

# 10<sup>th</sup> Delaware WETLANDS Conference



DELAWARE DEPARTMENT OF  
NATURAL RESOURCES AND  
ENVIRONMENTAL CONTROL

February 6 and 7, 2024  
Wilmington, Delaware



# We Welcome You

Welcome to the 2024 Delaware Wetlands Conference! This time, more than ever, we are excited and grateful to be hosting this event. So much has happened since we last gathered in January 2020. This conference is special for several reasons and we are so glad you could join us. After the challenges we have all faced in the last four years, it is so heartening to be able to continue the tradition of hosting this audience in the name of wetlands. It is wonderful to gather again with our colleagues from around the mid-Atlantic region and beyond.

This event marks the 10th anniversary of the Delaware Wetlands Conference! Starting back in 2001 at Cape Henlopen State Park, today we carry on the tradition of gathering local professionals and students to share, network and learn. Many things have changed over the years but the focus is still to increase awareness, facilitate collaboration, and advance the state of knowledge around wetlands. The outcome remains a strengthened community of wetland science, management and conservation.

This year we added some fun and special touches to help mark our milestone event that hope you will enjoy. The agenda is packed with over four dozen presentations, and another three dozen poster contributions further the sharing, plus ample professional exhibitors to network with. We encourage you to drop by a lunch meeting or sign up for a field trip to a local wetland restoration site. You can also stay after hours on Day 1 to eat, drink and mingle.

On February 2 we celebrated World Wetlands Day. This week we carry that energy forward. Through your participation at this conference, you are supporting the effort to care for, nurture and support wetlands for all that they do for us. Each of you make this conference what it is by presenting, attending, sponsoring, exhibiting, or volunteering. Sometimes more than one of those at once. Thank you for your part in making the 2024 Delaware Wetlands Conference a success. We could not be more excited to celebrate and experience it right along with you.

Enjoy!

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## The Conference Committee

### DNREC Wetland Monitoring and Assessment Program

Alison Rogerson

Kenny Smith

Alison Stouffer

Olivia Allread

### DNREC Division of Watershed Stewardship

Mark Biddle

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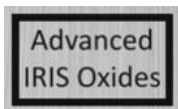
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# Things to Know

## Networking Opportunities

### Collaborative Group Meetings

Attendees are welcome to finish their lunch or dessert while attending. All are invited to join.

### American Shore and Beach Preservation Association, Mid-Atlantic Chapter Meeting (ASBPA MAC)

Tuesday, February 6 at 12:30p.m. – Christina Ballroom  
ASBPA MAC's mission is, "Working regionally for healthy, sustainable, and resilient coastal and shoreline systems." Discover what the chapter in our region has been up to and find out how you can get involved with shores and beaches, community protection, strong economy, and ecological health and recreation.

### Society of Wetland Scientists, Mid-Atlantic Chapter Meeting (SWS MAC)

Wednesday, February 7 at 12:30p.m. – Christina Ballroom  
SWS MAC objectives include encouraging communication of wetlands issues and research activities in the Mid-Atlantic region (New York, New Jersey, Pennsylvania, Delaware, Maryland and the District of Columbia). Also, to connect with students and recent graduates, provide mentorship and networking opportunities, and strengthen the MAC footprint.

### Lunch and Poster Sessions

Each day, time has been set aside for you to enjoy your lunch in the Riverfront Ballroom, and network. Posters in the lobby and exhibits in the Governors' Hall will be staffed following lunch. This is also where dessert and afternoon treats will be available.

### Eat, Drink, and Connect

Join us in Governors' Hall of the Chase Center on the Riverfront from 4:15–6:00p.m. on Tuesday. Enjoy complimentary light hors d'oeuvres and drinks for purchase while catching up with old and new friends alike.

### Student Poster Competition

The student poster competition returns for 2024! Posters participating in the competition are marked with a star. Judging takes place on Tuesday, with awards announced on Wednesday during the opening remarks in the Riverfront Ballroom. If you're interested in judging on Tuesday, please stop by the registration desk.

### Professional Credits

This event has been preapproved for 5 continuing education credits under the Society for Ecological Restoration's Certified Ecological Restoration Practitioner program (SER CERP). Credits provided assume you attend both days. For more information, ask staff at the registration desk.

## Field Trips

### Restoration Planting: Approaches and Outcomes

Russell Peterson Wildlife Refuge and DuPont Environmental Education Center

Day 1—1:30–3:00p.m.

Day 2—10:00–11:30a.m., 1:30–3:00p.m.

Join Bob Meadows to explore a wetland restoration site. Over 5,000 native trees have been planted on the Peterson Refuge with many lessons learned. With the completion of all restoration work scheduled for next year, a final effort has been initiated to build 1 mile of hiking trail and 2 miles of interconnecting water trail including a dock on the Christina River. During the tour we will look at various restoration strategies and discuss their success.

**Pre-registration required.** To sign-up or make inquiries, visit the registration desk. A minimum attendance is required. Please note, this field trip is weather dependent and entails moderate amount of path/trail walking. Feel free to bring a snack and water. Transportation will be provided to and from the site. Meet at the registration desk prior to departure.

## ENVIRONMENTAL RESTORATION AND RESILIENCE SOLUTIONS

- // Fish Passage and Dam Removal
- // Wetland and Stream Restoration
- // Living Shoreline and Coastal Resilience
- // Watershed Management
- // Permitting
- // Funding and Grants
- // Construction Management and Monitoring



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# Plenary Speaker Bios

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**Mike Trumbauer, CERP, Biohabitats, Inc.**

**Bio:** Mike serves as the Chesapeake/Delaware Bays Bioregion Team Leader for Biohabitats and is a Certified Ecological Restoration Practitioner. Inspired by a

childhood spent stomping around the wetlands and marshes of the Delmarva Peninsula, Mike has built a career dedicated to understanding, restoring, and protecting delicate ecosystems. Now an accomplished restoration ecologist with over 20 years of professional experience in natural resources assessments, environmental permitting, and ecological restoration design and implementation, Mike leads multidisciplinary teams in deepening an understanding of degraded ecological systems and crafting nature-based solutions to reset ecological trajectories toward thriving ecosystems.

## Plenary Presentation

### *Building Foundations for Thriving Ecosystems*

Our landscapes have been accruing ecological debts since colonial times—filling wetlands, overharvesting, building dams, etc. The cumulative impacts of these debts have led to widescale loss of habitat, biodiversity, and ecological function at the landscape level. Additionally, emerging climate threats and shifting baselines add a layer of complexity and uncertainty to management strategies for ecological resources. As resource managers, regulators, and practitioners we understand the scope of this damage and have the science and tools to assist the recovery process. Biohabitats will share perspectives gained from 40 years as an ecological restoration practitioner challenging the status quo and integrating the disciplines of landscape architecture, restoration ecology, and engineering with sound science engineering to build the foundations for ecological recovery. Through our experience, we will share novel approaches to engineering with nature and nature-based design that help build resiliency for all forms of life back into the landscape.



**Josh Murphy, National Oceanic and Atmospheric Administration (NOAA)**

**Bio:** Josh Murphy is a senior coastal information specialist with NOAA's Office for Coastal Management in Silver Spring, Maryland. As a subject matter expert in geographic information systems (GIS) tools and methods, Josh

brings 20 years of experience in the areas of data and tool development, spatial analysis, and technical assistance to coastal communities. Since 2008, he has played a key role in the development of NOAA's Digital Coast platform, first serving as project manager, then as a partnership liaison with the American Planning Association and Urban Land Institute. Josh's current work focuses on helping coastal communities use and apply geospatial information to adapt to a changing climate, and enhance their community resilience. As an educator, Josh has extensive experience in the areas of curriculum development and instruction. He holds an adjunct faculty position within the Urban and Regional Planning Program at Georgetown University where he teaches classes focused on the integration of GIS data and tools with urban planning concepts.

## Plenary Presentation

### *NOAA's Digital Coast: Actionable Information to Support Resilient Coastal Communities*

Coastal communities rely on timely, accurate information to help them understand their current and future coastal hazard risks and take actions to respond. The Digital Coast was developed to provide a comprehensive end-to-end approach that provides data, tools, and training to help communities of all sizes better achieve their resilience goals. This presentation will highlight the growing portfolio of Digital Coast products and services that incorporate natural and nature-based solutions.

# Reminders

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## Session Timing

Each presentation will be 15 minutes. The audience will have an additional five minutes to ask questions followed by a five minute lapse. Please feel free to move between sessions during this time.

## Nametags

Please wear your name tag at all times and return them at the end of your stay.



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# Tell Us What You Think!

Notes:

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After the conference, you will receive a follow-up email with a survey about the event.



Save time now or fill it out during a break; use the QR code to the right to fill out the survey. Your input is important in determining future efforts for this conference.

