

Living shorelines: Using nature to fight back coastal erosion



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In 2012, Hurricane Sandy flooded the Dodge Paddock-Beal Preserve in Stonington with saltwater from Fishers Island Sound gushing across boulders and a broken seawall.

The force pushed sand back, sending ocean water over shrubs and trapping about 5 feet of water behind a berm. Sand and gravel from

coastal storms blocked the paddock's drainage system. Invasive, nonnative reeds that can grow 15 to 20 feet tall in wetlands and coastal areas, called [phragmites](#), gained a foothold in the wetland.

Staff from the state Department of Energy and Environmental Protection (DEEP) cleared a channel to allow the water to drain back into the Sound and led efforts to remove the phragmites, an aggressive grass that threatens biodiversity. Avalonia Land Conservancy leaders, working with experts, devised plans to protect the conservation land from rising sea levels and increasing floods. This involved replicating nature by planting native marsh grasses and shrubs with deep roots to help the land absorb saltwater soakings and prevent soil erosion.

"This is a perfect example of a natural living shoreline," said Beth Sullivan, a longtime steward of the 3.7-acre Dodge Paddock-Beal Preserve in the Borough of Stonington. "This is what nature does when left to its own devices."

The term "living shorelines" refers to nature-based solutions to protect coastlines from erosion as sea levels rise and severe storms, due to climate change, become more frequent. They're called "nature-based" solutions because they replicate historic natural features such as coastal reefs, sand spits and abundant oyster beds, all of which helped absorb or diffuse wave energy.

Along the Eastern seaboard, engineers, environmental scientists and landscape architects design nature-based solutions to try to protect beaches, marshes, homes and infrastructure from coastal erosion.

Some of the solutions that help attenuate wave energy before it hits the land also provide a habitat for pollutant-filtering oysters. These include oyster castles (LEGO-like concrete blocks), reef balls (Wiffle ball-shaped

concrete balls), rock sills (lines of rocks placed off the shoreline similar to a sand bar or sand spit) and bags of strategically placed oyster shells or slipper shells.

Living shorelines require regular maintenance and can be expensive, but they're an effective solution to coastal erosion.

Living shorelines versus seawalls

Experts now know seawalls give a false sense of security and exacerbate erosion elsewhere, said Juliana Barrett, extension educator emerita, Connecticut Sea Grant College Program, so it's extremely difficult to get a permit from the DEEP to build a new seawall.

These hard structures "all impact the flow of sediment to different areas," Barrett said. Over time, sand at the base of the sea wall erodes, so that nothing stands between the water and houses, businesses and roads except sea walls.

Seventy percent of Connecticut's coastline is "armored," meaning it has been engineered, protected or turned into a pier or dock, said physicist Jim O'Donnell, executive director of Connecticut Institute for Resilience and Climate Adaptation (CIRCA), part of UConn's Department of Marine Sciences. Examples of 'engineered' measures are sea walls, jetties and collections of large sloping rocks called a revetment.

Because much of Connecticut is built right up to the edge, Barrett said, often, removing a seawall isn't an option.

In the few areas where there isn't development right up to the seawall, if the wall were removed, she said, the ocean would reclaim the area, or it could develop into a dune or beach. At Dodge Paddock-Beal Preserve,

conservationists have no plans to replace the remaining seawall as it breaks down.

Another problem with seawalls, O'Donnell said, is that once the sand that used to be a beach erodes, all that's left is the water and the wall. The intertidal land in front of the seawall disappears. The public is allowed to access the intertidal land between the high water and low water marks. But if you have no intertidal zone, the public can't walk along the shore, he said, adding, "The seawall protects the landowners' rights at the expense of the public."

Nature-based solutions

Nature-based solutions work with nature, such as plants, marshes and rocks, and, in many cases, attempt to replicate coastal topography that existed before development. Scientists and engineers from multiple agencies work together to evaluate the right living shoreline project for the conditions of each location.

"We're all learning from each other," Barrett said, since there are many different nature-based solutions. What works elsewhere won't work in Connecticut, she said. Connecticut has bedrock or pocket beaches, not long expanses of beach like Cape Cod.

