2021 Living Shorelines Tech Transfer Workshop

Introduction

The 2021 Living Shorelines Tech Transfer Workshop, hosted by Restore America's Estuaries and the American Littoral Society, was held in Cape May, NJ on October 19-20, 2021. The Workshop offered both in-person and virtual attendance option, to increase accessibility particularly with respect to the ongoing Covid-19 related travel restrictions. More than 300 people participated in this event from around the United States and internationally.

Tuesday, October 19, 2021

Attendees were welcomed to the 2021 Workshop by leaders of the hosting organizations, Daniel Hayden of Restore America's Estuaries and Tim Dillingham of the American Littoral Society. Recorded remarks from New Jersey Senator Cory Booker underscored the importance of wise management of coastal resources.

Ed Mahaney, an educator, resiliency consultant, and former mayor of Cape May, then took the stage to welcome participants to his hometown. He touched on numerous local projects and coastal management concerns, giving the audience context of the threats and opportunities facing the local community.

Opening Plenary: Dr. Joe Smith, US Fish and Wildlife Service

Dr. **Joe Smith**, lead wildlife biologist at Edwin B. Forsythe National Wildlife Refuge, opened his presentation on coastal erosion by speaking about the vast amount of coastal habitat in New Jersey He explained how most coastal areas in New Jersey contain marshland, and how erosion is threatening these already fragile ecosystems.

There has been a 6% loss in marshes since 1970, and 70% of the losses have been due to edge erosion. Historically, at least 50% of marshes in New Jersey have been impounded for agriculture. Furthermore, 80% of marshes throughout the Northeast have been ditched. Impounding marshes for agricultural purposes degrades the soil, causing it to shift from aerobic to anaerobic. Harmful agricultural practices also lower marsh elevation, leaving it more vulnerable to wave-driven erosion.

Because of the historic degradation of marshes and recent erosion, oyster populations have been dwindling due to the loss of habitat, according to Dr. Smith's research. Tidal flats are crucial to maintaining coastal biodiversity, as tidal flats are home to a wealth of local species as well as marine and migratory birds. He also presented a potential solution to wave impact on shorelines.

In addition to living shoreline improvements, planting seagrass greatly helps alleviate the force of waves on the shore. Dr Joe Smith's mix of informative data and advocacy for coastal resilience set the tone for the rest of the Workshop.

Hybrid Designs, Urban Settings and Retrofits: Working with Communities to Balance Habitat and Infrastructure Needs

Camden, NJ

The first part of this session included presenters **Frank McLaughlin** from the New Jersey Dept of Environmental Protection, **Simeon Hahn** of the National Oceanic and Atmospheric Administration (NOAA), and three representatives from the Camden County Municipal Utilities Authority (CCMUA): executive director **Scott Schreiber**, and staff members **Peter Kroll** and **Tim Feeney**. They spoke about the importance of living shorelines in urban environments such as the Delaware River in Camden, New Jersey. These settings are more challenging than less developed areas due to pollution and existing infrastructure but are critical to sustainable growth and environmental justice.

Frank McLaughlin described the Harrison Avenue project area, a landfill brownfield site along the Delaware and Cooper Rivers that needed restoration. The local community wanted a waterfront park and the final design included walking trails and a fishing pond. Simeon Hahn spoke about NOAA's approach to shoreline restoration, giving particular emphasis to ecosystem services and environmental justice. The CCMUA representatives talked about many aspects of their mission, including serving the local community, proving water treatment, and keeping rates affordable. They presented on the local wastewater treatment plant site, which includes solar panels, a living shoreline, rain gardens and other improvements. CCMUA also partners with the city of Camden on workforce development to provide training to local residents in green infrastructure construction and maintenance.

Dewey Beach, DE

Bob Collins of the Delaware Center for the Inland Bays, **Larry Trout Jr**. from Straughan Environmental, and **Douglas Janiec** of Sovereign Consulting presented their recent living shoreline and stormwater management project in Dewey Beach, Delaware. The goal of the project was to retrofit a living shoreline and to design and implement a stormwater management system to manage flooding from precipitation and rising back bay water. The Read Avenue site experienced frequent flooding due to rising water in the bay and to poor management of street runoff. The flooding was being managed with ad hoc measures such as sandbags. The new design featured a dune and low marsh with plantings, a new outfall, redistributed stone, and a kayak launch. A redesign of the Read Avenue and Rte. 1 intersection farther inland included a

bioretention facility, trench drains as well as new curbs and improved pedestrian access. In addition to improved stormwater management, these new designs also greatly improved the aesthetics and recreation value of these sites, which is an important factor in a tourist destination.