## Silent Auction

When you can, be sure to check out our Silent Auction in the Lobby area of the Chase Center on the Riverfront. A variety of items, ranging from resource books to a rain barrel, will be up for bid to benefit the Dr. Robert Brooks Student Scholarship Award to benefit a future student who otherwise would not be able to attend (see page 10 for details). Browse through the items, place a bid on your favorite things, and wait to see if you've won—it's as easy as that.

The Silent Auction will begin at 9:15a.m. on Day 1 of the conference and run until 12:00p.m. on Day 2 of the conference. The winners will be announced at 12:30p.m. on Day 2. *Cash and check are the only accepted forms of payment; please make checks payable to DNREC Division of Watershed Stewardship.* Winners can pick-up their item(s) at the end of Day 2 or will be contacted via email if not present.

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# 2024 Schedule: Day 1—Tuesday, February 6

8:15	Registration (Lobby) and Refreshments (Governors' Hall)		
9:15	Opening Remarks and Welcome—DNREC Secretary Shawn M. Garvin — Riverfront Ballroom		
9:45	Plenary Talk: Michael Trumbauer, Biohabitats, Inc. — Riverfront Ballroom		
Room:	Dravo Auditorium	Christina Ballroom	Pusey and Jones Room
Title:	Wildlife	CBR4	Implementation Tools and BMP's
10:20	Restoration Impacts on Flora and Fauna Abundance and Diversity <i>Andrew MacKenzie, West Virginia University</i>	CBR4 Sediment Remediation FFS Program Update <i>Travis Merritts, Anchor QEA</i>	Wetland Reserve Easement Program <i>Elena Stewart; USDA — Natural Resources Conservation Service</i>
10:45	Beach Habitat Management for Vegetation Control to Benefit Breeding Piping Plovers and Least Terns <i>Nate Selleck, USFWS Coastal Delaware NWR Complex</i>	The CBR4 Strategy for Riparian Habitat Restoration <i>Matt Sarver, Sarver Ecological, LLC</i>	Coastal Restoration from an Ecosystem Perspective — Joint Agency Guidance <i>Bartholomew Wilson, USFWS Northeast Region</i>
11:10	Monitoring Secretive Marsh Bird Occupancy and Demography in Priority Salt Marshes in Delaware <i>Erin Rogers, DNREC Division of Fish and Wildlife</i>	The CBR4 Strategy for Urban Freshwater Tidal Habitat Restoration <i>Ella Rothermel, Partnership for the Delaware Estuary</i>	Integrating Pollinator Habitat into Wetlands, Floodplains, SWM Ponds, and Demonstration Gardens: Test Cases and the Future of Habitat Projects <i>Emily Dolbin, McCormick Taylor Angela Schreffler, McCormick Taylor</i>
11:35	Population Characteristics Assessment on Blue Crabs ( <i>Callinectes sapidus</i> ) and Virus Identification of <i>Callinectes sapidus</i> Reovirus 1 (CsRV1) using PCR Analysis on Delaware Inland Bays <i>Juan Ramos, Delaware State University</i>	Resiliency Considerations for the Christina River <i>Jordana Cutajar, DNREC Division of Climate, Coastal, and Energy</i>	Advancements Toward the Chesapeake Bay Program Wetlands Outcome <i>Pamela Mason, Virginia Institute of Marine Science</i>
12:00	Lunch (Riverfront Ballroom), Poster Viewing (Lobby), and Networking (Governors' Hall)		
12:30	American Shore and Beach Preservation Association, Mid-Atlantic Chapter Meeting (ASBPA) — Christina Ballroom		
Title:	Coastal Resiliency	Non-Tidal Restoration	Soils
1:30	Development of an Acoustic Monitoring Framework for Salt Marsh Restoration Decision-Making <i>Kelly Faller, Partnership for the Delaware Estuary</i>	Hydric in a Haystack: Restoring Wetland Hydrology to a Historical Seasonal Pond Complex <i>Brigham Whitman, Delaware Wild Lands Matt Sarver, Sarver Ecological, LLC</i>	Impacts of Biochar on Phosphorus Distributions in Salt Marsh Surface Soils <i>Pamela Edris, University of Delaware</i>
1:55	Programmatic Approach to Assessing Salt Marsh for "Low-Tech" Restoration in Delaware and New Jersey <i>Brian Marsh, USFWS</i>		Impact of Milldams on the Partitioning Between Denitrification and DNRA in Persistently Anoxic Riparian Soils <i>MD Moklesur Rahman, University of Delaware</i>
2:20	Vanishing Act: The Disappearance of Delaware's Rare Sea Level Fen Due to Sea Level Rise <i>Melanie Cucunato, DNREC Division of Parks and Recreation</i>	Restoration of Lizardhill Sandmine Using Sand Seepage Wetlands <i>Joe Berg, Biohabitats, Inc.</i>	Memories of the Soils: Assessment of Floodplain Restorations and Nitrogen Removal Effectiveness <i>Joseph George Galella, University of Delaware</i>
2:45	Break and Refreshments — Governors' Hall		
3:00	Understanding the Fate of Jug Bay Tidal Freshwater Wetlands Under Current Relative Sea Level Rise Conditions <i>Patricia Delgado, Jug Bay Wetlands Sanctuary</i>	Back From the Past? Biogeochemical Recovery of Precolonial Wetland Soils in Modern Floodplain Restorations <i>Shreeram Inamdar, University of Delaware</i>	Catching Rain Where it Falls — Climate Resiliency and Adaptation by Rebuilding Degraded Urban Soils <i>Chuck Hegberg, RES, LLC</i>
3:25	Developing a Tidal Wetlands Strategic Plan for the Chesapeake Bay Watershed <i>Sarah Koser, The Chesapeake Bay Trust</i>	Converting a Pond into a Wetland Mosaic Within Public Park <i>Emily Bjorhus, Princeton Hydro, LLC Amy McNamara, Princeton Hydro, LLC</i>	Blue Carbon and the NRCS Coastal Zone Soil Survey <i>David Steinmann, USDA — Natural Resources Conservation Service</i>
4:15	Eat, Drink, and Connect in Governors' Hall: 4:15 — 6:00PM		



# 2024 Schedule: Day 2—Wednesday, February 7

8:15	Registration (Lobby) and Refreshments (Governors' Hall)		
9:15	Opening Remarks and Student Poster Awards – Alison Rogerson, DNREC – Riverfront Ballroom		
9:30	Plenary Talk: Josh Murphy, NOAA's Office of Coastal Management – Riverfront Ballroom		
Room:	Dravo Auditorium	Christina Ballroom	Pusey and Jones Room
Title:	Nature-Based Solutions	Beneficial Use	Streams
10:20	Living Shorelines in the Region – A 5-year Review <i>Doug Janiec, Sovereign Consulting</i>	Scotch Bonnet Island Marsh Elevation Enhancement Project: Beneficially Using Dredged Sediments to Stabilize Drowning Marshes <i>Lenore Tedesco, The Wetlands Institute</i>	Cypress Branch Dam Removal <i>Duncan Simpson, Princeton Hydro, LLC</i>
10:45	Angola by the Bay Living Shoreline <i>Bob Collins, Delaware Center for the Inland Bays</i>	Delaware Regional Assessment of Dredging and Beneficial Use of Dredged Material <i>Mindy Strevig, Anchor QEA, LLC</i>	Bensalem Township High School Wetland/Stream Mitigation Project <i>Kristin Aiosa, JMT, Inc. Andrew Donaldson, JMT, Inc.</i>
11:10	Sediment-Vegetation Interactions in the Created Marshes of Living Shorelines: Does Age Matter? <i>Cindy Palinkas, University of Maryland Center for Environmental Science Horn Point Lab</i>	Restoration of a Tidal Wetlands Using Dredge Material; Millsboro, Delaware <i>Ram Mohan, Anchor QEA, LLC</i>	Uncovering the History of DC's Buried Streams and Wetlands <i>Larry Trout, Jr. Straughan Environmental, Inc.</i>
11:35	Third River Urban Park and Habitat Creation Project – Brownfield Turned Wetland Sanctuary <i>Ivy Babson, Princeton Hydro, LLC</i>	Wetland Restoration Case Study: White Creek and Assawoman Canal Dredging and Beneficial Use Project <i>Jonathan Hart, Anchor QEA, LLC</i>	Where Does the Wetland End and the Stream Begin? <i>Jeremy Koser, JMT, Inc. Mike Galvin, JMT, Inc.</i>
12:00	Lunch (Riverfront Ballroom), Poster Viewing (Lobby), and Networking (Governors' Hall)		
12:30	Society of Wetland Scientists, Mid-Atlantic Chapter Meeting (SWS) – Christina Ballroom		
Title:	Monitoring and Assessment	Tidal Restoration	Technology and Education
1:30	Ethics in the Field: Research Impacts on Environmental Processes and Proposed Best Practices <i>Shelby Rinehart, Drexel University</i>	Southbridge Wilmington Park – The Good, The Bad, The Biodiversity <i>Natalie Byers, RK&amp;K</i>	Educational Freshwater Wetland Pond: Transforming Public School Land Use <i>Todd Klawinski, Caesar Rodney School District</i>
1:55	Megapools: Vegetation Dieback and Restoration Potential of a Ditched Coastal Salt Marsh <i>Katherine Stahl, USFWS/University of Maryland</i>	Topgolf and Ridgeley's Cove: Tidal Wetland Creation in Baltimore City <i>Matt Jennette, Geo-Technology Associates, Inc.</i>	Reducing Vertical Bias in Delaware Coastal Wetland DEMs with Machine Learning <i>Daniel Warner, Delaware Geological Survey</i>
2:20	Revisiting Successful Wetland Mitigation Projects – Is Five Years of Monitoring Sufficient? <i>Michael Rehman, Princeton Hydro, LLC</i>	Coastal Restoration Toolkit – An Online Resource to Launch a Restoration Project in Your Community <i>Elsa Schwartz, Restore America's Estuaries</i>	Investigating the Use of Multispectral Drones for Identifying Salt Marsh Conditions <i>Joshua Moody, NJDEP</i>
2:45	Break and Refreshments – Governors' Hall		
3:00	Long-Term Monitoring of Peatlands in Pennsylvania <i>Mary Ann Furedi, Western Pennsylvania Conservancy/Pennsylvania Natural Heritage Program</i>	Utilizing Nature-Based Solutions (NBS) to Restore Tidal Habitat and Reduce Flooding at John Heinz NWR <i>Bartholomew Wilson, USFWS Northeast Region</i>	Improving the Surface Water Quality of Coastal Basins with Resilient Land Cover Scenarios <i>Martha Ryan, University of Delaware</i>
3:25	Rapid Response of Understory Plants to Ash Canopy Loss From Emerald Ash Borer in Tidal Freshwater Forested Wetlands <i>Andy Baldwin, University of Maryland</i>	Innovative Approaches to Habitat Enhancement Within a Wetland Restoration Project <i>Kristen Coveleski, Inter-Fluve</i>	Submerged Aquatic Vegetation in Delaware's Inland Bays <i>Taylor Hoffman, Delaware Center for the Inland Bays</i>

