

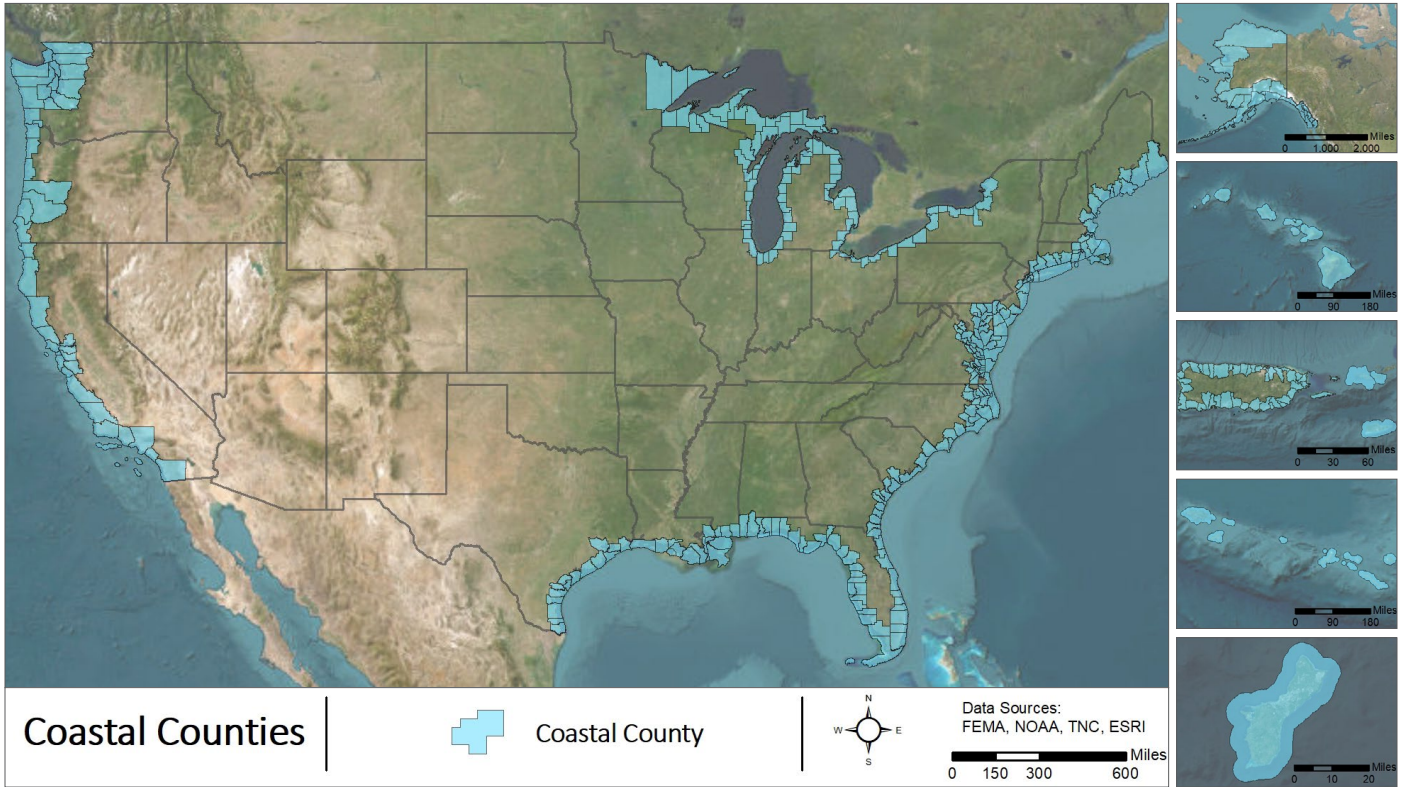


Photo description: Skagit Valley's Historic Town of La Conner, Washington

THE ECONOMIC CASE FOR **COASTAL RESILIENCE**



FEMA



Map description: U.S. coastal counties include those on the Atlantic, Pacific, and Gulf coasts; Great Lakes; Alaskan coast; Hawaii; and U.S. territories.

THE COST OF COASTAL HAZARDS AND THE VALUE OF INVESTING IN EQUITABLE RESILIENCE

U.S. coastlines have long been engines of economic growth. These drivers of commerce and culture are home to one in four Americans. Coastal areas are home to some of the country’s most diverse communities.

Coastal areas are also highly vulnerable to natural disasters. In 2020, every mile of the mainland Atlantic coast was under watch or warning from tropical cyclones at some point. All but five coastal counties had tropical storm-force winds in that year.

The threat is not only in the east coast. Coastal areas across the United States and territories all suffer costly disasters. Disasters have become more frequent and severe.

2021 was the seventh consecutive year in which the U.S. experienced 10 or more billion-dollar natural disasters. Many of them were along the coasts. Each disaster, big or small, means damaged or disrupted businesses, communities and lives.