Field Trip

Tuesday afternoon included a field trip that explored the coastal habitats of different sites near Cape May. In-person participants opted between visiting a series of beaches along the Delaware Bay shoreline or sites along the Atlantic coast. The remote audience was taken for a live guided tour of the Delaware Bay beaches by **Shane Godshall**, Habitat Restoration Project Manager with the American Littoral Society (ALS), which is described here.

The tour started at Reed's Beach, a breeding ground for horseshoe crabs. Shane explained that due to wave-driven erosion, the shoreline has been eroding and creating a barrier for horseshoe crabs to return to the ocean after their annual spawning migration. The Society restored a berm by adding 6,000 tons of sand and planting vegetation with volunteers near the shore to reduce the impact of wind-driven waves on the shoreline. This work has resulted in reducing shoreline erosion and a much lower (none observed) mortality of horseshoe crabs dying in the marsh behind the beach when they return to spawn.

Following the tour of Reed's beach, Shane headed south to Cook's Beach. Cook's Beach also has a high number of horseshoe crab spawning, which in turn attracts marine birds to prey on them. Due to breakwaters being constructed, which impacts the transport of sand along the shore, erosion has been increasing in this area. To combat this degradation, the Society installed woven, biodegradable, shell bags to create living shorelines that prevent erosion and stabilize the shoreline. This effort protects the habitat as well as the private property near the shoreline from damage due to erosion.

Similar restoration techniques are also yielding success at the third stop, Pierce's Point, which is also home to a high number of spawning horseshoe crab. These restoration projects are crucial to the strength of shorelines.

Coastal Restoration Toolkit

The coastal restoration toolkit, presented for the remote audience by **Elsa Carlisle Schwartz** from Restore America's Estuaries, is an online tool to aimed at helping groups undertake coastal restoration projects for the first time. The site includes regional examples of various types of projects and guidance for understanding what types of projects are best suited to what sites. The Toolkit is available at www.restoreyourcoast.org.

Wednesday, October 20, 2021

Innovation and Designing for the Future

Bret Webb works at the University of Southern Alabama and specializes in civil and coastal engineering. His presentation outlined the need to plan shoreline protection infrastructure and innovation around sea-level rise. He explained how the goal of living shoreline projects should be to manage shoreline erosion, but not solve it. He also described how living shoreline projects need to effectively manage ecosystem services wherever they are implemented. Dr. Webb explained that it is hard to predict the pattern of future sea-level rise, but sea level rise will become a major threat to shorelines, marshes, and coastal ecosystems. Sea level rise leads to bigger waves which erode the shorelines faster, degrading habitat and disrupting the ecosystem. As well as sea-level rise, an increase in storm frequency and severity also poses a threat to the strength of shorelines and coastal habitats. He emphasized the need for living shoreline projects and managing the ecosystem in order to better prepare for the future.

Larry Niles, from Wildlife Restoration Partnerships, opened his presentation by speaking about Delaware Bay and how it is one of the last remaining strongholds for horseshoe crabs. However, shoreline erosion and loss of coastal habitat is threatening the crab populations. Restoration projects are crucial for keeping the ecosystems healthy and protecting key species. He went into depth about the restoration project at Fortescue Beach. The southern part of the beach is crucial to the overall integrity of the shoreline, moreover, it is an important breeding ground for seabirds. There is often a conflict between the humans who use the beach and the birds who need the habitat to reproduce. Egg Island, which is close to the Fortescue Restoration Site, is the largest continuous area of marsh on the East Coast and it is also a very important site for seabirds and other animals. Egg Island is known to be home to endangered species, but due to wind-driven wave erosion, the island is under threat. Both Fortescue and Egg Island are battered by erosion. The first step in the restoration project was to place 40 tons of sand along the shoreline to help restore the structure and add a barrier that would lessen the impact of the waves. The other steps of the restoration project consisted of laying rock breakwaters off of the shore to lessen erosion while giving crabs and oysters a place to breed and live. The breakwaters help make the shoreline resilient while also increasing the ecological value of the region. The restoration projects near Fortescue and the Delaware Bay as a whole are essential to preserving the area and preserving the ecological value.

