

HEALTHY COASTAL ECOSYSTEMS

IMPACTS

S.C. Sea Grant Consortium Co-Organizes Grand Strand Regional Stormwater Pond Management Conference

April Turner and Brooke Saari, S.C. Sea Grant Consortium

Recap: S.C. Sea Grant Consortium co-organized a pond management conference, providing training and technical assistance to build capacity and inform more than 150 stormwater professionals, homeowners, and local government officials and staff in Myrtle Beach, S.C. Conference planning for 2021 is underway for Beaufort County and the greater Charleston area coastal communities.

Relevance: Stormwater ponds are the most common structural best management practice for regulating stormwater runoff in the highly developed areas of coastal S.C. Ponds play a significant role in watershed function, providing for flood management and pollution mitigation; they also are regarded as amenities. Without regular inspections and proper maintenance, ponds can be transformed from pollutant sinks to pollutant sources, having implications for downstream ecosystem and human health.

Response: The Consortium co-organized a regional pond conference in February 2020, extending the latest stormwater pond scientific information, resources, and tools to public- and private-sector pond managers and owners. The goals were to: increase awareness of the purpose of ponds and their need for regular maintenance; provide information and tools to overcome common challenges in pond management; and integrate pond owner and pond manager audiences with service providers to assist with inspections and management actions.

Results: Over 150 participants attended the conference. The event was an opportunity for participants to hear from local and regional experts, interact with organizations and businesses in the pond management industry, and receive valuable information and continuing education credits. The Consortium's effort for this conference is estimated to have provided an economic benefit of \$13,279 based on the provision of continuing education credits at a discounted rate, registration fees, travel costs, and opportunity costs of time.

Partners: Clemson University Cooperative Extension; Georgetown County, S.C.; Horry County; North Inlet-Winyah Bay National Estuarine Research Reserve (US DOC, NOAA, NOS, NERRS); Myrtle Beach, S.C.; Coastal Waccamaw Stormwater Education Consortium

S.C. Sea Grant Consortium Co-Organizes Regional Grand Strand Healthy Pond Series

Brooke Saari, S.C. Sea Grant Consortium

Recap: The S.C. Sea Grant Consortium played an essential role in planning and organizing the Grand Strand and North Coast Healthy Pond Series in September and December of 2020.

Relevance: In South Carolina, stormwater ponds are the most common structural best management practice for regulating stormwater runoff, particularly in coastal areas where development rates are high. Despite their benefits,

they create a unique set of management issues without proper maintenance. Some of the most common barriers to pond maintenance include lack of awareness of responsibility, misinformation on best management techniques, and financial costs. These needs did not diminish during COVID-19, leading to virtual-based Programming opportunities.

Response: The Consortium, along with Partners, organized and implemented a regional virtual stormwater pond education series called the Grand Strand Healthy Pond Series. A total of four interactive webinars, two of which were during this reporting period, focused on extending the latest stormwater pond scientific information, resources, guidance, and tools to pond managers and owners. The goal of the webinars was to create an opportunity for pond owners to learn about and share pond management techniques.

Results: A post-event survey (23% response rate) revealed respondents increased knowledge (92%) and indicated they learned something new (85%). Participant feedback showed that attending these events was a good use of their time (92%) and indicated excitement over upcoming opportunities. The planning, organization, and administration provided by the Consortium for the 2020 Grand Strand and North Coast Healthy Pond Series is estimated to have provided an economic benefit of \$965 based on opportunity costs of time.

Partners: Clemson University; University of South Carolina (USC); North Inlet-Winyah Bay National Estuarine Research Reserve (US DOC, NOAA, NOS, NERRS)

ACCOMPLISHMENTS

S.C. Sea Grant Consortium Researchers Analyze Impacts of Development on Estuarine Habitat Quality

Andrew Tweel and Denise Sanger, S.C. Department of Natural Resources

Recap: S.C. Sea Grant research has demonstrated that there are significant positive relationships between various metrics of sediment contamination (ERMQ) and development intensity, precipitation amount, and temperature. While the correlation to development intensity is fairly well documented, the potential compounding effect that increases in temperature and/or precipitation may have may exacerbate this relationship, leading to increases in contamination at already-impacted sites or an increase in the proportion of sites identified as impacted.