# Dr. Robert Brooks Student Scholarship Award

The 2024 Delaware Wetlands Conference includes a newly established Dr. Robert Brooks Student Scholarship Award. The Award is given to an outstanding college or high school student showing exemplary interest in wetlands and other aquatic resources. Going forward, this award will be given biennially to support students to attend future Delaware Wetlands Conference.

In May of 2021, the wetland professional community lost a national leader in wetland science and wildlife biology. Dr. Brooks (Rob) passed far too soon from a rare and devastating disease. Rob enjoyed a 38-year career as a leading professor at Penn State University, including as a founder of Riparia, teaching more than a dozen different undergraduate and graduate courses in ecology, wetlands management, wildlife conservation, and restoration ecology. His work led to publishing more than 125 technical papers and books, and he delivered more than 140 technical presentations at conferences and meetings. Needless to say, Rob mentored countless students along their personal and professional journeys, making an everlasting imprint on their lives.

Rob served as Chair of the Pennsylvania DEP Wetlands Protection Advisory Committee, and was instrumental in the formation and success of the Mid-Atlantic Wetland Working Group (MAWWG). He's assisted many federal, state, and local agencies in policy, protection, and mitigation of rivers and wetlands. Very often, colleagues looked to him for his professional expertise, unique insight, and contagious enthusiasm for wetland science, and life itself.

Rob enjoyed a combination of good scotch, classic rock, and collecting antique tools, all while talking about wildlife and his list of ever growing projects. He went out of his way to help people, but no one was ever "out of the way". People were the way. Rob always made people feel included and always helped those who asked (including those who didn't even know they needed help). Rob would want you to carry on his kindness and help others you encounter along the way, especially those in the wetland community. He will be missed by many – family, friends, students, and colleagues – and will continue to be with us with through his everlasting work, unique shared experiences, and special memories.



You can support this scholarship fund by visiting the silent Auction table (see page 7 for details).

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# Abstracts

## **Wildlife: Day 1, a.m. — Dravo Auditorium**

*Moderated by Erin Rogers, the Marsh Bird Biologist for DNREC's Division of Fish and Wildlife.*

### **Restoration Impacts on Flora and Fauna Abundance and Diversity**

*Andrew MacKenzie, West Virginia University*

Quality wetland mitigation should result in positive or neutral floral and faunal responses. The study aims to assess anurans, birds, fish, macroinvertebrates, small mammals, turtles, and vegetation. The abundance and diversity of these species are compared by performing surveys before, during, and after wetland restoration. The research will also discuss the ecological trends observed throughout the restoration process. This study contributes to understanding wetland restoration efforts and their effects on different ecosystem components.

### **Beach Habitat Management for Vegetation Control to Benefit Breeding Piping Plovers and Least Terns**

*Nate Selleck, USFWS Coastal Delaware NWR Complex*

Following a large tidal marsh restoration project, Fowler Beach at Prime Hook National Wildlife Refuge became a new breeding site for federally threatened piping plovers, now hosting about 18 to 20 pairs. However, vegetation has increased on the beach and along a natural foredune, which can affect breeding and foraging success. We conducted several habitat management actions to maintain site suitability for the plovers without affecting the integrity of the restored beach, and will share results.

### **Monitoring Secretive Marsh Bird Occupancy and Demography in Priority Salt Marshes in Delaware**

*Erin Rogers, DNREC Division of Fish and Wildlife*

Many secretive saltmarsh bird species, including the saltmarsh sparrow, have experienced steep declines in recent years. It is critical to monitor imperiled marsh birds to better inform saltmarsh restoration and conservation efforts. In 2023, we began nest searching and mist-netting in three priority saltmarshes in Delaware. This is the start of a long-term monitoring project that aims to evaluate marsh bird occupancy, reproductive success, site fidelity, and survival to help guide local saltmarsh restoration projects.

### **Population Characteristics Assessment on Blue Crabs (*Callinectes sapidus*) and Virus Identification of *Callinectes sapidus* Reovirus 1 (CsRV1) using PCR Analysis on Delaware Inland Bays**

*Juan Ramous, Delaware State University*

Due to its economic and ecological importance, the blue crab population is assessed in Delaware Inland Bays in relation to ongoing oyster aquaculture and pilot oyster reefs. The objective of this study focuses on the blue crabs (*Callinectes Sapidus*), targeting population characteristics. Also testing for the presence of a deadly virus called *Callinectes sapidus* Reovirus 1 (CsRV1), within the Delaware Inland Bays, specifically around the Indian River Inlet Marina.

## **CBR4: Day 1, a.m. — Christina Ballroom**

*Moderated by John Cargill, a Hydrologist V in the Watershed Assessment and Management Section of DNREC's Division of Watershed Stewardship. He manages Delaware's Toxics in Biota program (fish advisories) and is co-leader of DNREC's WATAR Team.*

### **CBR4 Sediment Remediation FFS Program Update**

*Travis Merritts, Anchor QEA*

The Christina-Brandywine River Remediation, Restoration, and Resilience (CBR4) initiative seeks to remove fish consumption advisories in the Christina and Brandywine Rivers and to make these rivers fishable and swimmable. The sediment remediation focused feasibility study component of the CBR4 program involves an ongoing comprehensive study of contaminated sediments in the CBR4 study area. This presentation will provide an update on studies completed to date and planned investigations and analyses to advance the CBR4 sediment remediation.

### **The CBR4 Strategy for Riparian Habitat Restoration**

*Matt Sarver, Sarver Ecological, LLC*

Riparian corridor habitats are critical to terrestrial and aquatic biodiversity, in-stream processes, and ecosystem function, but on urban rivers like the Christina, they are also the most heavily degraded and impacted areas. We describe restoration concepts that will create a network of habitat patches at spatial scales relevant for supporting urban riparian biodiversity, beginning with the implementation of a multi-phase restoration of the Christina River's last large forest patch at New Castle County's Banning Park.

### **The CBR4 Strategy for Urban Freshwater Tidal Habitat Restoration**

*Ella Rothermel, Partnership for the Delaware Estuary*

The CBR4 plan aims to preserve, restore, and enhance critical freshwater tidal habitats that were once abundant on the Christina and Brandywine Rivers. However, urban riverine projects present unique challenges due to their position among hardened landscapes with legacies of ecological disconnection and contamination. We describe restoration concepts to increase habitat complexity and connectedness, beginning with the implementation of the Christina's first living shoreline, which will utilize a habitat mosaic approach and feature freshwater mussels.

### **Resiliency Considerations for the Christina River**

*Jordana Cutajar, DNREC Division of Climate, Coastal and Energy*

A comprehensive remediation, restoration, resiliency, and revitalization plan is underway for the Christina River, led by the state of Delaware. Improving the coastal and flood resiliency of the river and surrounding environs is a key goal of the overall project. This presentation will provide a review of ongoing efforts by DNREC, DELDOT, City of Wilmington, New Castle County, and other local communities. Status of ongoing efforts and best management practices will be discussed.

