NEW JERSEY COASTAL RESILIENCE COLLABORATIVE 2025 COASTAL ECOLOGICAL RESTORATION TECHNICAL WORKSHOP

Rutgers Eco-Complex, Bordentown NJ
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ABSTRACTS

Integrating Oyster Recruitment Dynamics with Alternative Materials for Shellfish-Based Living Shorelines in Delaware Bay

Presented by Jessica Klinkam, Coordinator of Restoration Science, Partnership for the Delaware Estuary
Co-Authors: Leah Morgan, LeeAnn Haaf, PhD, Jenny Shinn, Toni Rose Tablante, Shane Godshall, and Maya Lopez

Shellfish recruitment is vital to estuarine ecosystem function and the long-term success of shellfish-based living shoreline restoration. Consistent recruitment of the eastern oyster (Crassostrea virginica) is especially important, yet outcomes vary widely due to environmental and site-specific factors. This study evaluated wild oyster recruitment to plastic shell bags deployed at two tidal elevations across five sites along a salinity gradient in Delaware Bay.

Site selection for shellfish-based living shorelines often prioritizes high-salinity zones and assumes subtidal placement yields better recruitment. However, our findings suggest these assumptions may oversimplify oyster recruitment dynamics. We observed recruitment across all salinity zones, with similar outcomes between intertidal and subtidal placements, indicating broader habitat suitability than typically considered. Notably, spat survival was highest at the lowest salinity site, while the highest salinity site showed the largest recruitment size class and signs of initial settlement followed by greater post-settlement loss, evidenced by prevalent spat scars, suggesting trade-offs between growth opportunity and early mortality pressure. These patterns suggest that local factors such as productivity, hydrodynamics, predation, and substrate availability may influence recruitment more than salinity or tidal elevation alone. Our findings support a more flexible, site-specific approach to living shoreline planning that moves beyond generalized thresholds.

In parallel, the project included a two-year evaluation of biodegradable shell bag materials in laboratory and field experiments. Two tested materials, a co-polyester and a biopolymer, demonstrated sufficient durability to warrant consideration for use in mid-Atlantic projects. Together, these efforts support plastic-free shorelines that enhance shellfish populations and promote resilience.

Restoration Revealed: eDNA and Water Quality as Indicators of Coastal Ecological Health
Presented by Emma Owendoff Najarian
Research Assistant , Monmouth University and Lehigh University
Co-Author: Dr. Jason Adolf

Environmental DNA (eDNA) metabarcoding is an emerging tool for assessing and monitoring aquatic biodiversity and ecological health in a non-invasive, potentially cost-effective way. This study utilizes eDNA metabarcoding and water quality monitoring to evaluate biological impacts of coastal restoration efforts within the Hudson River estuary.

Water samples were collected from 22 sites from the Atlantic Highlands Marina in New Jersey and the Hudson River, including two inter-pier sites. Oyster castles and salt marshes were implemented to support biodiversity and habitat rehabilitation in the Gansevoort Peninsula in Manhattan. Unrestored control sites included sites throughout the Hudson River and Pier 25.

Each site was assessed for water quality parameters (e.g., temperature, dissolved oxygen, salinity, turbidity, pH, and chlorophyll) to contextualize eDNA results. DNA was extracted from samples of roughly 1 L of water per site and was sequenced for fish biodiversity analysis. Preliminary observations suggest differences in water quality and fish assemblage between restored and unrestored areas, consistent with the presence of restoration efforts at Gansevoort.

This project highlights the value of eDNA as a scalable and minimally invasive method for monitoring restoration outcomes and tracking shifts in aquatic community composition. It offers insight into the potential for molecular tools to complement traditional ecological monitoring and improve data-driven restoration strategies in urban coastal environments.

Field-based evaluation of glass cullet as a supplementary sediment source for coastal restoration
Presented by Charles Schutte, Associate Professor, Rowan University
Co-Author: Lily Pfeifer, Rowan University

There is an ever-increasing demand for sand to support coastal restoration projects, but dredging and mining sand causes environmental damage. Using crushed and ground glass (cullet) to support coastal restoration projects could simultaneously divert waste from landfills and decrease the need to mine or dredge sand. Here we present results from a field-based experiment to test the function of cullet as a plant growth medium. American beachgrass, a plant commonly used in dune restoration, did not survive a growing season when planted in 100% cullet, but did survive in 100% sand and a 90%/10% sand/cullet mix.