The United States has over **95,000 miles** of shoreline. That’s the distance from Miami to Seattle nearly **35 times!**

FEMA considers communities to be coastal when they experience waves and storm surge. Coastal areas include:

- Atlantic coast
- Pacific coast
- Gulf coast
- Great Lakes
- Coastal Alaska
- Hawaii
- U.S. territories

However, the economic impact of the coasts extends far inland.

THE COST OF COASTAL HAZARDS AND THE VALUE OF INVESTING IN EQUITABLE RESILIENCE, CONT'D

Coastal disasters are expensive. And they will happen. The question is not if, but when—and how often. But communities can act to reduce their losses, speed up recovery and build a stronger future for all residents. Building resilience against natural disasters can improve residents' quality of life today. It can also protect them from disasters for decades to come.

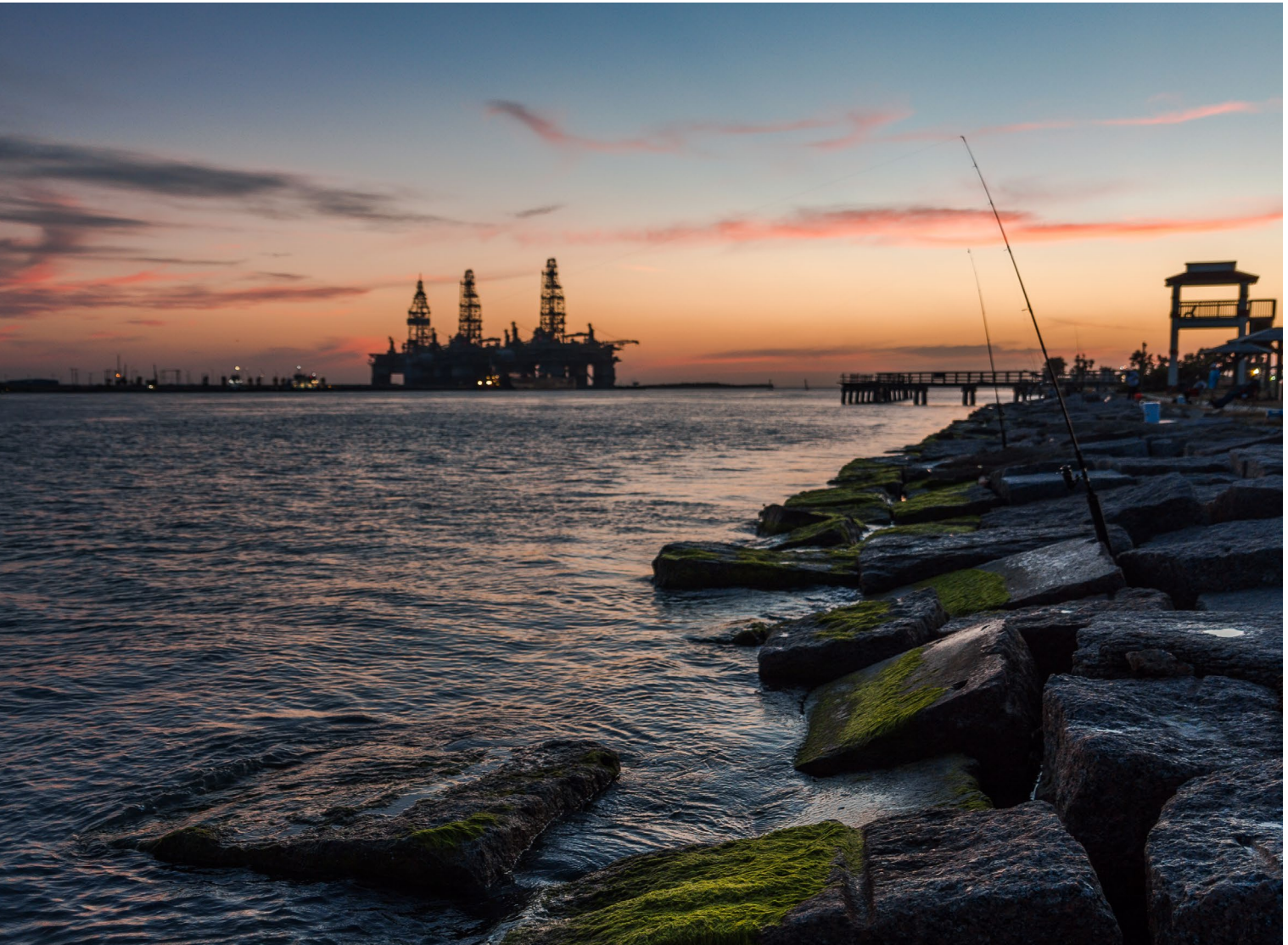
That is why leaders in coastal areas must invest in resilience. This guide gives background on coastal natural disasters and their effect on communities nationwide—including yours. The pamphlet then explains how to reduce the risk from disasters. It offers case studies on what communities of all sizes do to reduce the impact of disasters.

Coastal areas are dynamic, and so are their risks.

Risk does not stay the same over time. The decisions of property owners and communities can raise or lower their risks—sometimes both at once. For example, a seawall can protect some properties but put others at a greater risk of damage. Changes to zoning and building codes can change how storms affect communities. Planners and local leaders should study many possible scenarios when deciding how to protect their communities.