Relevance: Preliminary analysis of several long-term environmental datasets reveals that high-density development increases sediment toxicity and degrades water quality but does not seem to significantly impact benthic communities. As coastal populations continue to grow, increasing stress is placed on downstream ecosystems. These relationships between watershed land use and estuarine quality have been quantified at a variety of spatial scales and response variables. How these relationships will interact with predicted changes in climate and weather patterns, however, has not been identified. Coastal planners and stormwater managers can utilize this information to design best management practices that account for increases in stormwater runoff, install targeted retrofits of stormwater infrastructure to maximize benefit, and to predict and manage potential decreases in environmental quality before water bodies are classified as impaired.

Response: S.C. Sea Grant Consortium researchers at the S.C. Department of Natural Resources (SCDNR) are synthesizing several long-term environmental monitoring datasets, dating from the 1990s to present. Several databases have been compiled to house water quality, environmental, land-cover, and weather data.

Results: Initial water quality data demonstrated that some indicators, such as fecal coliform bacteria, are responsive to short-term precipitation patterns, while other indicators, such as sediment contamination, are more strongly correlated to seasonal-level precipitation patterns. Predictive modeling tools pointed to a decline in the overall quality of the estuarine environment under climate change and population growth.

Partners: Carolina's Integrated Sciences and Assessment Center; National Oceanic and Atmospheric Administration (US DOC, NOAA)

Urban Stormwater Runoff as a Source of Microplastic and Tire Wear Particles in Coastal Waterways: Transport, Cumulative Impacts to Biota, and Mitigation

Peter van den Hurk, Clemson University

John Weinstein, The Citadel

Barbara Beckingham, College of Charleston

Recap: Consortium researchers have begun characterizing the role of stormwater runoff as a pathway of microplastic entry into our coastal waterways, hoping to inform policy and management decisions that minimize the environmental and economic impacts of this type of debris in the future

Relevance: Marine plastic debris is considered to be a top environmental problem, and an emerging global issue that may affect our ability to conserve biological diversity and maintain ecological interrelationships. In 2014, a comprehensive survey of the occurrence of microplastic particles in Charleston Harbor was conducted and the most common type was found to be black fragments from tire-wear particles produced through the abrasion of tires on road surfaces.

Response: S.C. Sea Grant Consortium researchers are characterizing the cumulative effects of microplastics, including tire particles, with their associated toxic chemicals on keystone estuarine organisms in stormwater detention ponds and salt marsh-tidal creek systems.

Results: Field monitoring locations for both stormwater pond and storm sewer inlet devices were identified and visited in coordination with the Town of Mt. Pleasant Stormwater Division. Laboratory work has included optimization of sediment processing methods and also chronic toxicological assessments with a vertebrate model.

Partners: Crystalstream Technologies; Town Of Mount Pleasant Stormwater Program

S.C. Sea Grant Researchers Measuring Marsh Sensitivity to Increased Flow and Sea Level Rise

Thomas O'Halloran, Clemson University

Erik Smith, University of South Carolina

Recap: Measuring marsh productivity and sensitivity related to environmental drivers is essential to understanding how salt marshes will respond to future changes in sea level. S.C. Sea Grant research will inform models on how marshes build vertical elevation that allows them to adapt to sea level rise.

Relevance: Along the Southeast U.S., intertidal salt marshes represent a critical habitat at the interface of the terrestrial and marine environments, performing a variety of ecological functions and services that make them of great economic importance for coastal communities. Salt marshes stabilize the shoreline and represent the first

line of defense against flood and storm events, and they provide essential fish and shellfish habitat. However, the ability of intertidal marshes to maintain their elevation and persist in the face of rising sea level is dependent on relationships between tidal inundation, plant growth, and accretion of organic matter and sediments. Measuring marsh productivity and sensitivity related to environmental drivers is essential to understanding how salt marshes will respond to future environmental and man-made stressors.

Response: To enable better prediction, S.C. Sea Grant Consortium researchers are measuring marsh production from tidal to seasonal time- scales. This information is essential to determining the importance of future physical changes on South Carolina's coastal ecosystems due to increased variability in freshwater flow and sea level rise. In particular, project results will lead to the improvement of models that forecast salt marsh responses to changes in sea level.

Results: Researchers have had success collecting significant data on salt marsh production and related environmental drivers. Additionally, a network of instrumented towers was erected to facilitate synthesis and modeling analyses that advance carbon cycle science. Pending final analysis of results, soil flux and photosynthesis measurements will inform models on how marshes build vertical elevation that allows them to adapt to sea level rise.