Introduction to Diatoms as Ecological Indicators in Living Shoreline Applications
Presented by Erin O'Brien, Environmental Technician, NJDEP Division of Science & Research
Co-Authors: Mihaela Enache, and Joshua Moody

Living shorelines" describes a suite of restoration techniques that aim to stem erosion while providing ecological benefits, and monitoring is foundational to understanding their development and effectiveness. A key aspect of living shorelines is their biological community, which will be sensitive to a variety of site-specific physiochemical conditions, including inundation. Inundation can be difficult to calculate from elevation measurements alone due to distance from established gauges and inaccurate datums, and logger deployments can be expensive and require long durations. Diatoms are microscopic algae that can provide many advantages for ecological monitoring due to their sensitivity to environmental changes in aquatic systems. The purpose of this project was to determine if diatoms can be used as an indicator of changes in tidal inundation after living shoreline project implementation.

To investigate, a soil core was taken from a living shoreline in Money Island, NJ, installed in 2016 using coir bio-logs, shell bags, and oyster castles and monitored annually for a variety of metrics including elevation via RTK-GPS. Elevation data were used to sub-section the core for analysis at five time periods from pre-installation through 2024. Diatom relative abundance and community composition were evaluated in each section using microscopy. Preliminary results show a shift in diatom species composition and diversity during and after installation. This shift in diatom communities reveals that important changes occurred in habitat characteristics, including inundation after installation. Results will be used to evaluate how diatom species can be utilized in assessment of living shoreline development.

How to Build a Digital Communications Toolkit for Climate Action
Presented by Dana Patterson Grear, Director of Marketing & Communications, Princeton Hydro

When driving action on coastal resilience and climate change, one of the most effective ways to reach your community is to prepare a digital communications toolkit to share with stakeholders and supporters. In this session, attendees will learn about what types of information is included in a digital toolkit (press release, social media shares, etc.), when to strategically share the information, and how to leverage project partners and external stakeholders. There will be recommendations on easy-to-access, free or low-cost graphic design and content management tools. Utilizing this technique can keep outreach materials organized, maximize media engagement, and create buzz about your topic across a variety of social media networks.

Building Better Habitat on Delaware Bay
Presented by Shane Godshall, Habitat Restoration Project Manager, American Littoral Society
Co-Authors: Alek Modjeski, Kerstin Axt, Steve Hafner, Larry Niles, Stephanie Feigin

For over a decade, the American Littoral Society has been restoring and protecting critical habitats along the Delaware Bay. These efforts have combined on-the-ground restoration with robust scientific monitoring to understand how shorelines, beaches, and associated ecosystems respond over time. By tracking both physical changes, such as shoreline stability, and biological indicators, such as species diversity and abundance, we have been able to adapt and refine our approaches for greater long-term success.

This presentation will provide an overview of the monitoring methods we use, ranging from shoreline changes and wave energy assessments to biological sampling of key species such as the Atlantic horseshoe crab (Limulus polyphemus) and rufa red knot (Calidris canutus). We will share findings from this work, highlighting how specific insights have influenced the design and implementation of subsequent projects. A recent example is the Fortescue beach restoration project, which integrates lessons learned from previous sites. This project incorporates breakwaters specifically engineered to withstand and mitigate the effects of high-energy coastal environments, protecting restored habitats while supporting the ecological needs of the region's wildlife. By combining rigorous science with practical restoration techniques, the American Littoral Society continues to advance strategies that build resilience for both natural habitats and the communities that depend on them.

NJ Restoration Tools Organization Suite (NJResTOrS)
Presented by Rick Lathrop, Director, Rutgers University Center for Remote Sensing & Spatial Analysis
Co-Authors: Michelle Stuart and Jim Trimble

A diverse coalition of state agency, non-governmental organization and academic partners has been collaborating on the development of a Coastal Ecological Restoration and Adaptation Plan (CERAP) for New Jersey's coastal marshes, estuaries and back-bays. To support this effort, this same coalition has been building the NJ Restoration Tool Organization Suite (NJResTOrS) to provide a more seamless integration of web-based decision support tools so that users can work directly from project scoping through evaluation. The NJResTOrS work flow (njrestors.rutgers.edu) proceeds from the statewide perspective of the CERAP tool to a landscape scale evaluation of the marsh landscape with the Marsh Explorer and Living Shorelines Explorer tools to more detailed site level assessment and guidance provided by the Wetlands Assessment Tool for Condition & Health (WATCH) and the Living Shoreline Feasibility Model (LSFM). The talk will highlight the newest tool, the Marsh Futures Mapper, which allows the user to explore potential coastal marsh futures based on different scenarios of sea level rise, vertical accretion and thin layer placement (TLP) of sediment. NJResTOrS is one component of a larger strategy to equip coastal municipal planners and non-profit partners with the resources to plan, coordinate and implement coastal restoration projects that support community resilience, ecosystem health and carbon sequestration.