Photo description: Copper Harbor, Michigan





THE IMPORTANCE OF COASTAL RESILIENCE

Resilience and hazard mitigation save lives. They reduce the risk of flooding, structural damage and other deadly hazards.

In addition, billions of dollars in property are at risk when disasters strike. They threaten homes, businesses, schools, restaurants and cultural areas. Coastal disasters threaten our most dear places, our lifestyles, and our livelihoods. A community's choices about resilience affect the level of damage they may face.

Resilience efforts change the quality of life in sunny skies and during and after disasters. Investing in resilience is a chance to protect coastal communities.

Resilience: The ability to prepare for and adapt to changing conditions. Resilient communities withstand disasters and recover quickly.

Hazard Mitigation: Any sustained action that reduces or eliminates long-term risk to people and property from disasters.

Mitigation and resilience are related. Mitigation supports a community's ability to endure shocks. After a disaster, the impulse is to return to normal. Mitigation and resilience both encourage communities to move forward to a safer and stronger state.

THE COST OF COASTAL DISASTERS

Coastal disasters have high costs. Some are easy to see and count. Others are hidden at first glance. Disasters destroy property, roads and buildings. They cause injuries and death. Emergency response costs add up as well. Other costs are longer term and often unseen. Businesses may shut down for weeks or months. Children may lose precious school days. Tourists may choose other places to visit. Then there is the price of trauma and anxiety. This includes the fear that, after a storm has passed, it could all happen again.

Disasters cost individuals, households, businesses and the community as a whole. Disasters affect people and communities in different ways. Communities and people with resources bounce back the fastest. Those with less access to resources are often left scrambling for months or years after a disaster.

Individual households suffer the costs from disasters. The costs are most severe for low- and moderate-income families. Households with less money saved may find it hard to find temporary housing. People who work at low-wage hourly jobs may lose those jobs if they cannot repair or replace damaged cars or use—or if public transportation is no longer running. Age, race, gender, social class, disability, ethnicity and other factors can affect how quickly people recover from a disaster. Without support, disasters push struggling families deeper into poverty.

Underserved communities experience differences in how prepared they are to respond to disasters, how well their homes have been adapted to mitigate against local hazards, and how quickly their communities are able to resume social and economic life after a major event. **FEMA must direct its resources to eliminate disparities in these outcomes.**

