

Using Nature to Reduce Climate and Disaster Risks



Across the nation, and most recently in the wake of Hurricane Sandy, communities face difficult decisions preparing for and recovering from natural disasters. How do we balance safety and cost efficiency with respect for people, property and nature?

Coastal storms, flooding and sea level rise endanger millions of Americans, and threaten infrastructure, industry, tourism and trade. In the U.S., the heaviest rainfall events have gotten even heavier over the last 50 years (67% heavier in the Northeast), making communities more vulnerable to flooding. Without action to reduce these risks, the losses to local and national economies will only continue to increase.

When it comes to disaster risks, an ounce of prevention is worth a pound of cure. A study by the Multihazard Mitigation Council found every \$1 spent on preparedness saves \$4 in natural disaster costs. **The good news is that natural defenses—like oyster and coral reefs, salt marshes, dunes, barrier islands, floodplains, wetlands, forests and mangroves—can help protect us from the damaging impacts of storms and floods.**

Poor coastal development decisions and climate change are putting more people and property at risk. Economic disruption and property damage from natural hazards like storms and flooding are increasing significantly. In 2011, global losses from natural disasters reached an all-time high of \$380 billion.

Nature is part of the solution

The Nature Conservancy is working to demonstrate the role of natural infrastructure in reducing risks to people and property.

We need a smart portfolio—one that includes natural defenses to natural disasters—as well as engineered solutions.

The Conservancy has led evidence-based reviews of the role of coastal habitats in risk reduction with key agency and academic partners. This global data shows that **marshes, for example, clearly play important roles in absorbing storm surge, reducing erosion and stabilizing shorelines.**

We have also shown that **coral reefs can reduce wave energy approaching coasts by more than 85 percent**, helping to reduce risks to the nearly 200 million people worldwide that live in low, at-risk coastal areas.

Inland, as well, natural areas help protect against flooding. Floodplains that remain connected to rivers retain high water, reducing downstream flooding. Forests hold soil in place and allow rainfall to seep underground instead of running off to swell rivers.

Compared to the cost and maintenance of engineered or structural flood protection, nature's infrastructure can provide a cost-effective first line of defense against storms.

The Nature Conservancy is working with partners at all levels to:

- Demonstrate where, when and how healthy or restored natural systems can contribute to cost-effective solutions that address current and growing risk from natural hazards and climate change;



Artificial reef structures at oyster restoration site in Alabama, Gulf of Mexico. © Andrew Kornylak; Strong roots anchor mangroves in Bahamas. © Mark Godfrey/TNC; Bass Creek saltmarsh at Shelter Island, New York. © Doug Wechsler

- Help provide communities, developers and government planners with the knowledge and tools to make decisions and take actions to reduce risks and enable climate-resilient development;
- Develop the partnerships and political will needed to promote the use of effective natural solutions in climate preparedness and disaster risk reduction.

How Much Can Nature Protect? With lives and livelihoods at stake, The Nature Conservancy is working with partners to move beyond anecdotal information to answer the tough questions about the role nature can play in reducing risk. For each major coastal habitat—coral reefs, oyster reefs, mangrove forests and salt marshes—we are documenting and quantifying the risk reduction benefits that these habitats can provide. By developing the same information about habitats that engineers provide about sea walls and other built defense structures, we can analyze and identify when and where coastal ecosystems are effective for reducing the risks from natural hazards.

Healthy Reefs

A healthy reef crests near the surface and serves as a major natural break-water—reducing most wave energy and helping protect coastal communities. Healthy reefs have abundant living corals and support fishing and tourism. In temperate zones, oyster reefs can provide some of the same protection and fishing benefits that coral reefs provide in the tropics.

In coastal areas behind reefs, or wherever wave energy is lower, mangroves—or marshes—can grow and further stabilize shorelines, reduce erosion, and provide nursery habitat for fish, shrimp and crabs.

Real Solutions for Reducing Social, Economic and Environmental Risks



Condemned house in Westbrook, CT after Sandy. © Adam Whelchel/TNC

The Nature Conservancy recognizes the challenges and trade-offs that communities face every day; addressing the issues of conservation, economic development and risk management all at once is a formidable task.