Danielle McCulloch from the U.S Fish and Wildlife Service started her presentation by explaining that restoration should be approached from a landscape level to examine the ecosystems and their specific functions. By approaching a restoration project this way, it is easier to determine the best technique based on the ecosystem. She explained how marsh edge habitats are very productive zones of habitat, especially to fisheries, but the loss of habitat is contributing

to a loss of species in the area. Specifically, New Jersey is experiencing sea-level rise of 4mm a year which is creating large tidal fluxes, especially in Delaware Bay. Ms. McCulloch then presented a restoration project for Delaware Bay that had the goal of protecting beaches from excess erosion while still allowing natural beach processes to occur. The projects had to make sure that they wouldn't interfere with shorebird foraging. One of the restoration sites was at Gandy's Beach, which is particularly prone to erosion, recently measured at 6.5 ft per year. A restoration project used oyster castles reduced the overall amount of erosion, but it did not fully control it. The oyster castles were resilient against the waves and cold weather, and some oysters ended up settling on the castles. The next restoration site was at Barnegat Bay, which contains more developed shorelines along with higher amounts of boat traffic. Boat wakes in Barnegat Bay contribute to a lot of erosion in the shorelines, and urban development harms marshes along the shore. In Barnegat Bay, Forked River Beach is the location of one of the restoration projects. The beach is near urban development, which has caused problems with the surrounding marshes and has negatively impacted animal populations. One of the methods that the restoration team used was creating oyster cages to help strengthen oyster populations while shielding the shoreline from erosion. The metal cages were filled with rock near the inside of the cage and then oyster shells near the outside, as the metal degrades, the structure holds and attracts oysters which form into a reef. These types of restoration projects are critical to the health of the shoreline, but successful implementation of the projects depends on an interdisciplinary team.

Colleen Keller, from the New Jersey Department of Environmental Protection (NJDEP), spoke about the permitting process for living shoreline and nature-based solutions. The NJDEP Division of Land Resources regulates development, along with nature-based solutions and living shoreline projects. Prior to Hurricane Sandy in 2012, permits for habitat restoration below the mean water line could not be issued. Once the rules were revised, living shoreline projects were allowed to be permitted only if the projects addressed erosion and restored habitat. One of the restoration projects that was allowed after the change in permitting laws was Great Flats. At this restoration site, the intercoastal waterways were dredged to gather material to create elevated structures that allow for birds to gather and reproduce. A similar tactic was used at Gull Island, a low-lying 287-acre marsh island. Dredge material was placed on 20 acres of island to raise the marsh elevation and create a habitat for birds to nest and make the island more resilience to erosion. A similar tactic was used at Sturgeon Island, a 13.5-acre island where dredge material was also placed to uplift the marsh to assist coastal birds and other species on the island. These restoration projects wouldn't have been possible without the updated permitting laws that were implemented in New Jersey to continue this crucial work.

Concurrent Sessions

Digital Tools for Visualization and Monitoring

Josh Moody, from the Partnership for the Delaware Estuary, started off this session by talking about decision-making and the need for information to guide best practices. In planning for shoreline management, planners need to use data such as wetlands inventories and engineering guidelines to guide site design. Criteria for living shorelines site evaluation include fetch and wave climate, soils, plant communities, and rate of erosion. After construction is complete, site monitoring is also very important to ensure longevity, and to help improve future designs.

Kim Mckenna, from Stockton University, spoke about the New Jersey Bay Island Initiative and how island restoration is key to ensuring the resilience of communities and natural habitats in Barnegat Bay. She talked about the New Jersey Bay Islands Restoration Planner (NJBIRP) and the baseline data collection to determine wetland conditions. From 1977-2015, 6.7 % of island land has been lost, moreover, from 1931-1977 over 13 islands have been fully submerged. In 2020, 54 islands were visited to examine shoreline change and erosion. The NJBIRP was used to identify five islands in need of restoration to prevent future submersion. This tool is crucial to the future protection of bay islands and regional coastal resiliency.

Bill Shadel from The Nature Conservancy also spoke about the NJBIRP and how it works to protect and conserve bay islands. He explained how the NJBIRP interface was a graphic way of viewing data sets from multiple bay islands. Having visual data that can be compared helps create future restoration projects and allows for high-risk islands to be identified.

Oyster Shell Recycling Session

Kellyn LaCour Conant, from the Coalition to Restore Coastal Louisiana, spoke about their ongoing oyster shell program. They rely on volunteers and on donations and fees to fund the project, which provides shells for living shoreline projects. Kellyn described several example projects where protective reefs were built using reclaimed shells, which have protected marshes and trees from recent hurricanes. They plan to expand to a new curing site, new restoration sites, and recruit more restaurant partners.