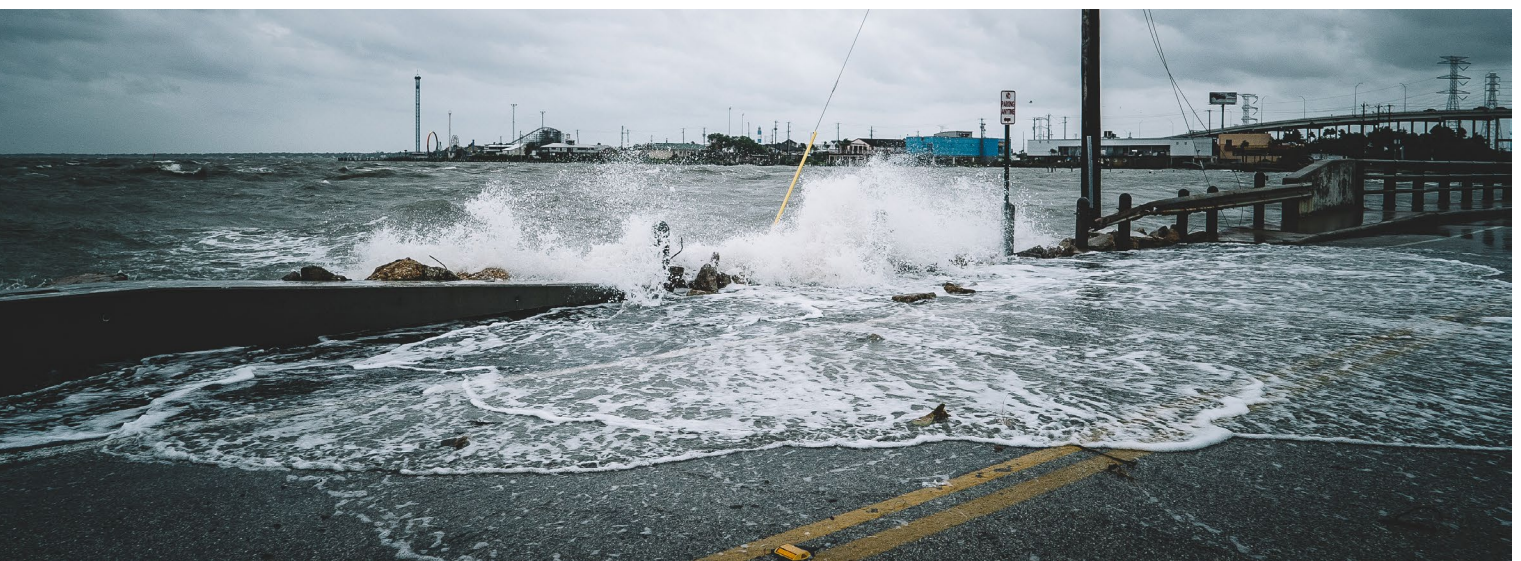
2022-2026 FEMA Strategic Plan

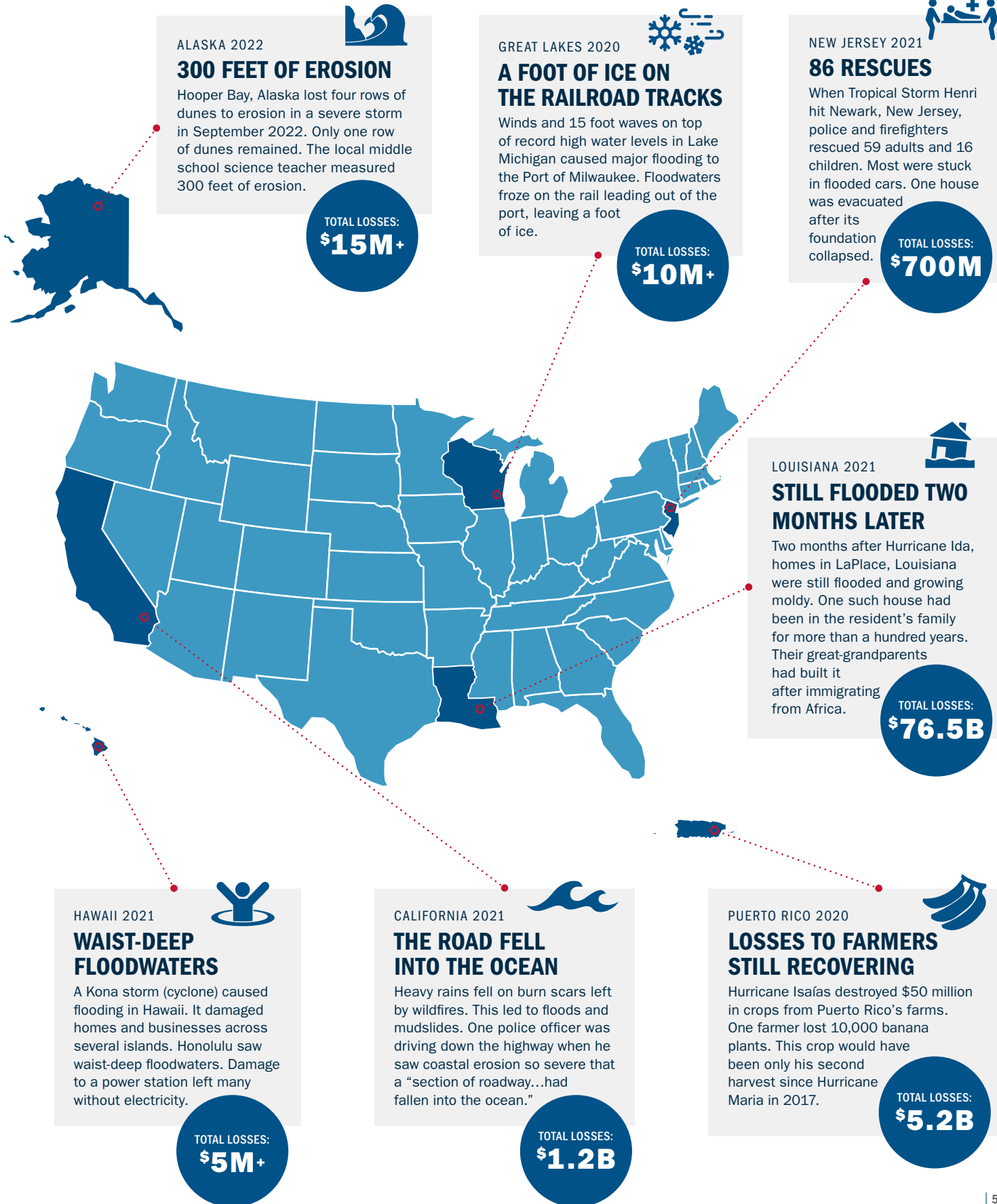
Coastal businesses suffer from disasters. Those that depend on the coast, such as fisheries and tourism, are more vulnerable. For example, extreme environmental events caused nearly 85% of fisheries disaster declared by the National Oceanographic and Atmospheric Administration (NOAA) between 1994 and 2020. Many working waterfronts are trying to reduce the risks to water-dependent businesses.

On a larger scale, disasters cost communities. Building and road damage can put a major strain on budgets. Communities must pay for emergency services, clean-up and other recovery costs. Later, the local government may see a 5 to 6% decrease in tax revenues and/or a lower bond rating. Damaged ecosystem services affect the community as well. Fallen trees will not help with heat waves. Polluted waters are less likely to attract tourists.

The infographic on the next page shows a small set of natural disasters from 2020 through 2022. The map does not list every disaster. Instead, it shows brief snapshots of how disasters have hit coastal communities.

