

## Coastal Restoration Utilizing Living Shorelines in the Gulf of Mexico: Protecting Vulnerable Shorelines and Providing Valuable Habitat - Stella Wilson

Natural infrastructure solutions like living shorelines provide wildlife habitat, as well as natural resilience for habitats and communities near the waterfront. Living shorelines connect the land and water to stabilize shorelines, reduce erosion, and provide valuable habitat like marshes and oyster reefs that enhances coastal resilience. To address injuries from the Deepwater Horizon oil spill in the northern Gulf of Mexico, three living shoreline restoration projects were installed in Mississippi, Alabama, and Florida to protect the shoreline, reduce shoreline erosion, and provide benthic habitat. Each project was carefully designed to balance these project goals. Together these projects constructed 9 miles (45 acres) of oyster reef breakwaters, 55 acres of salt marsh habitat, and 46 acres of subtidal reef habitat. A robust 7-year performance monitoring program includes data collection and analysis of the shoreline position, shoreline profile, breakwater area, breakwater elevation, bivalve density, invertebrate biomass, and water quality. Results indicate that these projects are performing well and are exceeding expectations in terms of shoreline erosion reduction and benthic habitat productivity, despite active tropical system seasons, especially in 2020. These projects have helped slow and even reverse land loss and are also providing excellent habitat for oysters, mussels, shrimp, crabs, fish, and other marine species while allowing us to learn from and adapt to challenges along the way. We're eager to discuss our results, challenges, and successes with other restoration practitioners in an effort to improve our implementation of living shoreline projects and monitoring.

## Evidence for Small-scale Living Shoreline Viability in Galveston Bay, Texas - Sally Clark

In response to coastal subsidence and erosion throughout the lower Galveston Bay watershed, a significant amount of shoreline restoration projects have been implemented. Common approaches to stabilization include shoreline armoring using sheet pile bulkheads or other artificial materials, some of which have marginal to negative ecologic function and can complicate stability of adjacent shorelines. Increasingly popular alternatives can incorporate more natural landscape strategies and biologic processes that mimic endemic shoreline structure and habitat (e.g., Living Shorelines). Anecdotal evidence suggests that Living Shorelines (LS) are an ecologically beneficial option for erosion control and property protection. However, much of the scientific data regarding ecologic function come from larger scale projects rather than smaller, privately owned LS sites along the upper Texas coast.

For this ongoing study, comprehensive data was collected at three small-scale LS restoration projects within the lower Galveston Bay system. This data was compared to nearby natural reference sites and traditionally armored sites near each project site to compare biologic function across plant and animal communities, water and sediment quality, and shoreline erosion trends. Additionally, emerging technologies were used in comparing sites as geospatial data was examined and collected via drone and satellite imagery and analyzed via GIS.

The results suggest that LS can perform the function of shoreline stabilization as well or better

than traditional methods, while providing secondary benefits to the local ecosystem and economy. These results suggest that living shorelines have important implications for shoreline habitat function and resiliency. In light of climate change, relative sea level rise, and increasing development pressure along waterfront properties, this data will be useful for restoration managers considering applicable techniques for future projects in these dynamic coastal environments. This study promotes coastal management practices grounded in scientific research.

### Enhancing Coastal Resiliency: Delaware's Living Shoreline Cost Share Program - Kayla Clauson

Delaware as a low-lying, coastal plain state tends to feel the ramifications of climate change, sea level rise, and shoreline erosion like other states across the east coast. A proven effective way to help mitigate some of these effects is the installment of living shorelines. Living shorelines are a shoreline stabilization technique that utilize natural materials and native plants to protect wetlands, filter pollutants, improve water quality, and help the land-water continuum for animals to access important breeding/nursery habitat. Many organizations with capacity and expertise (i.e., Non-profit organizations) have the means to acquire various funding to implement large-scale living shoreline restoration projects. However, there is a disconnect between funding opportunities between formalized organizations and the public, who reside along our beloved waterways. To fill this gap, Delaware's Department of Natural Resources and Environmental Control hosts a Living Shoreline Cost Share Program. The program offers financial assistance to singular landowners and/or Homeowner Associations who are looking to install living shorelines on their properties that are facing erosion. The goal is to increase coastal resilience by incentivizing waterfront landowners to install sustainable shoreline stabilization techniques. With half of Delaware watersheds draining into the Chesapeake Bay, there are important implications of addressing wetland habitat restoration as such for the health of the Bay. In this presentation I will discuss the logistics of the cost share program, how it works, project criteria, and challenges, including lessons learned so far.

### Living Shorelines - How to Avoid Failures/Lessons Learned - Thomas Ries

Nature-based shoreline stabilization projects are now being implemented nationwide and most of these are functioning as intended and designed, however in some cases these have failed. This presentation will provide examples of living shorelines sites that experienced unintended consequences, i.e., catastrophic failures to protect a shoreline. Several non-performing sites were assessed to understand why they did not hold up as anticipated. These post assessments provide valuable information on why a particular design strategy was unsuccessful. This presentation will provide important project and specific site considerations that must be addressed to ensure that a particular approach will function over time and be able to withstand high-energy conditions. The intent of this presentation is to offer lessons learned so that future nature-based shoreline stabilization projects function as intended. Since the general public can be somewhat skeptical of new approaches to shoreline stabilization, the last thing that any of us shoreline restoration practitioners want is a site calamity, as these are not the "poster child" that will further the use of these innovative approaches that protect shorelines,

while also conserving ecosystem services. Therefore, these post living shoreline assessments will provide a better understanding on what works and why.

Franklin-98 Living Shoreline - Rick Harter

Due to chronic erosion along six miles of Highway 98 in Eastpoint, FL (a designated hurricane evacuation route), millions of tax dollars have been spent trying to protect the roadway from erosion damage. During these repairs, traffic must be diverted around construction areas, often by condensing the two-lane road down to one lane, thus causing delays to motorists. Over the years, efforts have been undertaken to stabilize the shoreline with various types of armoring, including vertical concrete seawalls, rock riprap, concrete rubble, and articulated-concrete block mats.

The Franklin-98 living shoreline restoration project aims to create estuarine habitat and enhance coastal resilience using an innovative design of nearshore reefs and intertidal marshes. Phase I, now constructed, includes sections of shoreline at Franklin County School and Tate's Hell State Forest. Phase II, adjacent to numerous private lands is anticipated to begin in Q2 2024. Future phases are also in development and will be added as more parcel owners agree to participate in the project.

Funded by NFWF's Gulf Environmental Benefit Fund and the National Coastal Resilience Fund, this project is actively engaging county businesses in the multi-million-dollar construction effort, thus contributing to the local struggling economy and employing former seafood workers who can no longer harvest oysters due to the recent collapse in the local oyster fishery. As a result of this and other oyster restoration activities in the bay, these oystermen may once again soon be able to sustainably harvest oysters in the bay.