Using interactive tools backed by the best available science—such as the Conservancy’s *Coastal Resilience* tool—we enable planners, elected officials, managers and citizens to visualize current and future risk using digital maps, and then help identify a suite of solutions that best reduces social and economic risks while maximizing the benefits that nature provides.

Natural solutions may include: protecting or restoring area salt marshes as buffers; developing hybrid approaches that link natural and artificial defense structures; removing incentives to build in high-risk areas; and even designing restored oyster reefs to serve as breakwaters tailored to community needs.

BRIDGEPORT, CONNECTICUT

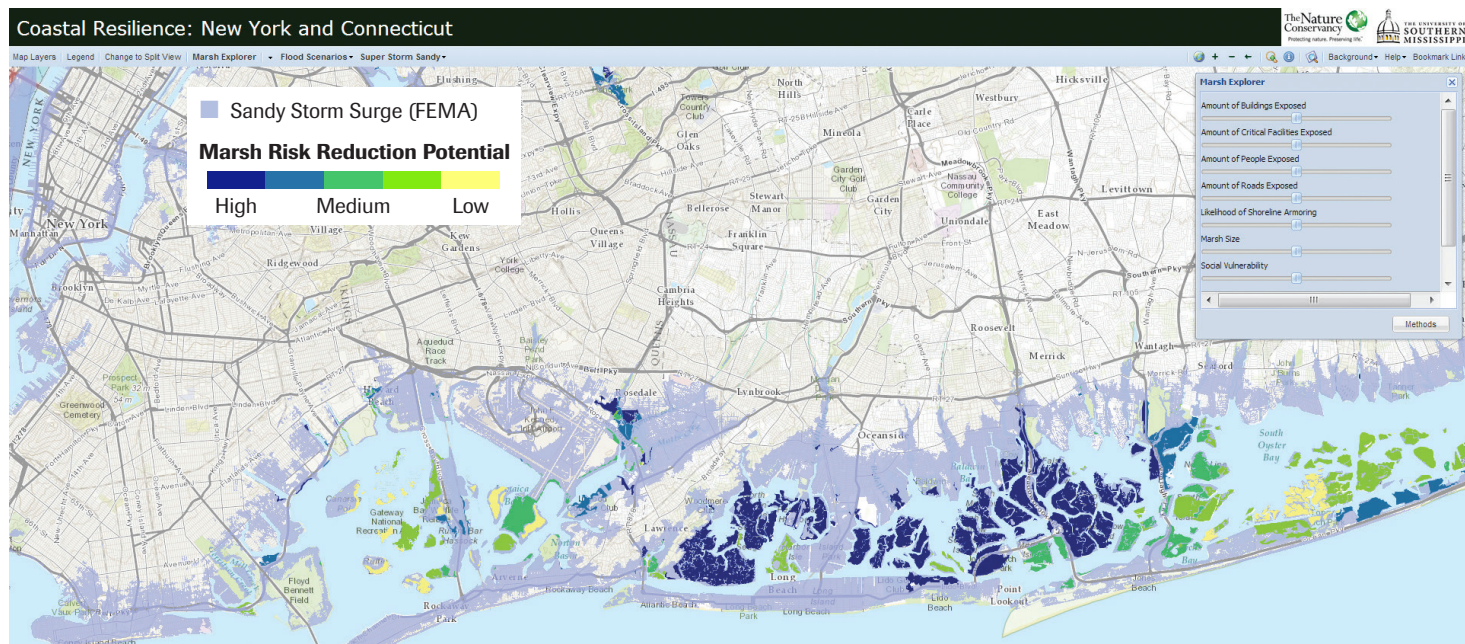
After living through Tropical Storm Irene, the 2011 Halloween Nor’easter and even a 2010 tornado, residents of Bridgeport—Connecticut’s most populous city—decided to better prepare for disasters. Partnering with The Nature Conservancy and others, city leaders held Climate Preparedness workshops in early 2012 to advance a community-driven dialogue on risk, choices, and actions.

This was before Hurricane Sandy carried an unprecedented 11-foot storm surge, coupled with inland flooding, over vulnerable areas of the city. Along Connecticut’s coast, homes owned for generations were condemned. One restaurant owner who had just reopened with support from community fundraisers, now faced another nine months of repairs.