Photo description: Water crashing over bridge during Hurricane Harvey in Kemah Texas





ALASKA 2022



300 FEET OF EROSION

Hooper Bay, Alaska lost four rows of dunes to erosion in a severe storm in September 2022. Only one row of dunes remained. The local middle school science teacher measured 300 feet of erosion.

TOTAL LOSSES:

\$15M+

GREAT LAKES 2020



A FOOT OF ICE ON THE RAILROAD TRACKS

Winds and 15 foot waves on top of record high water levels in Lake Michigan caused major flooding to the Port of Milwaukee. Floodwaters froze on the rail leading out of the port, leaving a foot of ice.

TOTAL LOSSES:

\$10M+

NEW JERSEY 2021



86 RESCUES

When Tropical Storm Henri hit Newark, New Jersey, police and firefighters rescued 59 adults and 16 children. Most were stuck in flooded cars. One house was evacuated after its foundation collapsed.

TOTAL LOSSES:

\$700M

LOUISIANA 2021



STILL FLOODED TWO MONTHS LATER

Two months after Hurricane Ida, homes in LaPlace, Louisiana were still flooded and growing moldy. One such house had been in the resident's family for more than a hundred years. Their great-grandparents had built it after immigrating from Africa.

TOTAL LOSSES:

\$76.5B

HAWAII 2021



WAIST-DEEP FLOODWATERS

A Kona storm (cyclone) caused flooding in Hawaii. It damaged homes and businesses across several islands. Honolulu saw waist-deep floodwaters. Damage to a power station left many without electricity.

TOTAL LOSSES:

\$5M+

CALIFORNIA 2021



THE ROAD FELL INTO THE OCEAN

Heavy rains fell on burn scars left by wildfires. This led to floods and mudslides. One police officer was driving down the highway when he saw coastal erosion so severe that a "section of roadway...had fallen into the ocean."

TOTAL LOSSES:

\$1.2B

PUERTO RICO 2020



LOSSES TO FARMERS STILL RECOVERING

Hurricane Isaias destroyed \$50 million in crops from Puerto Rico's farms. One farmer lost 10,000 banana plants. This crop would have been only his second harvest since Hurricane Maria in 2017.

TOTAL LOSSES:

\$5.2B

MITIGATION PREVENTS **ECONOMIC LOSSES**

Building resilience is a smart economic decision. Research from the National Institute for Building Sciences shows that every \$1 spent on mitigation saves \$6 on future disaster losses. Simply put, mitigation prevents severe losses from disasters.

TRIED AND TESTED METHODS THAT **PREVENT LOSSES**

Every coastal community is unique. Natural disasters affect different areas in different ways. But there are tried and tested solutions that help communities avoid losses when disasters strike. It can be useful to think about these tools in four buckets:

1 | Structure and infrastructure

Move buildings out of harm's way. Buyout programs can cost time and money. They can also have a high emotional cost. However, removing homes from danger is the most effective way to keep people safe and prevent damage. Buyouts can create new natural assets for the community. They can also save communities from disasters that would have a much worse impact.

Update or retrofit critical infrastructure that support community lifelines. When critical roads, lines, rail, and buildings are damaged, businesses stop functioning. Then, residents suffer. Repairs can be costly. Losing essential services can be even costlier. When possible, build critical facilities on high ground. Buy backup generators and temporary flood barriers. Harden the facilities against flood and extreme heat. This way, a storm is more likely to last just a few hours. It will not leave residents without power or clean water for days, weeks, or months. Losing power and water can harm people and hurt local businesses.



Photo description: Aerial of lower Manhattan skyline, New York, USA

Raise homes and other structures and/or build barriers to protect against hazards. Retrofitting old buildings can reduce risks, especially in conjunction with strengthened building codes. Elevating houses is proven to save money over time. Coastal communities also build seawalls and other grey infrastructure protection. These measures often work best with green or nature-based solutions.

Critical infrastructure includes:

- Power lines and utilities
- Roads
- Water and wastewater facilities
- Railroads and mass transit
- Energy facilities

These facilities support “community lifelines” needed to keep communities running.

TRIED AND TESTED METHODS THAT PREVENT LOSSES, CONT'D

2 | Nature-Based Solutions

Use the power of natural features to reduce the risks from natural disasters. Nature-based solutions work to protect coastal communities and vary in scale. They could be a single rain garden or bioswale off a parking lot to reduce flooding from a road. At large scales, nature-based solutions can protect or restore several acres of dunes and wetlands. Dunes and wetlands absorb storm surge and wave energy during storms. They can also reduce damage. However, projects are most effective at larger scales. Finding space for large projects can pose challenges for built-out urban areas.

Nature-based solutions and projects often cost less than grey solutions. They can also promote economic growth, green jobs, higher property values, environmental quality and public health.

3 | Plans and regulations

Plan where and how to invest in resilience. Hazard mitigation, climate adaptation and other plans help community develop and prioritize actions to advance equity and resilience. Planning processes should include input from the whole community. They should include socially vulnerable populations.