Charlotte Boesch, of the Billion Oyster Project (BOP), spoke about her project in the New York City area. BOP works with nearly 50 restaurants and takes in over 5,000 lbs of shells each week. Education is also a key component of this project. The pandemic has severely impacted the project and their restaurant partners, but they plan to continue the shell collection efforts as the situation improves.

Sarah Boubolis, of the Partnership for the Delaware Estuary, discussed their oyster shell recycling program, which has been going since 2016 and collected over 140 tons of shells in that time. Her project takes shells from eight restaurants in New Castle, DE. Like the other projects, they rely on volunteer labor and partnerships with local institutions for their success.

Wetlands Tool Session

Benjamin Strauss, Dan Rizza and **Kelly Van Baalen**, all of Climate Central, introduced a new digital tool they are developing to map how wetlands in the US will be impacted by sea level rise. The speakers gave a demonstration of the online interface and how users can adjust various settings and produce graphics at different scales. The tool is in the final developmental stages, and they anticipate a full release in early 2022.

Review and Q&A

The first afternoon session was an open and wide-ranging discussion with panelists **Al Modjeski** of American Littoral Society, **Martha Maxwell-Doyle** of the Barneget Bay Partnership, and **Jon Miller** of the Stevens Institute of Technology. The panel took questions from remote and in-person audiences over a diverse range of topics and perspectives.

The Future of Nature-based Shoreline Stabilization

Dennis Blazak is a retired U.S Navy veteran with a degree in chemical engineering. He talked about military bases adapting to climate change and sea-level rise. He explained how multiple military bases have been damaged due to coastal storms and flooding, specifically at Homestead and Tyndall Air Force Bases. While bases on the east coast are more prone to storms and other climate change-driven events, bases on the west coast are being affected by major droughts and wildfire threats. The military is willing to adapt to climate change, but the community near the bases also needs to adapt to see a major improvement. He spoke about two programs, the Readiness and Environmental Protection Integration (REPI) program and the Office of Local Defense Community Cooperation (OLD CC). The main one is REPI, with 757,297 acres protected while increasing military installation resilience. Continuing with the theme of base resilience, he talked about Naval Weapon Station Earle. It supplies the Atlantic fleet with ammunition but has had issues with storm surge flooding and general flooding around the base. Because of the threat of flooding to these bases, REPI proposed a solution of protecting over 1.7 million acres of land, which in turn protects five military bases and over 1.6 million people. They started to implement oyster reefs and living shoreline projects, which helped to curb erosion and overall shoreline structure near the base and pier. After summarizing the actions taken by the REPI program, Mr. Blazak ended by reminding the audience that resilience actions this decade will set the pattern for the rest of the century.

Danielle Kreeger, from the Partnership of the Delaware Estuary, gave a presentation on the future of nature-based shoreline protection. She prefaced her presentation by explaining that there is a huge need for green infrastructure and that economic factors will drive the change. Most coastal wetland trends are pointing towards lots of erosion and marshes are not keeping up with the pace of sea-level rise. However, some solutions like thin layer sediment applications are helping marshes maintain elevation. Marshes need this elevation because 90% of the losses are

driven at the marsh edge. Mussel populations are also dwindling because of shoreline erosion. Mussels are critical to maintaining water quality, as they filter 5 million liters of water each day and they help to remove 476 kg of particulate nitrogen per hectare per year. If the shoreline continues to erode and habitat is lost, the amounts of pollutants in the water will increase. Coastal wetlands also protect against flooding, and if the ecosystem continues to decline costs will increase. There is an increasing need to sustain critical ecosystem services, but we need to use science to monitor shared outcomes and pursue nature-based solutions.

Bart Wilson is from the U.S Fish and Wildlife Service. He explored the topic of shoreline stabilization and what we are trying to protect. The goal of these projects should be to bring order to the dynamic shoreline interface. The project design should be oriented towards protecting the edge of shorelines and marshes while including ecological objectives. He explained how many coastal systems are in disequilibrium and that sea-level rise is changing coastal dynamics. Older techniques such as breakwaters refract wave energy to different parts of the coast contributing to more erosion. They also are not dynamic, meaning they cannot adapt to different environmental conditions. Rock structures are also vectors for invasive species, such as the Asian shore crab, which out-competes native species along the coast. Sediment placement is also a feasible option, but failure to match the natural grain size causes beach erosion 2-3 times faster than if it was replaced with more closely matched beach sediment. He spoke about Point Mahon, Delaware, a location that has one of the highest rates of erosion in Delaware Bay. This erosion is harming horseshoe crab populations and degrading the ecosystem. He closed by explaining that we need to move away from species-specific restoration and switch to ecosystem-based restoration.

