Reefs in Georgia – UGA Marine Extension and Georgia Sea Grant](#).

**Wisconsin** – The Kemper Center Shoreline Protection Design Case Study was led by the Wisconsin Coastal Management Program and funded by the Southeastern Wisconsin Coastal Resilience project. The project addressed both stormwater management and shore protection design. This joint approach allowed both systems to work better together to reduce flooding and stormwater infrastructure damage. To learn more about this project, read the [Kemper Center Shoreline Protection Design Case Study](#).

For more case studies and examples, please visit [U.S. Army Corp of Engineers' Engineering with Nature Atlases](#), [Sea Grant's Interactive Narratives](#), and [Hawaii's Ocean Resources and Management Plan](#).

## REFERENCES

- Bostick, T. P., Holzer, T. H. & Sarkani, S. (2017). *Enabling stakeholder involvement in coastal disaster resilience planning*. Risk Analysis, 37(6), 1181-1200.
- Hassanali, K. 2013-2014.
- Jurjonas, M. & Seekamp, E. (2020). “A commons before the sea:” *Climate justice considerations for coastal zone management*. Climate and Development, 12(3), 199-203.
- Masselink, G., & Lazarus, E. D. (2019). *Defining coastal resilience*. Water, 11(12), 2587.
- NOAA Office for Coastal Management. (2022). Fast Facts: Economics and Demographics.
- Reguero, B. G., Beck, M. W., Schmid, D., Stadtmüller, D., Raeppele, J., Schüssele, S., & Pfliegner, K. (2020). *Financing coastal resilience by combining nature-based risk reduction with insurance*. Ecological Economics, 169, 106487.
- Simms, J.R.Z. (2021) *Solastalgic Landscapes: Prospects of Relocation in Coastal Louisiana*. Frontiers Journal.
- Simms, J.R.Z., Waller, H.L., Brunet, C., Jenkins, P. (2021). *The Long Goodbye on a Disappearing, Ancestral Island: a Just Retreat from Isle de Jean Charles*. Journal of Environmental Studies and Sciences.
- The Nature Conservancy. (2021). *Promoting nature-based hazard mitigation through FEMA mitigation grants*.



Photo: Turret along Old San Juan Wall in Puerto Rico



## RESOURCES

### Guides to Expanding Mitigation

<https://www.fema.gov/guides-expanding-mitigation>

### FEMA Nature-Based Solutions

<https://www.fema.gov/emergency-managers/risk-management/nature-based-solutions>

### FEMA Resilient Nation Partnership Network (RNPN)

<https://www.fema.gov/business-industry/resilient-nation-partnership-network>

### National Oceanic and Atmospheric Administration (NOAA)

Digital Coast

<https://coast.noaa.gov/digitalcoast/>

Coastal Fast Facts

<https://maps.coast.noaa.gov/coastal-facts/>

Tool to Pinpoint Natural Disaster Risk Down to the County Level

<https://www.noaa.gov/news-release/new-noaa-tool-pinpoints-natural-disaster-risk-down-to-county-level>

### Coastal States Organization (CSO)

<https://www.coastalstates.org/csopublications/>

### National Aeronautics and Space Administration (NASA)

<https://climate.nasa.gov/vital-signs/sea-level/>

### Environmental Protection Agency (EPA)

<https://www.epa.gov/cre/climate-change-coastal-communities>

### U.S. Army Corps of Engineers - Engineering with Nature Atlases

[https://ewn.erdc.dren.mil/?page\\_id=4174](https://ewn.erdc.dren.mil/?page_id=4174)

### Georgetown Climate Center

<https://www.georgetownclimate.org/adaptation/toolkits/equitable-adaptation-toolkit/introduction.html>

<https://www.georgetownclimate.org/adaptation/toolkits/managed-retreat-toolkit/introduction.html>

### The Nature Conservancy

The Blue Guide to Coastal Resilience. Protecting coastal communities through nature-based solutions. A handbook for practitioners of disaster risk reduction.

<https://www.natureprotects.org/>

### Sea Grant - Resilient Communities and Economies (RCE) Toolkit

<https://seagrant.noaa.gov/Our-Work/RCE>

### U.S. Geological Survey (USGS) – Tribal Resources for Climate Change

<https://www.usgs.gov/media/videos/tribal-resources-climate-change-vulnerability-assessments>

### Environmental Law Institute – Hazard Mitigation Planning

<https://www.eli.org/land-biodiversity/hazard-mitigation-planning>

### The National Wildlife Federation

Building Ecological Solutions to Coastal Community Hazards –  
A Guide for New Jersey Coastal Communities

<https://www.nwf.org/CoastalSolutionsGuideNJ>

### Florida Planning Adaptation Guidebook

<https://floridadep.gov/rcp/florida-resilient-coastlines-program/documents/adaptationplanningguidebook>

### U.S. Coastal Research Program (USCRP)

<https://uscoastalresearch.org/>

## ACKNOWLEDGEMENTS

We thank the following organizations, whose staff contributed their time to advance our understanding of coastal management: FEMA (Headquarters and Region 2); National Oceanic and Atmospheric Administration; National Sea Grant Program; Coastal States Organization; Environmental Protection Agency; Carolinas Integrated Sciences and Assessment – South Carolina Sea Grant Consortium; East West Center; Florida Department of Environmental Protection; Georgetown Climate Center; Hawaii Office of Planning – Coastal Zone Management; Illinois Department of Natural Resources – Coastal Management Program; National Academy of Sciences; New Hampshire Department of Environmental Services – Coastal Program; The Nature Conservancy; United States Army Corps of Engineers; United States Virgin Islands Department of Planning and Natural Resources; University of Michigan Taubman College of Architecture and Urban Planning; University of the Virgin Islands; and Wisconsin Coastal Management Program.



## ENGAGE WITH US

Are you a state, local, tribal, or territorial official interested in connecting coastal management and hazard mitigation? Are you a coastal management professional interested in working with local officials to reduce the risk from hazards? Please contact us at [FEMA-ExpandingMitigation@fema.dhs.gov](mailto:FEMA-ExpandingMitigation@fema.dhs.gov).