To design a nature-based solution, Barrett said, scientists determine what's causing the erosion. It could be a hurricane or a nor'easter. A beach or marsh can typically recover from those storms if beach grass is replanted and sand is brought back, she said.

Connecticut's living shorelines with nature-based features appear to be working.

For example, concrete reef balls, which contain holes for water flow and wildlife habitat, were placed in a parallel line near the water's edge in Stratford Point in 2014 and at the base of the [Thames River in New London](#) in 2021 to slow the wave action and allow marsh to build up along the shoreline, Barrett said. The reef balls are collecting sediment around them.

Reef balls mimic nearly all the features of natural reefs, and they are used [worldwide](#) to restore ailing reefs or create new reefs for several reasons, including beach erosion protection.

After successfully combating erosion in Florida for decades, Barrett said, reef balls were first used in Connecticut for the Stratford Point project. Local experts had to figure out how to make them so they could withstand ice shields, since the reef balls are placed in the tidal area, where the tide goes in and out.

Another ongoing living shoreline project is the Hepburn Dune-Crab Creek in the Fenwick borough in Old Saybrook. Engineers created a hybrid living shoreline to restore and enhance the coastal dune habitat, tidal wetlands and tidal creek. The project involves 450 feet of shoreline along Long Island Sound and is owned and maintained as part of the Hepburn Family Preserve by the Lynde Point Land Trust. Wetland habitats act as natural buffers against waves and powerful storm surges, studies show.

The barrier beach fronting what's known as the "Hepburn Dune" has eroded continuously for more than a century, partly blamed on the stone jetties and seawalls built on the property during the 20th century.

The Connecticut National Estuarian Research Reserve (CT NERR) worked with the Lynde Point Land Trust to protect the salt marsh

behind the dune on the Hepburn preserve, said Katie Lund, coastal training program coordinator at the CT NERR.

“People think of protecting their lawn from eroding, or the foundation of their house being threatened,” Lund said. “These living shorelines protect entire ecosystems.”

Tidal Marshes’ role

Coastal resilience experts are working together to try to figure out how to protect tidal marshes.

“They absorb the huge amounts of water that come in during a storm surge. They act like a sponge and slowly filter out water over time,” Barrett said.

Coastal habitats like salt marshes, beaches and dunes provide many different benefits, including resilience from storms, Lund said. They are “incredible filtration systems,” filtering pollutants, such as runoff, that come in from the land and the water. Salt marshes also protect developed properties, she said, because they provide a buffer from storms and wave erosion.

But a hundred years ago, people didn’t understand the value of salt marshes, and many were paved over to make airports, including Groton-New London Airport. Connecticut has lost 35% of its tidal marsh, said Tim Clark, resilient southeastern Connecticut program director with The Nature Conservancy.

“To lose any [marsh] is really problematic,” Clark said. “We’re trying to work with partners to figure out ... how involved people should be

getting, whether we want to stop that erosion entirely, or whether we ought to let nature do its thing."

Future

Living shorelines are being designed to incorporate [CIRCA](#) projections that by 2050, sea levels will have risen up to 20 inches, Lund said.

When deciding what to plant at the Dodge Paddock-Beal Preserve, said Sullivan, the land steward, conservationists chose native plants such as swamp milkweed, pussy willow, blueberry, bayberry and winterberry that would soak up water and survive getting drenched during super high tides.

But living shorelines are not a panacea. CIRCA's O'Donnell said he hopes people accept the inevitability of sea level rise. That means, he said, building structures so they're less vulnerable, such as elevating properties on pilings and moving them away from the ocean.

How you can help:

Citizen scientists can help those working to protect coastlines by downloading the "[MyCoast.org](#)" weather app. Connecticut Sea Grant, the CT NERR and CIRCA partnered to implement MyCoast as a pilot project in New London, Groton and Stonington.

To help people working to make coastlines more resilient, Lund said, citizen [scientists](#) are encouraged to download the app and take photos after high tides or rain events to create records of coastal flooding. For example, Lund said, public officials in nearby states use the information to identify the best roads to lead people away from flooding during evacuation.

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