



“Build a Wall”: The Wrong Solution for Our Coastal Problems. An Interview with Jennifer Mattei

Jennifer H. Mattei and Lisa Jean Moore

Metropolitics editorial committee member and sociologist Lisa Jean Moore interviewed biologist Jennifer Mattei, an expert on coastal ecology and restoration, on January 25, 2017, about coastal restoration, “reef balls,” and how cities of the future can become a part of the natural world rather than walling it out.

What is a living shoreline?

Living shorelines, a concept that is now being developed and promoted by the National Oceanic and Atmospheric Administration (NOAA), are nature-based solutions to man-made problems along our highly populated coasts. Coastal development, pollution, and uncontrolled harvest of seafood have changed the conformation of our coastlines. One would need to go back to the late 1700s to find descriptions of what our natural coastal habitats used to look like because we have changed every habitat in our coastal ecosystem. For example, we overharvested the oyster and stripped out nearly all of the oyster beds and reefs. We have filled in and taken out the majority of our salt marshes and vegetated dunes, many replaced with human developments. These coastal habitats were the natural buffers of wave energy and coastal storms. In the past, wave energy would dissipate well before it hit the upland. Most think that flat and barren coasts are normal.

Now, some people concerned about sea-level rise feel the solution is to build bigger walls to keep out the rising sea. But building walls is not a good solution for many of the problems that we currently face because, ultimately, seawalls change how the ocean interacts with the land. Each wave that is turned back by the wall takes the underlying sand with it. The fastest way to lose a beach is to build a seawall. Many federal and state organizations are trying to find better ways to prevent eroding beaches and marshes, particularly in light of global climate change and sea-level rise.

Hurricanes Irene and Sandy were wake-up calls to many coastal inhabitants. Seawaters are more frequently breaking the barriers we have erected and flooding our homes and streets. People are looking for solutions.

One idea is to put back or try to restore natural habitats, install a living shoreline to abate wave energy, stop shoreline erosion, and enhance important nursery habitats for fish, shellfish and wildlife. In this way, we restore ecosystem services that have been lost through ignorance of these important natural processes.

What kind of work is your team currently doing?

After witnessing a number of failed attempts at coastal restoration, our research team decided to jump-start the natural succession that can take 50 to 100 years by installing an artificial reef to give some solid structure to the shoreline and encourage shellfish settlement. We placed what is called a

“reef ball” at mean tide. As the waves approach the shore, they will hit the reef first. Then, behind the reef, we have planted salt-marsh grasses. As the waves go through those grasses, the sediment trickles out and sediment accumulates rather than being eroded. The grasses protected by the reef grew up much faster than grasses planted in other areas without the reef. The restoration of both missing habitats—the reefs and the grasses—performs better than trying to restore estuarine habitats in isolation. Some coastal communities are trying to protect their shoreline property with just sand dunes, some are using just bags of shells, and others are just planting marsh grasses. But when installed together, these different habitats have synergistic interactions like the weaving together of different threads to make a garment. Alone, a single thread does not withstand a storm.

Originally, the reef balls that I mentioned before were designed to help restore coral reefs that were destroyed by hurricanes and human development in the Caribbean Sea. In 2014, we ran a pilot study installing a 150-foot-long [45 m] artificial reef consisting of 64 reef balls. We placed these hollow, dome-shaped, 1,500-pound [680 kg] cement structures that look like molded Swiss cheese off Stratford Point, Connecticut. When they are hit by a wave, the water flows up, over and through them. We measured a 30% dampening of the energy headed shoreward. Algae and shellfish settle on the reef and fish sometimes take shelter inside. After several years, they become part of the natural structure of the shoreline. After three years, a quarter of the reef has been buried in sediment.

Before the living shoreline idea, how did people refer to what was being done to protect the shoreline?

Coastal engineers refer to the practice of building walls as armoring the shoreline. Armoring is important and has worked in some places, like busy urban harbors. However, many property owners took this practice to the extreme. It can prevent shoreline erosion from boat wakes. But when a huge storm comes, the waves go up and over the armament and can actually hollow out behind it. Seawalls may hold the water on the land, acting like a bathtub—the water goes up and over the lip, but it is not able to flow back out. Armoring also breaks the natural connection of land and sea that is needed by so many plants and animals (e.g. seaside goldenrod, horseshoe crabs, terrapins and piping plovers).