Status of the Development of a Multidimensional Coastal Wetland Migration and Maintenance Data Layer for NJ ResTOrS

Presented by Kimberly McKenna, Interim Executive Director, Coastal Research Center, Stockton University
Co-Authors: Dr. Joshua Moody, Division of Science & Research, NJDEP; Dr. Richard Lathrop, Center for Remote Sensing and Spatial Analysis, Rutgers University; Dr. Thomas Herrington, Urban Coast Institute, Monmouth University

The New Jersey Restoration Tool & Organization Suite (NJ ResTOrS) is a group of web tools developed to provide New Jersey coastal restoration practitioners with the resources to plan, coordinate and implement coastal restoration projects that support community resilience, ecosystem health and carbon sequestration. Many of these tools can be used in tandem to guide users through the various stages between project siting and implementation. One component that is largely missing from this sequence is accounting for the ability of a coastal wetland to provide any level of self-maintenance, either pre or post restoration, horizontally or vertically. The level of self-maintenance is informative not only for restoration tactic selection, but for understanding the degree at which a tactic needs to be applied to leverage desired results.

Currently Stockton, Rutgers, & Monmouth Universities and NJ DEP are developing a new data layer to be included in NJ ResTOrS that will bundle existing horizontal (i.e., transgression or progradation) and vertical (i.e. elevation & vegetation presence and sediment trapping capacity) datasets, and integrate them into a composited, easily accessible, geospatial layer. This layer will not only provide insight into multidimensional aspects of site-specific vulnerability, wetland health trajectories, and restoration project needs, but will also inform spatial variability regarding site-specific potential to adapt to climate change. To date, the project team has compiled and evaluated datasets and is developing the inputs that are needed for horizontal forcing (ex. marsh unit parcels, shoreline change, marsh migration) and sustaining vertical capacity (ex. marsh elevation, tidal range, unvegetated to vegetated ratio, elevation change rates from SETs). This talk will present the project timeline, discussion and status of the composited data layers, and next steps.

Introducing the NJ Tidal Wetland Monitoring Network SET Database & Mapping Platform
Presented by Joshua Moody, Research Scientist, NJDEP Division of Science & Research
Co-Authors: Kirk Raper, Ceili Pestalozzi, LeeAnn Haaf, Joe Grzyb, and Metthea Yepsen

The New Jersey Tidal Wetland Monitoring Network (NJTWMN) is a multi-sector collaborative, formalized in 2019 to consistently monitor tidal wetlands across the state to track and assess wetland health and long-term trajectories. NJTWMN partners support this mission by following standardized monitoring protocols, sharing data, identifying research needs across the region, and engaging the public about the importance of tidal wetlands in New Jersey. It was always a priority to make these data publicly available to inform decision-making regarding coastal wetland protection, enhancement, & restoration, to improve coastal community and ecosystem resilience. In this talk, we will introduce a new public-facing website and mapping platform that synthesizes many of the data collected to date and presents it on an accessible ArcGIS Hub platform.

The primary objective of the NJTWMN has been to determine how tidal marsh elevation dynamics are changing relative to local sea level rise. To accomplish this, partners monitor wetland elevation, accretion, and vegetation at >230 Surface Elevation Tables (SETs) in NJ. Elevation changes are evaluated with accretion rates to determine if enough sediment is being captured to allow the marsh to keep pace with increasing sea-level. This mapping platform allows users to explore and download these data. Preliminary analyses indicate that of the 196 analyzed SETs, 46% have elevation change rates below the rate of long-term SLR, and 59% were below recent 19-year SLR rates. Future efforts include developing new schema for additional data types collected by the network, and to identify other data to prioritize for collection.