Plans work best when they provide:

- ✓ Detailed descriptions of resilience projects
- ✓ Concrete timelines and funding sources
- ✓ Next steps for each action

One easy way to focus on actions in plans is to align with comprehensive and capital planning.

Use building codes and standards to require new buildings to be more resilient. Hazard-resistant building codes support construction that resists wind, water, seismic activity, fires and other hazards. Newer codes reduce the cost of damage when a disaster strikes. Every dollar invested in developing and enforcing strong building codes saves \$11 following a disaster. They also help communities avoid the hidden losses from moving, lost rent, extra living expenses, lost tax revenue, and the health effects of unsafe or uncertain housing. The economic and social impact of halting or relocating businesses and services for repairs can be massive.

4 | Education and outreach

Inspire and teach your community about risks and resilience. When residents know their risks and options to reduce it, they can better protect themselves, their families and their property.

People are not born knowing how to reduce their risks. And, until a disaster hits, many people do not spend time and money to prepare. After a disaster, they may wish they had. It is not easy to count the cost savings from education and outreach. Giving people the facts they need to stay safe and protect their property has a human and economic benefit.

Reach socially vulnerable populations and build relationships across the community. Relationships between neighbors build social resilience. Communities where residents know each other and have strong bonds often fare better during disasters. Education and outreach can build those critical connections.

Think about the whole community when planning outreach. Make sure all meeting places (buildings and neighborhoods) are accessible to people with disabilities. Use locations that residents can reach without a car. Translate materials into languages used in the community. These should include meeting notices.

Local leaders and decision makers across the country use these tools to make their communities stronger. The infographic on the next page explains the economics of some mitigation tools. It also gives brief case studies from communities that successfully used them.

1 STRUCTURE AND INFRASTRUCTURE

Retrofit existing buildings and update utilities:

For every \$1 invested, avoid \$4 in losses.

Build new coastal homes 2 feet above the 1%-annual-chance flood level:

For every \$1 invested, avoid \$17 in losses.

After Hurricane Katrina, Jefferson Parish, LA used FEMA grants and other funds to elevate 23 homes. So far, the project has saved more than double its cost in avoided losses.

2 NATURE-BASED SOLUTIONS

Wetland and reef restoration:

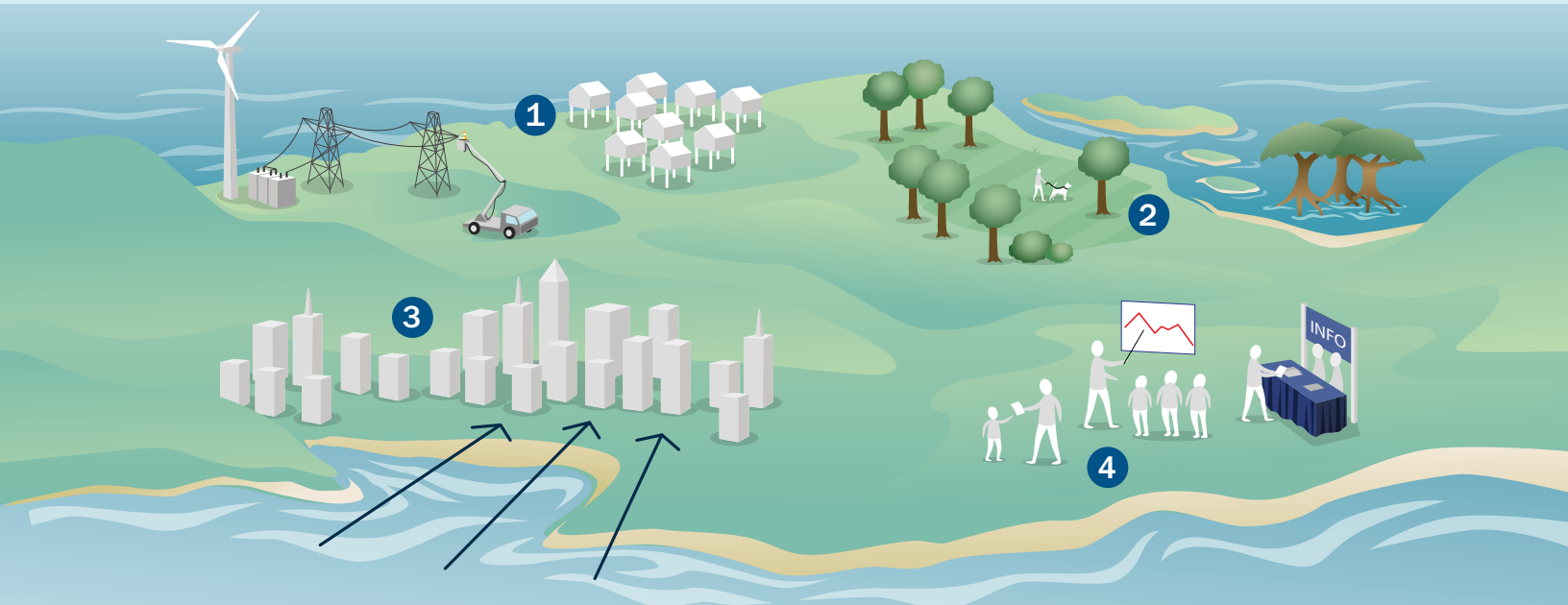
For every \$1 invested, avoid \$7 in losses.¹

A study found that

Wetlands prevented \$625 million in losses

just from Hurricane Sandy.