## **Implementation Tools and BMP's: Day 1, a.m. — Pusey and Jones Room**

*Moderated by Mark Biddle, a Program Manager in the in DNREC's Division of Watershed Stewardship Watershed Assessment and Management Section.*

### **Wetland Reserve Easement Program**

*Elena Stewart; USDA — Natural Resources Conservation Service*

The Wetland Reserve Easement (WRE) component of the Agricultural Conservation Easement Program (ACEP) seeks to provide habitat, improve water quality, reduce flooding, recharge groundwater, protect biological diversity and provide resilience to climate change. Through WRE, NRCS purchases the development rights from eligible private landowners then pays to develop and implement a Wetland Reserve Plan of Operations (WRPO). This plan describes practices which help restore, protect, and enhance the wetlands functions and values of the land.

### **Coastal Restoration from an Ecosystem Perspective — Joint Agency Guidance**

*Bartholomew Wilson, USFWS Northeast Region*

This presentation will offer guidance developed by NOAA and USFWS to assist with project planning, design, permitting, implementation, monitoring, and adaptive management. While this guidance may apply to other coastal marsh settings, it has been developed primarily by practitioners from the U.S. Mid-Atlantic and southern New England coastal regions and is focused on techniques that have been successfully implemented there. The intent of this guidance is to outline a suite of coastal restoration approaches that offer a greater likelihood of success at each project phase.

### **Integrating Pollinator Habitat into Wetlands, Floodplains, SWM Ponds, and Demonstration Gardens: Test Cases and the Future of Habitat Projects**

*Emily Dolbin and Angela Schreffler, McCormick Taylor*

Pollinator habitat discussions are gaining traction, but how can they be integrated into projects with the goal of a successful project with client buy-in? We'll discuss pollinator habitat test cases, maximizing site potential, how to engage with clients about the benefits and realities of integration, and implications of pollinator threatened and endangered species listings.

### **Advancements Toward the Chesapeake Bay Program Wetlands Outcome**

*Pamela Mason, Virginia Institute of Marine Science*

A review of the likely attainment of CBP outcomes by 2025 found the wetlands outcome was off-course. Significant efforts to course correct the outcome were varied, engaged hundreds of individuals and resulted in notable new processes and tools to improve accounting, modify BMP tracking, engage jurisdictions, and re-imagine the WWG framework to focus efforts to match restoration efforts. A review of these new approaches and efforts will highlight new thinking on wetlands vulnerability, co-benefits and management frameworks.

## **Coastal Resiliency: Day 1, p.m. — Dravo Auditorium**

*Moderated by Erin Velott, an Environmental Scientist for DNREC's Division of Watershed Stewardship Shellfish and Recreational Waters Program.*

### **Development of an Acoustic Monitoring Framework for Salt Marsh Restoration Decision-making**

*Kelly Faller, Partnership for the Delaware Estuary*

Bioacoustic monitoring offers a cost-effective solution for assessing salt marsh restoration success amid changing conditions. This method enhances data collection efficiency while exploring the acoustic interactions between organisms and their surroundings through their soundscapes. Our ongoing research is focused on identifying acoustic niche gaps in Delaware Bay's unrestored marshes, potentially signaling degradation. We're developing a framework for long-term acoustic monitoring, which will support marsh restoration decision-making tools and aid conservation initiatives in the Mid-Atlantic region.

### **Programmatic Approach to Assessing Salt Marsh for "Low-Tech" Restoration in Delaware and New Jersey**

*Brian Marsh, USFWS Delaware Bay Estuary Project*

We are developing a programmatic approach to assess for and implement low-cost, low-disturbance, and scalable salt marsh restoration in Delaware and New Jersey for resilience and habitat. We have identified sites and are looking at elevation, hydrology, and ecological metrics to inform use of runnels, ditch remediation, wave attenuation, and strategic elevation enhancement. Sites include those heavily ditched or with mudflats within their interior. We will present the project to date and its potential value.

### **Vanishing Act: The Disappearance of Delaware's Rare Sea Level Fen Due to Sea Level Rise**

*Melanie Cucunato, DNREC Division of Parks and Recreation*

Delve into Delaware's Natural Areas Preservation Program and the Angola Neck Nature Preserve. Learn about the state's Natural Areas Preservation Program and the Preserve's acquisition, showcasing dedication to preserving a fragile ecosystem. Witness the tragedy of the sea level fen, succumbing to sea level rise—a stark reminder of climate change's urgency. Explore the delicate balance between progress and conservation and join us in discussing strategies for safeguarding natural heritage. Together, we can make the difference for future generations of Delawareans.

### **Understanding the Fate of Jug Bay Tidal Freshwater Wetlands Under Current Relative Sea Level Rise Conditions**

*Patricia Delgado, Jug Bay Wetlands Sanctuary*

The resilience of Jug Bay tidal freshwater marshes (Patuxent River) to sea level rise was evaluated using surface elevation change data. Results showed significant temporal and spatial variability. In addition to a marked seasonality, episodic storm events played an important role in altering the elevation trajectories. Spatially, elevation change was significantly affected by channel category and marsh zone. Because Jug Bay marshes are bordered by steep slopes they are not able to migrate inland.

## Coastal Resiliency Continued: Day 1, p.m. — Dravo Auditorium

### Developing a Tidal Wetlands Strategic Plan for the Chesapeake Bay Watershed

*Sarah Koser, The Chesapeake Bay Trust*

The Chesapeake Bay Trust is preparing a Strategic Plan to define existing/identified barriers to tidal wetland restoration in the Chesapeake Bay Watershed and to address the off-course Wetlands Outcome that will not meet the 2025 goal (restore 85,000 acres). The Plan will define parameters to be considered when targeting locations for large-scale tidal wetland restoration, including developing consensus siting and success criteria and defining timescales (short- and long-term objectives) while considering migration corridors, shallow water and upland/riparian habitat, and the effects of climate change.

### Non-Tidal Restoration: Day 1, p.m. — Christina Ballroom

*Moderated by Alison Stouffer, a Wetland Biologist for DNREC's Division of Watershed Stewardship Wetland Monitoring and Assessment Program.*

#### Hydric in a Haystack: Restoring Wetland Hydrology to a Historical Seasonal Pond Complex

*Brigham Whitman, Delaware Wild Lands and Matt Sarver, Sarver Ecological, LLC*

Delaware Wild Lands and Sarver Ecological are restoring a 45-acre Coastal Plain Seasonal Pond complex on former agricultural land. Eight wetlands were located using historical aerial photography and soil investigation and were excavated to their original depth and hydroperiod. The surrounding matrix was planted with native herbaceous species, with trees to be installed in 2024. This project will support nearby habitats threatened by sea level rise, benefit species of greatest conservation concern wildlife species, and improve water quality.

local community in hands-on conservation practices.

#### Restoration of Lizardhill Sandmine Using Sand Seepage Wetlands

*Joe Berg, Biohabitats, Inc.*

An approximately 30 acres exhausted sandmine was 'restored' to a stream flowing through an upland-wetland mosaic of sand seepage forested wetlands, shallow open water wetlands, and forested uplands. The primary project goal was to provide water quality treatment to approximately 400 acres of ditched agricultural fields normally used to 'waste' chicken manure from broiler houses. This project site is located in one of the worst nutrient-contaminated drainages in the coastal bays of Maryland and Delaware.

### Back From the Past? Biogeochemical Recovery of Precolonial Wetland Soils in Modern Floodplain Restorations

*Shreeram Inamdar, University of Delaware*

Buried, historic hydric soils are not included in most floodplain restoration designs. We compared carbon and nitrogen contents; C:N ratios; nitrate-N and ammonium-N concentrations; denitrification rates; functional genes for denitrification (*nosZ*) and nitrification (*amoA* for AoA+AoB); and phospholipid fatty acid biomasses of historic wetland soils with contemporary wetland soils. Our results suggest that the recovery of historic, hydric soils is slow and attainment of restoration goals, such as increased denitrification, may require multiple years.

### Converting a Pond into a Wetland Mosaic within Public Park

*Emily Bjorhus and Amy McNamara, Princeton Hydro, LLC*

This presentation explores the design and construction of the Lion's Pride Park Ecological Restoration Project in Warrington, PA. The project converts a stagnant pond overrun with invasive species and water quality concerns into a diverse wetland complex that provides native wildlife habitat and reduces nonpoint source pollutants discharged to downstream waters. Additionally, the project incorporates ADA-compliant walking paths, boardwalks, and observation platforms so all community members may enjoy and learn from this restored aquatic setting.