How long has this idea of a living shoreline been around?

Nature-based infrastructure, combining gray material (artificial reef) and green material (plants) has been developed for different coastal urban areas over the past 15 years. What I have experienced from my own research is that some type of oyster reef structure is needed first, and these must not be solid walls at the water’s edge because allowance must be made for tidal exchange and organisms to move between the sea and land. Behind the protective reef, low and high marsh plants thrive followed away from the high-tide line by sand dunes and upland grass/wildflower/shrub and tree mosaics. These habitats together increase species diversity and maximize protection.

In the past, successful living shorelines were placed in protected low-wave-energy sites with the use of biodegradable materials. Where I am working, in a high-wave-energy area at the mouth of the Housatonic River, the waves from a nor’easter would tear up fiber matting in about 10 minutes. So we are trying to find nature-based solutions but at the same time use some type of harder structure that can withstand wave energy. Two hundred years ago, you would have found the shore ringed by oyster reefs.

What did oyster reefs do for coastlines at that time?

Read Mark Kurlansky's book *The Big Oyster: History on the Half Shell*, and you will immediately get the picture. Oysters were environmental engineers—both providing habitat structure and filtering the waters they lived in. But the oyster reefs that rimmed the shoreline in the 1700s were gone by the late 1800s. Not only were all the live oysters eaten and their habitat polluted with human waste, but the mounds of shells that served as reefs were removed, ground up and laid beneath our roads. By 2005, wild populations of our native eastern oysters continued to decline, suffering from habitat pollution, degradation and overharvest. Diseases began spreading through the remaining beds and a petition was filed to list the American eastern oyster on the Federal Endangered Species list. Oyster farmers and other state fisheries managers protested the petition and it was soon withdrawn. Now most eastern oysters are farmed and harvested within three years of settling. We have lost both their filtering power and the storm protections that their reefs offered.

There is evidence at the bottom of old middens (oyster-shell trash heaps) of oysters growing as big as dinner plates. You don't see oysters this big any more because we harvest them before they reach a few inches long. Kurlansky estimates that in the early 1800s, when oysters dominated the Hudson and East River estuaries, all the water in New York Harbor was filtered through oysters every few days. New York City, with its current record population (8.5 million), could really use that service now.¹

How can living shorelines help a metropolis today?

In 2012, former New York City Mayor Bloomberg announced a competition seeking proposals that would change the course of waterfront construction and help the city of New York build and maintain waterfront infrastructure in the most cost-effective and sustainable manner. In the light of the damage caused by Hurricane Sandy, the mayor wanted nature-based solutions. Although the winning design has not been built yet, some of my ideas have been influenced by drawings I saw from this competition².

For living shorelines to succeed at varying sites, not only do you need landscape architects, but also environmental engineers, ecologists, city planners and managers. For example, at our site in Stratford, engineers examined wave trajectories during different storm events and determined how winds and currents run on average. Once they knew the trajectory of the most damaging waves, a reef could be built further out to sea to abate oncoming waves with a design that would also increase habitat diversity and include plants along the shore that are adapted to coastal habitats. We are experimenting with a combination of wave-attenuating structures and natural barriers.

As sea levels rise and storm frequency increases, there are going to be some setbacks. Relatively soon, we will need to move houses back from the shore. Along the East Coast, in towns like Milford, Connecticut, people are now putting their homes on stilts. They are not moving back, they are building up. The storm water will be going under their homes. I think eventually they will lose that property based on the predictions of how high the seas will be in 50 years. There is no stopping a hurricane. However, living shorelines may limit damage and provide resiliency.

People look at armoring as a solution, but it is also very expensive. You have to keep mending the armor because it is going to be broken down. I think a nature-based solution in a lot of areas, which can actually grow and perform better, might be costly upfront but in the long run it is worth the investment. We need to make room for nature-based solutions to better adapt to our changing climate.