Natural shoreline protection on the North Carolina shore was not damaged by Hurricane Irene. In contrast, the storm damaged more than 76% of bulkheads.



3 PLANS AND REGULATIONS

Enforce the most recent IRC/IBC codes for new coastal buildings:

For every \$1 invested, avoid \$11 in losses.

Texas buildings built to meet building codes were stronger during Hurricane Harvey. Their insurance claims were half those of buildings built before the codes were adopted.

4 EDUCATION AND OUTREACH

The city and county of Honolulu found that, of 900 survey respondents,

more than 75%

wanted to see the government spend more money on resilience to the impacts of climate change.

Lots of people are interested in resilience, reducing the impacts of climate change, and/or community safety. Connect hazard mitigation to existing concerns and priorities.

Sources:

FEMA (2020). Building Codes Save: A Nationwide Study.

Multi-Hazard Mitigation Council (2019). Natural Hazard Mitigation Saves: 2019 Report. Porter, K. et. al. National Institute of Building Sciences. Washington, DC.

Narayan, S., Beck, M.W., Wilson, P. et al. (2017). The Value of Coastal Wetlands for Flood Damage Reduction in the Northeastern USA. Sci Rep 7, 9463.

Reguero, B. et. al (2018). Comparing the cost effectiveness of nature-based and coastal adaptation: A case study from the Gulf Coast of the United States. PLoS ONE 13(4)

¹ This study reviewed the Gulf of Mexico only.

MITIGATION IS A **COMMUNITY EFFORT**

The question of who pays and who saves in risk reduction is complex. Property owners, developers, or taxpayers at the local, state, or federal level may make investments. They could also be made by a mix of those people. Those who invest may recoup their costs through avoided losses. They may also gain from lower insurance rates. The benefits of a resilient community, such as a strong tax base and protected property values, also help.

It can be hard to convince a person or organization to invest in risk reduction if they will not be the one to benefit from avoided losses. For example, a developer may oppose stronger building codes because they will raise building costs. Buyouts may reduce the local property tax base. Making the economic case for risk reduction often needs a long-term, whole community view.

Disasters hurt communities. Every disaster and community are different. In most cases, though, worse losses and bigger impacts mean it takes longer to recover. Disasters can change demographic and social patterns. Such changes can lead to business losses long after an event. Lasting damage can have a negative impact on views about a community.

For those who already invested in the community's future, it can help to present mitigation as a group activity. It protects what is special about a community for generations to come. It brings benefits to everyone.

CO-BENEFITS OF MITIGATION

Along with reducing risks, mitigation can bring immediate benefits and economic growth. Benefits can include:

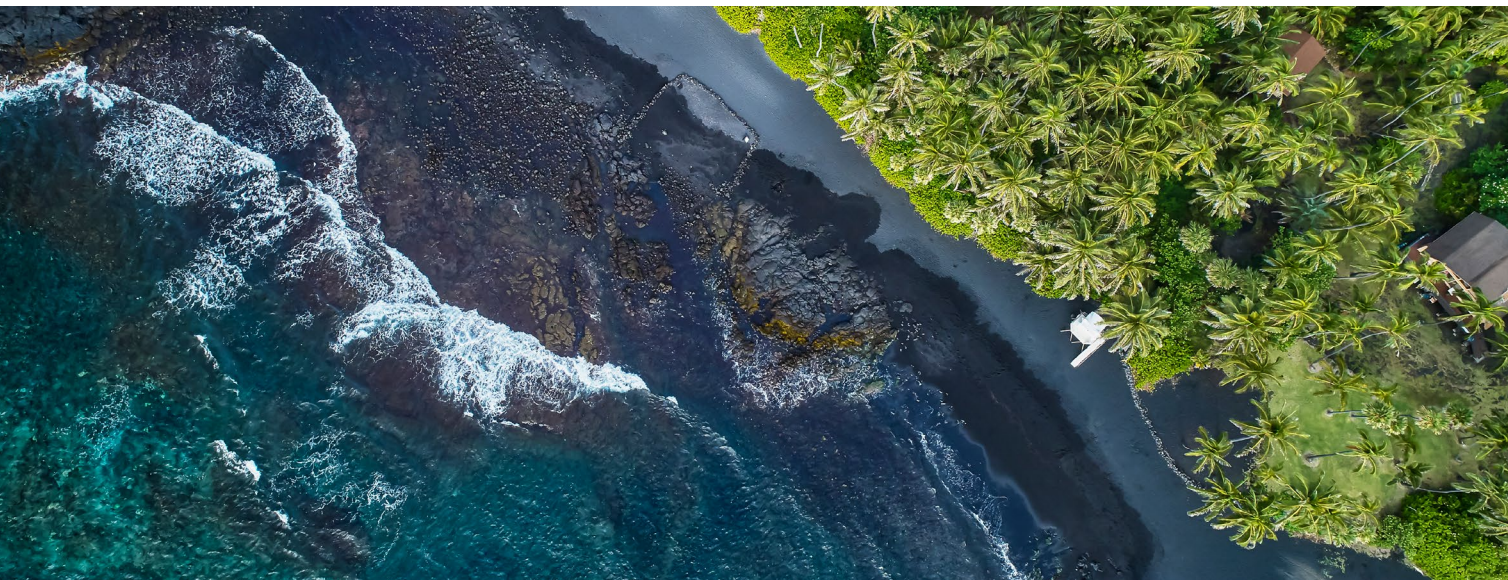
Job creation – New mitigation projects bring new jobs. Los Angeles, California spent \$166 million on nature-based mitigation from 2012 to 2014. The investment made more than 2,000 new jobs. Structure and infrastructure projects also often create jobs in engineering and construction.