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Lizard Hill Sand Mine Reclamation & Bishopville Pond Restoration  
Bishopville, MD ©William Wilhelm

## Soils: Day 1, p.m. — Pusey and Jones Room

*Moderated by Ashley Tabibian, an Environmental Scientist for DNREC's Division of Watershed Stewardship Shellfish and Recreational Water Programs.*

### Impacts of Biochar on Phosphorus Distributions in Salt Marsh Surface Soils

*Pamela Edris, University of Delaware*

The invasive reed, *Phragmites australis*, may provide an enhanced phosphorus storage ecosystem service compared to native vegetation and its removal may reduce phosphorus storage in marsh soil. Biochar introduced by prescribed burns may recoup this lost service. We examined soil phosphorus in marshes of varying burn frequency and biochar additions. Preliminary results show that burning is not correlated with organic or inorganic phosphorus concentrations, but it may impact refractory phosphorus concentrations.

### Impact of Milldams on the Partitioning Between Denitrification and DNRA in Persistently Anoxic Riparian Soils

*MD Moklesur Rahman, University of Delaware*

Biogeochemical processes such as denitrification (DNF) and dissimilatory nitrate reduction to ammonium (DNRA) are known to occur in anoxic soils but DNF permanently removes nitrogen (N) while DNRA retains N within an ecosystem. We investigated which of these two processes dominate in milldam-affected riparian soils and the potential controlling environmental factors. Preliminary results demonstrate that one of the two sites with higher iron (Fe) in anoxic groundwater showed higher rates of DNRA than DNF.

### Memories of a Salt Marsh: Assessment of Floodplain Restorations and Nitrogen Removal Effectiveness

*Joseph George Galella, University of Delaware*

Stream and floodplain restoration has been a growing industry in the Mid-Atlantic for the past 20 Years. However, limited long-term monitoring of those restorations has been conducted. Soil and water samples were collected from 15 stream restorations 1 to 22 years post-restoration. Results indicated increasing organic matter, organic carbon and microbial denitrification rates with restoration age at restored sites. 15N concentrations decreased with restoration age at restored sites possibly due to organic N accumulation.

### Catching Rain Where it Falls — Climate Resiliency and Adaptation by Rebuilding Degraded Urban Soils

*Chuck Hegberg, RES, LLC*

Biochar, a sustainable carbon-rich material, has 30,000 international, peer-reviewed articles highlighting its environmental benefits. Yet widespread adoption of its use lags behind. The USA has over 40 million acres of turf/lawns causing high volumes of polluted runoff. Using biochar to rebuild urban soil offers significant environmental and economic advantages through improving a watershed's hydrodynamics response, temperature regulation, and carbon sequestration. This talk will discuss the scientific, procedural, and economic aspects of implementing such an initiative.

## Blue Carbon and the NRCS Coastal Zone Soil Survey

David Steinmann, USDA — Natural Resource Conservation Service

As the scientific community continues to value blue carbon studies to quantify carbon sequestration rates, the USDA's Natural Resources Conservation Service recognizes the significant role Coastal Zone Soil Survey (CZSS) will play in this effort. As the nation's lead in mapping and evaluating soil resources, studying and quantifying carbon values will continue in the coastal zone. CZSS inventories describe soils to two meters, allowing for a deeper understanding of blue carbon stocks. With this data, a soil carbon network will be developed.

## Nature-Based Solutions: Day 2, a.m.— Dravo Auditorium

*Moderated by Olivia Allread, the Outreach and Communications Coordinator for DNREC's Division of Watershed Stewardship Wetland Monitoring and Assessment Program.*

### Living Shorelines in the Region— A 5-year Review

Doug Janiec, Sovereign Consulting

The Delaware-southern New Jersey region has been a "hot-spot" for living shoreline research and development, technical outreach, and innovation. Most presentations focus on a single project. This presentation will touch upon 8 to 10 such projects in an attempt to demonstrate the diversity and uniqueness of this group of natural and nature-based features. How are they the same and how are they different? A few lessons learned will also be provided.

### Angola by the Bay Living Shoreline

*Bob Collins, Delaware Center for the Inland Bays*

The Angola by the Bay Living Shoreline project was completed in spring of 2023. This 2,225 linear feet project employs various tactics and serves as a plan for maintaining the low-medium community shoreline on Burton's Prong, a tributary of Rehoboth Bay. The presentation will discuss planning and implementation of the project.

### Sediment-vegetation Interactions in the Created Marshes of Living Shorelines: Does Age Matter?

*Cindy Palinkas, University of Maryland Center for Environmental Science Horn Point Lab*

Property owners are increasingly using living shorelines (LS) to address shoreline erosion, yet LS performance over time remains uncertain. This study examines sediment dynamics in the created marshes of several LS in mesohaline Chesapeake Bay that are 3 to 10 years old. On average, sediment is finer and accretes faster at older LS, but stem density is similar across age groups. These results indicate that different models/metrics should be used to evaluate LS performance as they age.



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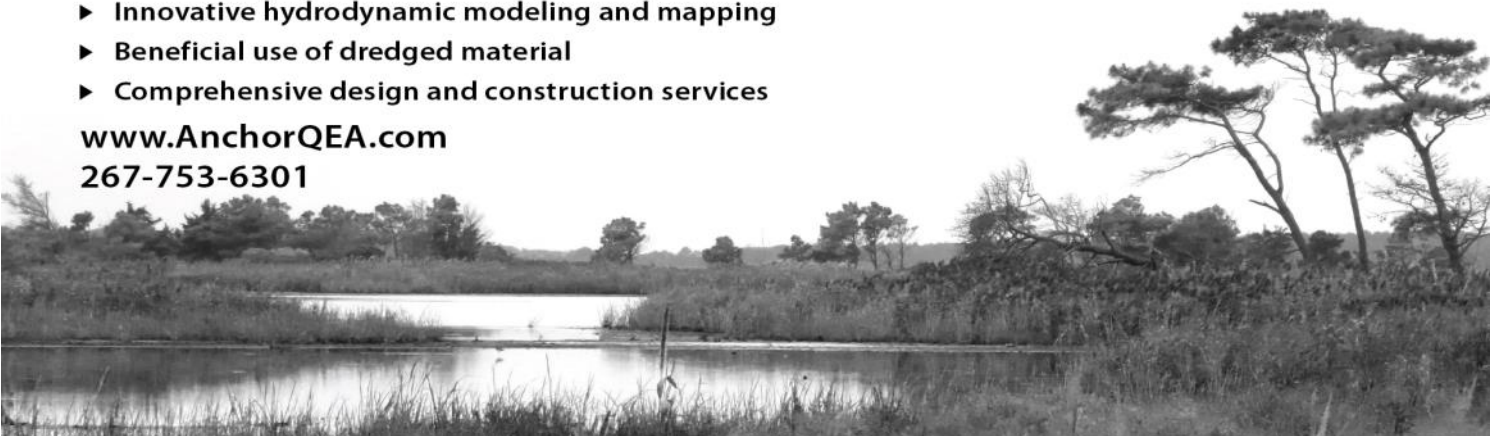
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## **Nature-Based Solutions Continued: Day 2, a.m.— Dravo Auditorium**

### **Third River Urban Park and Habitat Creation Project – Brownfield Turned Wetland Sanctuary**

*Ivy Babson, Princeton Hydro, LLC*

In urban Bloomfield, NJ, a former brownfield situated within a 100-year floodplain was transformed into a public park featuring 4.2 acres of constructed wetland that is teeming with wildlife and a diverse array of native plant species. This project is an example of how green infrastructure can re-establish lost wetland ecosystem functions and values within an urbanized setting through attenuating floodwaters, increasing flood storage periods, and providing attractive foraging and breeding opportunities for wildlife.

### **Beneficial Use: Day 2, a.m.— Christina Ballroom**

*Moderated by Alison Rogerson, an Environmental Scientist and Lead for DNREC's Division of Watershed Stewardship Wetland Monitoring and Assessment Program.*

#### **Scotch Bonnet Island Marsh Elevation Enhancement Project: Beneficially Using Dredged Sediments to Stabilize Drowning Marshes**

*Lenore Tedesco, The Wetlands Institute*

Scotch Bonnet Island is a low-lying marsh island in Cape May, NJ whose elevations have fallen into the lower limit of low marsh elevation. The platform is undergoing rapid marsh loss through conversion to mud flat and open water and dissection via tidal creek expansion. The project will stabilize the drowning marsh platform using sediment addition to uplift 12 acres of low marsh by infilling expanding pools and marsh areas that recently converted to mudflat.

#### **Delaware Regional Assessment of Dredging and Beneficial Use of Dredged Material**

*Mindy Strevig, Anchor QEA, LLC*

The state of Delaware recently performed a regional assessment of dredging and dredged material management regulations and practices, with a view to protect the environment, while promoting sustainable end-uses of dredged material. A regional review of neighboring states surrounding Delaware along with a cursory review of various other state programs, presents an opportunity to compare policies of dredging regulatory programs and identify best management practices. This presentation focuses on our findings of this regional assessment.

### **Restoration of a Tidal Wetlands Using Dredge Material; Millsboro, Delaware**

*Ram Mohan, Anchor QEA, LLC*

Tidal wetlands adjacent to the Town of Millsboro has been historically degraded, and converted to tidal flats, thereby increasing the potential for storm damage to the residents. A beneficial use concept of using dredged material from the State of Delaware channels to restore the wetlands back to a functioning habitat is being developed and construction is underway. Concept development, adaptive management aspects, construction steps, and monitoring will be discussed in this presentation.