The Science and Funding for Blue Carbon Projects in NJ
Presented by Metthea Yepsen, Bureau Chief | Bureau of Environmental Assessment, NJDEP
Co-Author: Anthony Bevaqua

The New Jersey Department of Environmental Protection recently announced the availability of $30 million in Natural Climate Solutions grants to create, restore, and enhance New Jersey's coastal wetlands, forests, and urban tree canopies. Each project will support carbon sequestration, the process of capturing carbon dioxide from the air by plants through photosynthesis and storage of that carbon in woody biomass and plant-derived soil organic carbon. While this is a naturally occurring process on land and in aquatic habitats, there are human actions that can help maintain and enhance carbon sequestration capacity to help further mitigate the effects of climate change. Protecting coastal ecosystems is particularly important since tidal marshes and seagrass meadows sequester more carbon per unit area than terrestrial forests. This talk will introduce the grant program, cover what makes a good blue carbon project, highlight a few blue carbon projects awarded in round one of funding, and cover how we are monitoring the projects to better account for carbon sequestration in blue carbon projects.

POSTER ABSTRACTS

A Viable Low Carbon Footprint Alternative for Eastern Oyster (Crassostrea virginica) Reef Substrates

Noemie Denis, Rutgers University

Approximately 85% of oyster reefs are now functionally extinct, posing a major threat to coastal ecosystems. Juvenile oysters, or spat, preferentially settle and grow on the shells of mature oysters. However, the availability of oyster shells has significantly declined, and current shell recycling programs, which aim to return consumed oyster shells back to the water, are insufficient to support large-scale reef restoration efforts.

To address this shortage, artificial reef structures such as Oyster Castles® and Reef Balls®, typically composed of concrete, lime, and shell, have been deployed to promote oyster habitat restoration. While these materials can successfully promote oyster settlement and growth, the production of concrete accounts for 8% of global CO_2 emissions, raising sustainability concerns.

This study investigates a low carbon footprint material as an alternative for oyster habitat restoration. Oyster settlement and oyster shell attachment strength of oyster larvae were evaluated across several substrate types, including a low carbon footprint material with and without oyster shell, Oyster Castle®, and natural oyster shell. In a series of experiments, larval settlement and growth were observed over a period of 2 months.

Results indicate that oyster larvae show a preference for a low carbon footprint material in initial settlement. Two months post-settlement, differences in oyster densities across all tested materials were statistically insignificant – the low carbon footprint material performed as well as oyster shell. Surface adhesion was found to be weaker on the low carbon footprint material. These findings suggest that the low carbon footprint material offers a promising viable alternative for oyster reef restoration, balancing ecological function with environmental sustainability.

Assessing the performance of a dune enhancement project at the coast of Cedar Street Park, Keyport, NJ

Juhi Rawal, Undergraduate Student and Jun Cheng (Assistant Professor), Kean University

Beaches, dunes, and coastal upland forests serve as critical natural defenses against storms and flooding. Nature-based solutions, such as living shorelines that integrate these three elements, provide sustainable and long-term coastal protection. The severe damage Keyport experienced during Superstorm Sandy 2012 highlighted the urgent need to enhance coastal resilience through such measures. Beyond reducing risk, living shorelines provide valuable ecosystem services, improve biodiversity and create educational and recreational opportunities for local residents. In this study, the coastline of Keyport will be assessed for feasibility for living shoreline project.

Based on bi-monthly surveys to monitor beach and dune dynamics since summer 2023, we divided the coastline of Keyport into three distinct sections (Section I, II, and III). Sections I and III show clear signs of erosion: Section I is marked by fallen trees and narrow beaches, while Section III features eroded bluff edges. In contrast, Section II, where the coastline fronting Cedar Street Park is located, shows an accretionary shoreline, meaning sediment is actively building up. The cross-shore profile of the coast of Cedar Street Park transitions from coastal upland forests down through dunes to the beaches. Overall, the Cedar Street Park at Section II's accretionary shoreline and dune-forest system make it an ideal test site: it has natural sediment supply and vegetative cover (dune grass and upland forest) that can be enhanced. The long-term monitoring of beach and shoreline provide insights for implementing the living shoreline project conducted at the site.