But Bridgeport, at least, had a head start in identifying its risks, vulnerabilities and strengths. Using the National Oceanic and Atmospheric Administration’s Roadmap for Adapting to Coastal Risk and The Nature Conservancy’s *Coastal Resilience* tool, **the city mapped exposure from projected flooding due to hurricanes combined with sea level rise, and prioritized actions to reduce risk.**

Now, as residents rebuild after Sandy, Bridgeport is working to enroll in the Federal Emergency Management Agency’s Community Rating System, which offers private property owners a premium reduction through the National Flood Insurance Program in return for community-wide hazard mitigation. Other city priorities include adjusting building codes and land use policy, incorporating nature-based solutions such as marsh advancement zones and natural infrastructure for managing storm water, and factoring climate change into redevelopment and infrastructure plans.

www.lis.coastalresilience.org The *Coastal Resilience* tool, originally created for Long Island, New York City and Connecticut, helps decision makers examine the social, ecological and economic vulnerabilities from current and future risks from storm surge and sea level rise scenarios. Users can interactively identify where marshes may have the highest potential to reduce risks to people and property so they can focus conservation and restoration based on their own priorities.



The Nature Conservancy is working with partners and planners to incorporate social, economic and environmental risk into coastal development policies and decisions.

Natural Defenses at Work

Building on 60 years of addressing local problems with tangible solutions, The Nature Conservancy is demonstrating how nature can be incorporated into development, adaptation and hazard management decisions in vulnerable flood-prone environments.

As we proceed with efforts to reduce the risks to people and nature from sea level rise and flooding along our rivers and coasts, we can never forget that **our decisions before and after storm events directly affect the magnitude of impacts from future events.**

People live and work in these places along rivers and by the sea and have cherished their homes and traditions for generations. Many will decide to rebuild in the same vulnerable places. **We now have an opportunity to rebuild smarter**, taking advantage of nature's protective buffers where we can, and using lessons from storms Irene and Sandy to plan wisely for a more resilient future.



Migratory bird refuge, Cape May, New Jersey. © Erika Nortemann/TNC

THE RIVERS OF NEW YORK STATE

The New York State Department of Transportation (NYSDOT) oversees 15,000 miles of state-owned highway. Beneath those state roads are approximately one million culverts connecting thousands of streams. When it comes to culverts, size matters. Undersized—or poorly placed—culverts can lead to flooding during heavy rain events, like Tropical Storm Irene in 2011. In addition to threatening safety and property, inadequate culverts can damage the health of our rivers as well, for example, blocking cold-water brook trout from finding refuge.

Replacing such culverts with fish- and wildlife-friendly designs that can also withstand periodic high water volumes is a win-win method to improve river and community resiliency. Using scientific data on stream condition, habitat needs for fish, and other ecological criteria, The Nature Conservancy developed a prioritization tool that is now being used statewide to help NYSDOT focus its limited resources toward culvert upgrades that will help keep people and property safer while improving conditions for rivers and wildlife.

SOUTH CAPE MAY MEADOWS, NEW JERSEY

Just off the southern tip of New Jersey, South Cape May's cottages lie beneath the waves, the scattered remnants of a Victorian-era resort town overtaken by the ocean in the 1950s. The lost town became South Cape May Meadows, a 212-acre Nature Conservancy preserve with wetlands, ponds and a beach important for migrating birds. But as the area lost 15 feet of shore to erosion per year, and storms breached and overtopped the preserve dunes, the nearby towns of Cape May City and Cape May Point began to experience severe flooding in the 1990s.

The towns approached the Conservancy, Army Corps of Engineers and the state, which owns the adjacent Cape May Point State Park, to seek common solutions. The result was a \$15 million ecological restoration project including both natural infrastructure (reconstructing dunes for bird nesting, restoring freshwater channel and foraging ponds, and creating islands in the wetlands) and engineered aspects (levees and water control structures).

Completed in 2006, the restored Meadows withstood a series of severe storms, including Irene in 2011 and Sandy in 2012, when waves did not breach the dunes, and wetlands remained intact. The project was also deemed a success as local communities experienced only minor flooding from Sandy. In the long run we'll need to allow wetlands and beaches to retreat in the face of sea level rise, but where the location of homes and communities prevents that retreat, natural solutions can still help reduce risks.

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