#### **Wetland Restoration Case Study: White Creek and Assawoman Canal Dredging and Beneficial Use Project**

*Jonathan Hart, Anchor QEA, LLC*

The DNREC-led White Creek and Assawoman Canal Dredging Project involves beneficial reuse of dredged material to restore approximately 90 acres of degraded wetlands within the Assawoman Wildlife Area. Marsh platform restoration using thin-layer placement of dredged material began in early 2023 and restoration operations will be completed in early 2024. This presentation provides an overview of the project including site assessment, monitoring protocols, thin layer placement design, restoration operations, and lessons learned.

### **Streams: Day 2, a.m.— Pusey and Jones Room**

*Moderated by Gabriella Vailati, an Environmental Scientist for DNREC's Division of Watershed Stewardship Watershed Assessment and Management Section.*

#### **Cypress Branch Dam Removal**

*Duncan Simpson, Princeton Hydro, LLC*

The Cypress Branch Dam Removal project is located in Kent County, MD. The earthen embankment has breached in two locations. The project will remove the concrete spillway, fill a scour hole, fill the bypass channels, and restore the main channel.

#### **Bensalem Township High School Wetland/Stream Mitigation Project**

*Kristin Aiosa and Andrew Donaldson, JMT, Inc.*

PennDOT is completing work for SR 0001, Group 03S corridor in Bucks County, PA. As part of the project, unavoidable impacts to wetlands were necessary to accommodate this transportation project. To offset these impacts, a comprehensive mitigation plan for wetland impacts was developed using an innovative and sustainable design solution. The project obtained unique permits including a NWP 23 (Categorical Exclusion) and a restoration waiver from Division of Wetlands and Encroachment for the restoration plan.



## **Streams Continued: Day 2, a.m.— Pusey and Jones Room**

### **Uncovering the History of DC's Buried Streams and Wetlands**

*Larry Trout, Jr. Straughan Environmental, Inc.*

The history of every city is written in its waterways. Straughan completed an effort to provide the District Department of Energy and Environment (DOEE) with an interactive online educational tool to tell the story of hydrology in Washington, DC with both an eye towards the past and a hope for the future. The goal of this study was to better understand streams and wetlands lost over time and develop future plans for restoring them to the surface.

### **Where Does the Wetland End and the Stream Begin?**

*Jeremy Koser and Mike Galvin, JMT, Inc.*

The Eccleston Stream and Wetland Mitigation project restored, enhanced, and preserved over 22 acres of high-quality floodplain wetlands along the Jones Falls in the Maryland Piedmont Ecoregion. We will explore the site selection process, non-standard data collection techniques, the restoration design approach, monitoring results and adaptive management activities, as well as how the design goals were met through unique opportunities to restore wetland hydrology, soils, and vegetation in this degraded natural trout stream valley.

## **Monitoring and Assessment: Day 2, p.m.—Dravo Auditorium**

*Moderated by Kayla Clauson, an Environmental Scientist for DNREC's Division of Watershed Stewardship Watershed Assessment and Management Section.*

### **Ethics in the Field: Research Impacts on Environmental Processes and Proposed Best Practices**

*Shelby Rinehart, Drexel University*

Field studies are essential for understanding ecological processes but require researchers to disturb the environment. We documented researcher impacts on coastal wetlands and assessed how researchers perceive their impacts. Researcher effects on biotic structure and edaphic conditions were evident one year after the conclusion of our original studies. Field researchers acknowledge, and often personally mitigate, their impacts on the environment. Implementing simple strategies (e.g., limiting visits and team size) may reduce researcher effects.

### **Megapools: Vegetation Dieback and Restoration Potential of a Ditched Coastal Salt Marsh**

*Katherine Stahl, USFWS/University of Maryland*

Areas of vegetation dieback are increasing in ditched salt marshes, commonly referred to as “megapools.” We found that megapools had higher sulfide levels (using IRIS films) and lower elevation, plant biomass, and carbon bulk density than vegetated marsh. These findings implicate soil water logging and sulfide, a phytotoxin, as causes of plant dieback, and suggest that restoration techniques should focus on reducing impoundment of water. Shallow hand dug channels, or “runnels”, may provide a solution.

### **Revisiting Successful Wetland Mitigation Projects – Is Five Years of Monitoring Sufficient?**

*Michael Rehman, Princeton Hydro, LLC*

Is the standard five years of monitoring typically prescribed to approved mitigation sites in New Jersey adequate or do mitigation sites, once approved, revert, over time, to their pre-mitigation site condition? Two case studies, one in a tidal wetland and one in a freshwater wetland setting, in New Jersey, are revisited eleven years, and fifteen years later, respectively.

### **Long-term Monitoring of Peatlands in Pennsylvania**

*Mary Ann Furedi, Western Pennsylvania Conservancy/Pennsylvania Natural Heritage Program*

Peatlands are a unique groups of wetlands. In Pennsylvania, they represent the near southern extent of boreal wetlands and provide habitat for a variety of more specialized flora and fauna. Given that these wetland systems are controlled by temperature and precipitation, they are likely to shift in composition as a result of climate change. This presentation will focus on some findings from a long-term monitoring effort of 30 peatlands in Pennsylvania.

### **Rapid Response of Understory Plants to Ash Canopy Loss From Emerald Ash Borer in Tidal Freshwater Forested Wetlands**

*Andy Baldwin, University of Maryland*

Emerald ash borer is responsible for tree canopy loss in many tidal freshwater forested wetlands of the Mid-Atlantic region. Increased light availability alters growth conditions for understory shrubs and herbs on hummocks (microtopographic highs) and promotes colonization by marsh plants in hollows (lows). This shift from a forested to a shrub-herbaceous ecosystem represents a rapid and widespread shift in plant species composition and biomass allocation that translates to altered biodiversity and ecosystem function.

## **Tidal Restoration: Day 2, p.m.— Christina Ballroom**

*Moderated by Kenny Smith, an Environmental Scientist for DNREC's Division of Watershed Stewardship Wetland Monitoring and Assessment Program.*

### **Southbridge Wilmington Park – The Good, The Bad, The Biodiversity**

*Natalie Byers, RK&K*

The City of Wilmington's Southbridge Wilmington Wetland Park—designed to reduce flooding, clean up a brownfield, and restore tidal wetlands within urban constraints – was completed in 2022 and just finished its first year of monitoring. In this talk, we'll discuss some widely applicable lessons learned about constructing a multi-acre wetland restoration in a disturbed urban environment, the challenges of fine-tuning the automated tide control system, and what the monitoring results indicate about the site's success.

## Tidal Restoration Continued: Day 2, p.m.— Christina Ballroom

### Topgolf and Ridgeley's Cove: Tidal Wetland Creation in Baltimore City

*Matt Jennette, Geo-Technology Associates, Inc.*

In 2022, 1.7 acres of tidal wetlands were created at Ridgley's Cove to revitalize an existing City-owned park and to provide compensatory mitigation for the nearby Topgolf Baltimore project. Work included removing invasive *Phragmites australis*, importing 3,500 cy of clean fill, monitoring marsh platform settlement, and planting 54,000 *S. alterniflora* and *S. patens* plugs. This presentation will also discuss design and permitting challenges.

### Coastal Restoration Toolkit — An Online Resource to Launch a Restoration Project in Your Community

*Elsa Schwartz, Restore America's Estuaries*

Restore America's Estuaries developed an online "Toolkit" (RestoreYourCoast.org) to support coastal residents and enables community members who aspire to improve their local ecosystem, but who need the information and guidance to go from project idea, to design, to implementation. The Toolkit is divided into five main topic areas: Water Quality, Flooding, Coastal Erosion, Invasive Species, and Wildlife Habitats. Each topic has the tools and resources needed to start developing a restoration project in your community.

### Utilizing Nature-Based Solutions (NBS) to Restore Tidal Habitat and Reduce Flooding at John Heinz NWR

*Bartholomew Wilson, USFWS Northeast Region*

John Heinz National Wildlife Refuge at Tinicum (Refuge), nestled within the urban setting of the City of Philadelphia, was historically surrounded by freshwater tidal marsh, but because of these large-scale disturbances, altered hydrology, and invasive species introductions, many of the Refuge's natural communities are continually impacted or lost. The refuge and its partners are in the process of designing and implementing nature-based strategies to alleviate urban flooding, bolster community resilience, and greatly expand tidal freshwater habitat.

### Innovative Approaches to Habitat Enhancement Within a Wetland Restoration Project

*Kristen Coveleski, Inter-Fluve*

Inter-Fluve used several innovative approaches when designing the wetland habitat features in the 308 acre, \$1 billion flood resiliency and revitalization effort in downtown Toronto. Ecological enhancements, such as osprey platforms, chimney swift towers, and "drowned" trees were designed to mimic their natural analogues while remaining structurally sound. This presentation will discuss the technical intricacies evaluated to deliver these unique ecological features that can serve as a template for wetland restoration projects throughout Delaware and beyond.