¹ See: www.billionoysterproject.org.

² See: www.6sqft.com/living-breakwaters-an-award-winning-project-brings-oyster-tecture-to-the-shores-of-staten-island.

Tell me a little bit about your specific research project in Connecticut.

I collaborate with the Connecticut chapter of the National Audubon Society at Stratford Point, Connecticut (site managers), and the DuPont Company (site owners). The property was used as a gun club for over 50 years. The lead shot that was used to shatter clay targets—known as skeet—was sprayed across the land and into the tidal wetlands. The lead was measured by the hundreds of tons! During the state-ordered remediation, the excavation of the land, and the removal of lead, most of the restoration attempts along the shore failed due to the intensified erosion by the sea.

We proposed using interconnected habitats, and that, so far, has been successful. After receiving state and federal permits in 2014, we started with a small pilot study. We created 150 feet [45 m] of reef using two rows of reef balls, each 3 feet [0.9 m] high and 4 feet [1.2 m] long. Shoreward of the reef, we planted salt-marsh grasses. They grew very fast and filled in quickly, mainly because they were protected by the reef balls from the wave energy that would have otherwise eroded the sediment around them. The last couple of storms that hit the Connecticut coast demonstrated the value of our design. Our site actually gained sediment while neighboring areas without the reef balls or grass plantings eroded. We showed the data to the state environmental managers and within a relatively short time they permitted us to expand the reef. Now we have about 1,000 feet [305 m] of living shoreline and we are going to have a community volunteer planting of 20,000 salt-marsh grass plugs on Earth Day in April.³ If any readers are interested, they are welcome to join us!

Given the political climate, what do you think the future holds for this type of research?

My colleagues and I are very concerned. I currently have a grant that is partially funded by the US Environmental Protection Agency (EPA), and a number of my other colleagues have EPA grants. We just heard the funds might be suspended. There is a freeze at EPA on all grant funding. And I just heard this morning that there is a blackout on all news coming out of EPA. A gag order on the results of legitimate research projects—this is horrible.⁴ There are emails flying about a “scientists’ march on Washington.” I was just on the Mall for the women’s march protecting my reproductive rights, and now I am feeling threatened for the research that I conduct!

Some colleagues are saying, “Wait four years, we have to get through just these four years.” But in that time, our losses will be great. We are just beginning to discover new ways of bringing back ecosystem services. With habitat restoration, it takes a long time to monitor what works and what does not. Losing four years can put us back 20 years. Our children will suffer the most. We need this funding and these data now to help inform how to help cities in the future become a part of the natural world, not wall it out or fence it in.

Jennifer H. Mattei, PhD, is a Professor of Biology at Sacred Heart University in Fairfield, Connecticut. Read more about her work at www.sacredheart.edu/livingshorelines and www.projectlimulus.com.

Lisa Jean Moore is a medical sociologist and Professor of Sociology and Gender Studies at Purchase College, State University of New York (SUNY). She lives in Crown Heights, Brooklyn. Her books include *Buzz: Urban Beekeeping and the Power of the Bee* (New York University Press, 2013, with Mary Kosut), *Gendered Bodies: Feminist Perspectives* (Oxford University Press, 2010, with Judith Lorber), *Missing Bodies: The Politics of Visibility* (New York University Press, 2009,

³ See: <https://weareshu.sacredheart.edu/project/3963>.

⁴ At the time of publication, the grant freeze, but not the gag order, had been lifted: www.engadget.com/2017/01/27/epa-grant-freeze-gag-order-scott-pruitt.

with Monica Casper), *Sperm Counts: Overcome by Man's Most Precious Fluid* (New York University Press, 2008), and the edited collection *The Body Reader: Essential Social and Cultural Readings* (New York University Press, 2010, with Mary Kosut). Her newest collaboration with Monica Casper is *The Body: Social and Cultural Dissections* (Routledge, 2014). Her most recent scholarship investigates the intraspecies relationships between humans and *Limulus polyphemus* (Atlantic horseshoe crabs).

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