Community cohesion and social resilience – Hazard mitigation and resilience planning give community leaders and members ways to meet and learn from each other. These connections build a stronger community during and between disasters. Resilience efforts also give chances to reach out to underserved populations. Communities are stronger when their leaders know the needs and concerns of all.

Natural beauty and tourism – Nature-based solutions help the beauty of an area to shine through when its wild landscapes can thrive. This can increase quality of life for residents. It can also bring tourists to the area.

Health – Mitigation projects often add green space. These spaces can benefit both physical and mental health. They can also lead to better air and water quality. Those changes may have a long-term positive health effect for the community.

Photo description: *Pohoiki Black sand beach, Pahoia, Big Island, Hawaii, USA*



NEXT STEPS

Reach out to your [State Hazard Mitigation Officer](#) and/or [regional FEMA office](#) for more resources and support.

More information on coastal hazards and equitable resilience

- Learn about how your community can use flood maps and other data to reduce risk and build resilience from the [Thinking Beyond Flood Maps: Using FEMA Coastal Data to Reduce Risk and Build Resilience](#) story map.
- Refer to the [Guide to Expanding Mitigation: Making the Connection to the Coast](#) to learn about coastal hazards and how your community can protect itself.
- The [Guide to Expanding Mitigation: Making the Connection to Equity](#) gives information and resources on equity and mitigation. [Building Alliances for Equitable Resilience](#) gives information on equity and stories from FEMA's partners.

Grants, resources and technical assistance

- Many grant sources can be used to reduce risks. The [Mitigation Resource Guide](#) gives a detailed list of grants and support. See the sidebar for examples of how communities have used non-traditional sources for resilience projects.
- FEMA gives [grant funding](#) to help communities reduce their risks.
 - The [Building Resilient Infrastructure and Communities](#) grant program gave more than \$1 billion to states, tribes, territories and local communities in FY 2021.
 - The [Flood Mitigation Assistance](#) grant program gives funding to states, tribes, territories and local communities to reduce or eliminate flood damages.
 - The [Hazard Mitigation Grant Program](#) gives funding for long-term hazard mitigation planning and projects following a major disaster declaration.

Where can I find funding and/or support for resilience projects?

Many federal and state grants can be used to protect your community from natural hazards. Do not ignore programs that do not focus on resilience! Other types of grants may have resilience benefits. Think about these examples:

The city of Houston, Texas worked with the NOAA's Coastal and Estuarine Land Conservation program. They worked to buy and protect Brays Bayou in Houston. The land captures stormwater runoff, reduces flooding, improves habitat and gives green space to residents.

Provincetown, Massachusetts got grant support from the Environmental Protection Agency's Non-Point Source program. The grant paid for porous pavement. The change reduced stormwater runoff into the harbor. The project also reduced pollution and can lessen flooding.

The Port Gamble S'Klallam Tribe joined with the North Olympic Salmon Coalition to replace a causeway with a bridge. The \$1.5 million grant from NOAA's Coastal Resilience Grant Program (now the National Coastal Resilience Fund) restored marshland and the tidal channel. This improves water quality. It also supports endangered chinook and summer chum. The project included raising the road to Marrowstone Island and its buried utility lines out of the 1% annual chance flood zone.

- Disaster-resistant building codes save lives and protect public and private investments. Learn about [your local building codes](#). Refer to the [Guide to Expanding Mitigation: Making the Connection to Building Codes and Standards](#) and FEMA's [Building Sciences](#) team for more information.
- There are many ways to pay for investments in resilience. Some communities have found success using bonds and other ways to finance resilience projects.

REFERENCES AND MATERIALS:

- FEMA Coastal Resources: <https://www.fema.gov/flood-maps/coastal>
- FEMA Nature-Based Solutions: <https://www.fema.gov/emergency-managers/risk-management/nature-based-solutions>
- NOAA's Office of Coastal Management: <https://www.coast.noaa.gov/>
- Natural Hazard Mitigation Saves: <https://www.nibs.org/projects/natural-hazard-mitigation-saves-2019-report>



Photo description: Crab traps on a dock in Cape May Harbor



FEMA