## Technology and Education: Day 2, p.m.— Pusey and Jones Room

*Moderated by Krystle Bell, a Coastal Ecological Restoration Scientist for DNREC's Department of Climate, Coastal and Energy at Delaware's National Estuarine Research Reserve.*

### Educational Freshwater Wetland Pond: Transforming Public School Land Use

*Todd Klawinski, Caesar Rodney School District*

The Caesar Rodney School District (CRSD) in Kent County, has several campuses that occupy large tracts of relatively underused land. For decades, these lands have largely been kept as mown turf of minimal value to native wildlife or as effective stormwater management infrastructure or meaningful outdoor learning spaces. With federal funding from the National Fish and Wildlife Foundation, CRSD designed and installed the Educational Freshwater Wetlands Pond at Fifer Middle School in Camden, DE.



## Technology and Education Continued: Day 2, p.m.— Pusey and Jones Room

### Reducing Vertical Bias in Delaware Coastal Wetland DEMs with Machine Learning

*Daniel Warner, Delaware Geological Survey*

The vertical bias and uncertainty of elevation data in coastal marshes is a major challenge for researchers in these critical ecosystems. This study aimed to develop a coastal marsh digital elevation model (DEM) correction model for the coastal marshes along Delaware Bay, DE. We tested several approaches using field GPS surveys and LIDAR terrain derivatives. Comparing these approaches, we found that deep neural networks performed best at reducing DEM bias and uncertainty.

### Investigating the Use of Multispectral Drones for Identifying Salt Marsh Conditions

Joshua Moody, NJDEP

New Jersey has ~165,000 acres of salt marshes. Appropriate protection and restoration efforts require understanding their spatial and temporal vulnerability. Field-based evaluation methods can be costly and time-consuming. Drones represent an opportunity to assess large areas efficiently. This project develops a methodology to use multispectral drone imagery to identify conditions that can lead to high marsh pond expansion and vegetation loss by evaluating relationships between soil and porewater chemistry, vegetation, and multispectral indices.

### Improving the Surface Water Quality of Coastal Basins with Resilient Land Cover Scenarios

Martha Ryan, University of Delaware

Delaware’s coastal basins provide water resources to communities, but they are being threatened as wetlands that improve their water quality are destroyed by coastal squeeze. Previous studies have used land change and water quality models to predict how land cover changes will impact water quality, however, these modeling techniques have predominantly been used for non-coastal water basins. This study will fill this gap to identify how land cover change will affect Delaware’s future water quality.

### Submerged Aquatic Vegetation in Delaware's Inland Bays

*Taylor Hoffman, Delaware Center for Inland Bays*

Submerged aquatic vegetation has historically been nearly eliminated in Delaware’s Inland Bays over the last century, and it remains severely limited in that region today. Patches of widgeon grass (*Ruppia cirrhosa*) and sago pondweed (*Stuckenia pectinata*) discovered over the last year in Little Assawoman Bay provided the Delaware Center for the Inland Bays the opportunity for restoration work for these two bay grass species.

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# Student and Professional Posters

Please visit posters in the lobby after lunch each day!

## Student Poster Competitors

- 1 Emma Cherigate**, Riparia Center, The Pennsylvania State University **From Drainage to Denitrification: Identification and Characterization of Drained Wetlands for Agricultural Nitrate Removal.** *Emma Cherigate, Tyler Hampton, Tim Frankstone, Nandita B Basu, and Kimberly J Van Meter.*
- 2 Samuel B. Cohen**, Riparia Center, The Pennsylvania State University **Using Herbicide Metabolites as a Novel Tracer of Agricultural Nitrate in U.S. Wetlands.** *Samuel B. Cohen, Kiely J. Hine, Hlengilizwe Nyoni, Gregory W. McCarty, Kimberly J. Van Meter*
- 3 Kate Collins**, Delaware State University **Blue Crab (*Callinectes sapidus*) Virus Identification Utilizing PCR for CsRV1 (*Callinectes sapidus* reovirus 1) within the Delaware Inland Bays.** *Kate Collins, Juan Ramos, Tahera Attarwala, Ali Parsaeimehr, Ph.D., and Gulnihal Ozbay, Ph.D.*
- 4 Lydia Franks**, University of Delaware Water Resources Center **Living Shoreline Inventory in the Indian River, Rehoboth, and Little Assawoman Bays.** *Lydia Franks, Andrew Homsey, Andrew McGowan, and Meghan Noe Fellows*
- 5 Kiely Hine**, Riparia Lab, The Pennsylvania State University **Wetland and Groundwater Monitoring of Agricultural Nitrogen in Chesapeake Bay Using MESA.** *Kiely Hine, Samuel Cohen, Kimberly Van Meter*
- 6 Sylvia Jacobson**, University of Maryland **Salinity Regulates Native Species Recovery in Post-Phragmites Restoration.** *Sylvia Jacobson, Andrew H. Baldwin, Hope Brooks, Melissa McCormick, Eric Buehl, Karin Kettenring, Dennis Whigham*
- 7 Justus Jobe**, The George Washington University **Herbivory by Geese Inhibits Tidal Freshwater Wetland Restoration Success.** *Justus Jobe, Keryn Gedan, Cairn Kraft, Mikaila Milton*
- 8 Zachary Kiedrowski**, University of Maryland College Park, Otter Point Creek Alliance **Analysis of Ahifts in *Phragmites australis* and *Zizania aquatica* Distribution from 2012 to 2023.** *Zachary Kiedrowski, Kyle Derby, Rebecca Swerida*
- 9 Riley Leff**, George Washington Univeristy **Seawater Inundation Induces Reverse Sap Flux In A Coastal Forest.** *Riley Leff, Keryn Gedan*
- 10 Kayla McKinley**, Delaware State University **Using Algal Turf Technology to Remove Excess Nutrients and Evaluate Biomass Potential.** *K. N. McKinley, G. Blank, A. Parsaeimehr, and G. Ozbay*
- 11 Kelvin Fynn Ofori**, Delaware State University **Investigation of the Microbial Safety of Oysters from Sally Cove in Rehoboth Bay, Delaware.** *Kelvin Fynn Ofori, Ali Parsaeimehr, Wilbert Long III, Gulnihal Ozbay*
- 12 Laetitia Igiraneza Sinyigenga**, University of Delaware **Exploring the Impact of Vegetation Response to Hydrological Processes on Evapotranspiration (ET) and Water Balance in the Marsh-Upland Transition Zones.** *Laetitia Igiraneza Sinyigenga, Holly Michael, Dannielle Pratt, Riley Leff*

## Professional Posters

- 14 **Emily Andrade**, Delaware State University **Habitat Suitability for Oyster Aquaculture Grow-out Conditions in Rehoboth Bay, Delaware .** Emily Andrade, Tahera Attarwala, Juan Ramos, Ali Parsaeimehr, and Gulnihal Ozbay
- 15 **Tahera Attarwala**, Delaware State University **Assessing Eastern Oyster (*Crassostrea virginica*) Predation Utilizing Real-Time Monitoring and eDNA Analysis in Delaware Inland Bays.** *Tahera Attarwala*
- 16 **Taylor Beck**, DNREC Division of Climate, Coastal and Energy **It's TeaTime! Assessing the Organic Matter Decay Rates within National Estuarine Research Reserves Using Teabags.** *Taylor Beck, Mollie Yacano, Kyle Derby, and Kari St. Laurent*
- 17 **Trevor Birkenholtz**, Pennsylvania State University **Placing Wetlands in the Watershed: Millbrook Marsh and Ecosystem Service Provision from Centre County, Pennsylvania to the Chesapeake Bay.** *Trevor Birkenholtz*
- 18 **Julie Blum**, The Wetlands Institute **Salt Marsh Vegetation Trends at Surface Elevation Tables in Stone Harbor, New Jersey.** *Julie Blum, Amanda Lyons, Lisa Ferguson*
- 19 **Frederick Cheng**, University of Virginia **Disconnectivity Matters: The Outsized Role of Small Ephemeral Wetlands in Landscape-scale Nutrient Retention.** *Frederick Cheng, Junehyeong Park, Mukesh Kumar, Nandita Basu*
- 20 **David Curson**, Audubon Mid-Atlantic **Marshes for Tomorrow : An Implementation Plan for the Restoration and Resilience of Maryland's Salt Marshes.** *David R. Curson, Henrietta A. Bellman, Brittany Panos*
- 21 **Mihaela Enache**, New Jersey Department of Environmental Protection **Diatom-based Assessment of New Jersey Coastal Wetlands Condition, Sea Level Rise and Thin Layer Placement Impacts.** *Mihaela Enache, Nina Desianti, Marina Potapova*
- 22 **Meghan Noe Fellows**, Delaware Center for the Inland Bays **Soil Metrics Can be Used to Understand Ecosystem Restoration Outcomes from Reforestation.** *Meghan Noe Fellows, Greg Noe, Katherine Frederick*
- 23 **LeeAnn Haaf**, Partnership for the Delaware Estuary **Effects of Sea Level Rise on the Growth of Coastal American Holly.** *Laia Andreu-Hayles (Columbia University), Troy Nixon (Columbia University), Caroline Leland (Columbia University), & Nicole Davi (William Paterson University)*
- 24 **Christopher Kelly**, University of Delaware **Impact of Prescribed Burns on Carbon Storage in Delaware Tidal Marshes: A Comparative Assessment.** *Christopher Kelly, Andrew Wozniak, Emma Leaseburg, Pamela Edris, Kari St. Laurent, Sasha Wagner, Alina Ebling*
- 25 **Bethany Kline**, DNREC Division of Climate, Coastal and Energy, DNERR **Optimizing Percent Recovery of Microbeads in Sand.** *Bethany Kline and Kari St. Laurent*
- 26 **Emma Leaseburg**, University of Delaware **The Influence of Biochar Amended Thin Layer Placements on Denitrification Potentials across Marsh Vegetation Zones.** *Emma Leaseburg, Jennifer Biddle, Charles Schutte, Kari St. Laurent, Andrew Wozniak*
- 27 **Juan Ignacio Martinez**, The George Washington University **Seed Production and Investment Along a Salinity Gradient in the Eastern Shore of the United States: Species Specific Responses.** *Juan Ignacio Martinez and Keryn Gedan*
- 28 **Michael Mensinger**, DNREC Division of Climate, Coastal and Energy, DNERR **Monitoring Nekton Biodiversity at the Delaware National Estuarine Research Reserve.** *Michael G. Mensinger and Drew Faulhaber*