Agenda

Tuesday, October 19			
Time	Room	Session	Speaker
8:00 am	**Registration open (Early Registration from 5-7:00 PM on Monday, October 18)**		
9:00 am	Penthouse Ballroom	Welcome Remarks	Daniel Hayden, Restore America's Estuaries; Tim Dillingham, American Littoral Society; Ed Mahaney, former mayor of Cape May; Sen. Cory Booker;
9:30 am	Penthouse Ballroom	Opening Plenary	Dr. Joe Smith, US Fish and Wildlife Service

10:00 am	Coffee Break		
10:30 am	Penthouse Ballroom	Morning Session: Hybrid Designs, Urban Settings and Retrofits: Working with Communities to Balance Habitat and Infrastructure Needs	**Camden:** Frank McLaughlin, NJ Dept of Environmental Protection; Simeon Hanh, National Oceanic and Atmospheric Administration; Scott Schreiber, Camden County Municipal Utilities Authority **Dewey Beach:** Doug Janiec, Sovereign Consulting; Larry Trout, Straughan Environmental; Bob Collins, Delaware Center for the Inland Bays
12:00 pm	Penthouse Ballroom	Instructions for field trips	Julie Schumacher, American Littoral Society
12:30 pm	Lobby	Load buses and depart for field trips	
1:00 - 5:00 pm	Lobby	**Field Trip 1: Cape May County Beach and Reef Restorations** Stop 1 - Reed's Beach Stop 2 – Cook's Beach Stop 3 – Pierce's Point **Field Trip 2: Atlantic Coast and Wetlands Restoration** Stop 1 - Maritime Forest & Dunes in Avalon Stop 2 - Aquaculture Innovation Center at Rutgers University Stop 3 - Cape May Wetlands State Natural Area	

Wednesday, October 20			
8:55 am	Penthouse Ballroom	Opening Remarks	Representative Frank Pallone
9:00 am	Penthouse Ballroom	Morning Session: Innovation and Designing for the Future	Bret Webb, University of South Alabama; Larry Niles, Wildlife Restoration Partnerships; Danielle McCulloch, US Fish and Wildlife Service; Colleen Keller, NJ Dept of Environmental Protection
10:30 am	Coffee Break		
11:00 am	**Breakout Sessions**		
	Penthouse Ballroom	Digital tools for visualization and modeling	Kim McKenna, Stockton University; Bill Schadel, The Nature Conservancy; Josh Moody, Partnership for the Delaware Estuary
	Crystal Room	Oyster shell recycling	Kellyn LaCour-Conant, Coalition to Restore Coastal Louisiana; Charlotte Boesch, Billion Oyster Project; Sarah Bouboulis, Partnership for the Delaware Estuary
	Online Only	Wetlands modeling tool	Ben Strauss, Climate Central Dan Rizza, Climate Central Kelly Van Baalan, Climate Central
12:00 pm	Main Ballroom	Lunch	
1:15 pm	Penthouse Ballroom	Review session, Q&A	Martha Maxwell-Doyle, Barnegat Bay Partnership; Jon Miller, Stevens Institute of Technology; Capt. Al Modjeski, American Littoral Society;

2:15 pm	Break		
2:45 pm	Penthouse Ballroom	Closing Plenary: The Future of Nature-based Shoreline Stabilization	Dennis Blazak, US Navy Danielle Kreeger, Partnership for the Delaware Estuary Bart Wilson, U.S. Fish and Wildlife Service
4:40 pm	Penthouse Ballroom	Closing remarks	Tim Dillingham, American Littoral Society Daniel Hayden, Restore America's Estuaries

Steering Committee

The organizers would like to thank the Steering Committee for their generous contributions of time and expertise in developing this Workshop.

Matt Chasse - National Oceanic and Atmospheric Administration

Vanessa Dornisch - Cousteau National Estuarine Research Reserve

Robert Fiorile – Matrix New World Engineering

Doug Janiec – Sovereign Consulting

Martha Maxwell-Doyle - Barnegat Bay Partnership

Jon Miller - Stevens Institute of Technology, New Jersey Sea Grant

Al Modjeski - American Littoral Society

Josh Moody – Partnership for the Delaware Estuary

David Sutherland - US Fish and Wildlife Service

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