Building a case for resilience within salt marsh restoration: Lessons Learned from Long Beach Township and Resilient LBI

Anna Hochhalter, Senior Landscape Architect , Ramboll
Co-Author: Angela Andersen

With ever-pressing climate change-related risks and stressors, framing the value of salt marsh restoration projects from a coastal resilience perspective can open more opportunities for funding and partnerships. In this presentation, we will make the case for resilience as a key benefit of coastal restoration using the Long Beach Township salt marsh and hybrid resilience living shorelines project as a case study to provide lessons learned and share unique perspectives from the design consultant and municipal project owner. Long Beach Township has been a leader in coastal restoration for many years and was recently awarded a National Fish and Wildlife Foundation grant to design back bay salt marsh restoration with hybrid living shorelines for resilience. This project evolved out of the Resilient LBI program, a multi-year community-based process overseen by New Jersey Department of Environmental Protection, to improve resilience on Long Beach Island.

We will discuss the planning for salt marsh restoration that also addresses flood risk and community well-being and safety challenges as well. The tidal salt marsh and hybrid living shoreline will provide wave attenuation, reduce high-tide flooding for critical municipal facilities and an emergency evacuation route, while improving public waterfront access and habitat uplift. The project leveraged resilience planning through the NJDEP Resilient NJ program including flood modeling and connecting to a multi-faceted Resilience Action Plan which included project conceptual development for nature-based solutions including this project. The project builds on long-standing community and academic partnerships with the Township on coastal restoration in the bay.

Recovery of salt marsh soil nitrogen cycling and carbon burial processes following thin layer placement of dredged material

Charles Schutte, Associate Professor, Rowan University
Co-Authors: Amber Hatter, Rowan University undergraduate student; Metthea Yepsen, NJDEP; Marshal Bowles, LUMCON; Gary Taghon, Rutgers University; Veronica Lucchese, NJDEP

Salt marshes provide many ecosystem services, including nitrogen removal and carbon sequestration. Many salt marshes are slowly drowning as they lose elevation to ongoing sea-level rise. Thin layer placement (TLP) is a restoration practice that makes beneficial use of dredged sediment to artificially increase salt marsh elevation relative to sea level to prevent marsh loss. TLP is also a substantial disturbance of the salt marsh ecosystem that likely impacts its ability to provide ecosystem services. We set out to determine how soil carbon sequestration and nitrogen cycling process rates responded to and recovered from thin layer placement in 3 salt marshes on the Northeastern coast of the United States. Six years following sediment placement, vegetated placement sites had similar live aboveground biomass as nearby control sites, while total belowground biomass was significantly lower at placement sites than it was at control sites. Similarly, the median potential denitrification rate from control sites of 2796 nmol N gdw-1 d-1 was significantly higher than the median rates of 35.5 nmol N gdw-1 d-1 and 142 nmol N gdw-1 d-1 from unvegetated and vegetated placement, respectively. At placement sites, the median soil organic carbon accumulation rate in vegetated plots was 354.4 g C m-2 yr-1 compared with -54.5 g C m-2 yr-1 in unvegetated plots. We conclude that the recovery of soil-based ecosystem services following dredged material placement is tightly coupled with the recovery of salt marsh vegetation, but note that some processes take longer to recover than others.

Scoping nature-based solutions for coastal protection - a tale of two cities

Vamsi Krishna Sridharan, Innovative Solutions Lead, Tetra Tech
Co-Authors: Ryan Hostak, Erin Hague, Jonas Oliviera, and Eric Nardi

We present a novel strategic seven-step workflow of selecting and siting nature-based solutions for coastal protection at a regional scale. In this seven-step workflow, a diorama of a nature-based shoreline protection concepts is built using specific solution elements such as oyster reefs, mangrove planters, and biomimicking seawalls. Two implementations of this strategic workflow will be demonstrated from coastal cities along the United States' eastern seaboard, Crisfield, Maryland, and Miami-Dade County, Florida. Our workflow can be used to rapidly assess different types of shorelines for suitability of specific grey-green infrastructure solutions and provides a cost-effective evaluation of highly detailed solutions during the scoping phase itself, thereby reducing the time consumption and number of iterations during design charettes and translation of designs to permit-readiness. The two case studies also highlight different facets of the coastal defense scoping process. The Crisfield experience demonstrates how to set up scoping-phase solutions for permit-ready design-focused modeling studies. The Miami-Dade experience demonstrates how to conduct stakeholder engagement to ensure that nature-based solutions such as living shorelines are implemented in a manner that can smoothen the permitting process. Lessons learned from these applications could be applied elsewhere for different ecosystems.