## Professional Posters Continued

- 29 **Faelyn Meyers**, New Jersey Department of Environmental Protection  
NJDEP Wetland Mitigation Tech Manual. *Faelyn Meyers*
- 30 **Ali Parsaeimehr**, Delaware State University  
Multiplex Detection of *Vibrio* Species in *Crassostrea virginica* and *Callinectes sapidus*. *Ali Parsaeimehr and Gulnihal Ozbay*
- 31 **Robert Petrillo**, McCormick Taylor  
Diamondback Terrapin (*Malaclemys terrapin*) mortality mitigation efforts in NJ. *Robert Petrillo*
- 32 **Dannielle Pratt**, University of Delaware  
Coastal Drought Drives Salinization of Groundwater Along the Marsh-upland Boundary on the Delmarva Peninsula. *Dannielle Pratt, Eva Snell Bacmeister, Julia Guimond, Holly A. Michael*
- 33 **Sam Robinson**, DNREC Division of Fish and Wildlife  
Results from Banding Delaware Piping Plovers at Cape Henlopen State Park and Fowler Beach, Prime Hook National Wildlife Refuge. *Sam Robinson, Erin Betancourt, Susan Guiteras, Hen Bellman, Shawn Sullivan and Kat Christie*
- 34 **Matthew Sena**, University of Delaware  
Temporal Patterns of Ammonium Concentrations in Anoxic Riparian Sediments Upstream of Milldams. *Matthew Sena*
- 35 **Christina Whiteman**, DNREC Division of Climate, Coastal and Energy, Coastal Programs  
Sounds of the Reserve: Developing a Soundscape Ecology Program at the Delaware National Estuarine Research Reserve. *Christina Whiteman*
- 36 **Elizabeth Whitney**, University of Delaware and DNERR  
Alkalinity Trends in Blackbird Creek and St. Jones River. *Elizabeth V. Whitney, Yu-Ping Chin*

## Join in on the Celebration! 10th Anniversary Activities

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Wow—20 years since our first Delaware Wetlands Conference. This biennial event has become more than we ever imagined. Help us celebrate this moment by visiting our Anniversary Activities area in the Lobby of the Chase Center on the Riverfront. Supplies are provided at each activity.

### Paint-by-Number

You don't have to be a trained artist to create this masterpiece. Grab a paint pen and fill in a small section of our wetland artwork. Critters, shoreline, blue skies—pick any part you'd like to paint. After the conference concludes, our staff is hanging this commemorative artwork in the DNREC Division of Watershed Stewardship office in Dover, Delaware.

### Wetland Word Search

Put those eyes to the test and see if you can spot the words in this old-school activity. Look for over 70 wetland-related words and give them a circle once found. Please, only one word per person, as we want all attendees to have a chance to participate.



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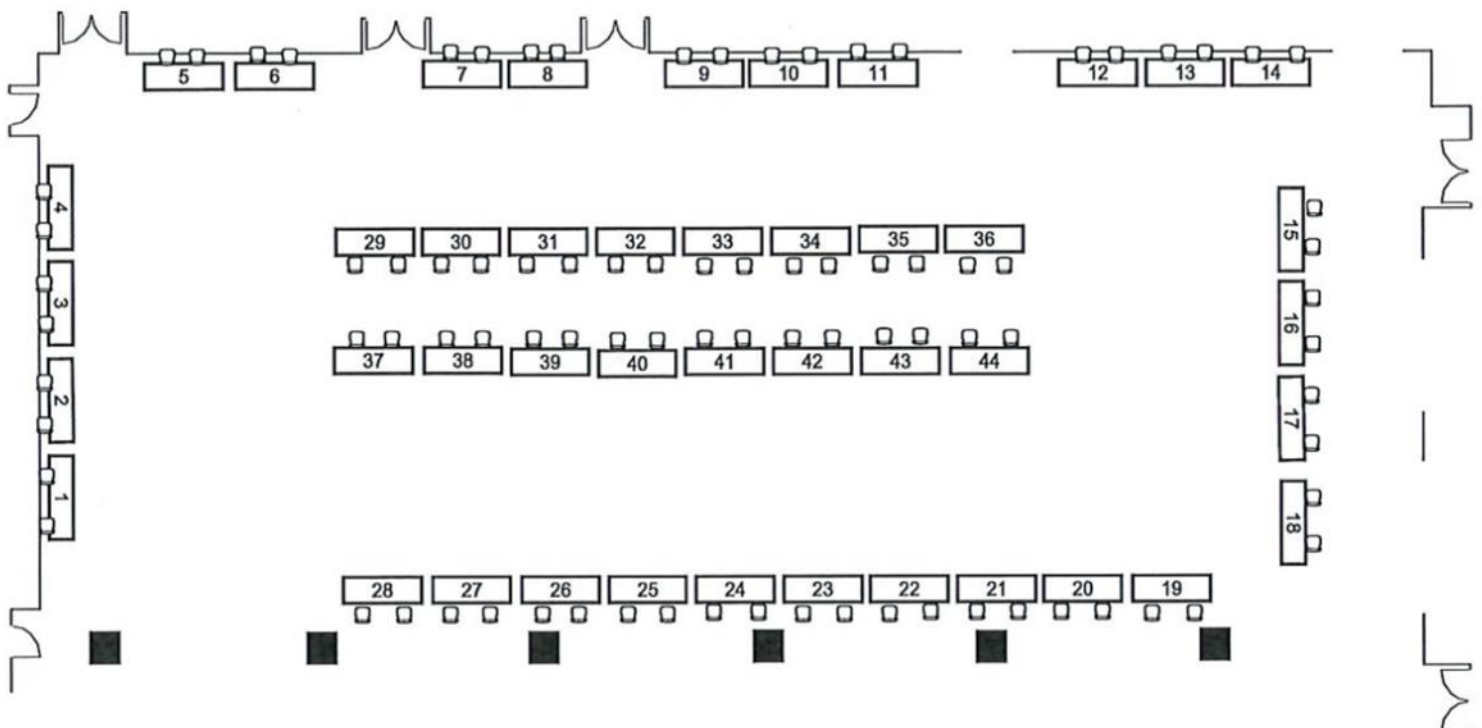
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# Exhibitors and Map

Organizations in bold are sponsors

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|----------------------------------------------|----------------------------------------------------------------------------|
| 1 Century Engineering, A Kleinfelder Company | 25 BioApp                                                                  |
| 2 Greenman-Pedersen, Inc. (GPI)              | 26 Delaware Center for the Inland Bays                                     |
| 3 New Moon Nursery                           | 27 Johnson, Mirmiran, & Thompson, Inc (JMT)                                |
| 4 Anchor QEA, LLC                            | 28 Riparia Center, Penn State University                                   |
| 5 DuBois & Associates, LLC                   | 29 Ecofabriks                                                              |
| 6 Pinelands Nursery & Supply                 | 30 North Creek Nurseries                                                   |
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| 20 Octoraro Native Plant Nursery             | 44 DNREC Wetland Monitoring and Assessment Program                         |
| 21 Flexamat                                  |                                                                            |
| 22 Restore America's Estuaries               |                                                                            |
| 23 RK&K                                      |                                                                            |
| 24 Delmarva Native Plants                    |                                                                            |







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