Partners: Bryn Mawr College; Marine Biological Laboratory (MBL, WHOI); University of Georgia (UGA); Rutgers University

S.C. Sea Grant Consortium Stormwater Ponds in Coastal South Carolina: State of Knowledge Report is Valuable Resource for Pond Managers and Residents

Brooke Saari, S.C. Sea Grant Consortium

Recap: Since publication in 2019, the Stormwater Ponds in Coastal South Carolina: State of Knowledge Full Report and Executive Summary continue to be useful and valued resources for South Carolina researchers, natural resource decision-makers, pond managers, and residents.

Relevance: More than 9,000 residential stormwater ponds in the eight coastal counties of South Carolina are providing numerous benefits, including control of stormwater runoff and improvement of water quality. In order to maintain and enhance the functionality of stormwater ponds, coastal residents, stormwater managers, and researchers need to have access to the most relevant information, tools, and resources in order to make sound management decisions, communicate their efforts, and inform sustainable behaviors.

Response: The S.C. Sea Grant Consortium coordinated the effort to develop the Stormwater Ponds in Coastal South Carolina: State of Knowledge Full Report, published in 2019, and the Executive Summary, published in 2018. Since publication, the full report and the executive summary serve as outreach products to improve knowledge regarding stormwater ponds.

Results: The executive summary of the report was provided to various audiences since publication in 2018, with more than 300 hard copies distributed and 171 digital copies downloaded (51 downloads this past year). The full report, published in 2019, has been accessed online 325 times, and the PDF was downloaded 113 times. These products also have been used and distributed by other extension and outreach organizations, such as Clemson Extension and the Ashley Cooper Stormwater Education Consortium.

S.C. Sea Grant Consortium Develops New Coastal Environmental Quality Extension Advisory Committee

Brooke Saari, S.C. Sea Grant Consortium

Recap: The S.C. Sea Grant Consortium (Consortium) continues to build capacity and external Partnerships through establishment of the Coastal Environmental Quality (CEQ) Extension Advisory Committee.

Relevance: In April 2020, the Consortium hired a CEQ Program specialist to establish a sustainable extension Program within the Healthy Coastal Ecosystems Programmatic focus area and to address issues related to stormwater within South Carolina. Building a successful extension Program requires inclusive and constructive collaboration with Partners throughout the state to enhance reach into the important communities served.

Response: In August 2020, the Consortium convened the first CEQ Extension Advisory Committee meeting. The purpose of the committee is to discuss and identify current issues impacting coastal natural resources and the communities dependent upon them, and assisting with the formulation of solutions to address the identified needs of constituents developed through strategic planning priorities. Several relevant stakeholder groups with an interest in healthy coastal ecosystems participated, resulting in a committee of nine Partners.

Results: Feedback was gathered on priority updates to the Consortium's strategic plan and CEQ focus areas. Three CEQ Program focus areas were created as a result of this input: stormwater, water quality, and environmental health. Input is continually sought to build and support Programming efforts as this Program area gains momentum.

S.C. Sea Grant Consortium Participates in South Carolina Harmful Algal Bloom Network

Brooke Saari, S.C. Sea Grant Consortium

Recap: The mission of the South Carolina Harmful Algal Bloom Network (SC HABNet) is to create a network of agencies with environmental, human health, or wildlife resource management responsibilities and universities conducting research relevant to harmful algal bloom (HAB)-associated subjects. The purpose of the group is the sharing of expertise and resources between members to encourage collaboration and coordination of existing activities. The Consortium serves on this task force and contributes to the coordination, outreach, and branding.

Relevance: Harmful algal blooms (HABs) result from the rapid growth of potentially harmful algae and are found in fresh, brackish, and saltwater ecosystems. These HABs can produce toxins that could be harmful to people, animals, and local ecology. The South Carolina Harmful Algal Bloom Network was reinvigorated, carrying on a previous effort from 1997-2005, and brought members back together to encourage collaboration on HAB response and education.

Response: The Consortium joined the South Carolina Harmful Algal Bloom Network and helped to coordinate branding, website content discussions, and educational efforts. The Consortium is involved with the outreach committee and has created a logo for the Network, along with providing education Program design input.

Results: The Consortium's Coastal Environmental Quality Program specialist and web developer/graphic designer led the effort to design a new logo to represent the South Carolina Harmful Algal Bloom Network (SC HABNet), and these two staff continue to move forward with initiating identity and branding efforts. The staff also served on the website design and content team through their participation in the outreach committee.

Partners: South Carolina Department of Health and Environmental Control (SC DHEC); South Carolina Department of Natural Resources (SC DNR); Clemson University; Coastal Carolina University (CCU); Medical University of South Carolina (MUSC); University of South Carolina (USC); Belle W. Baruch Institute for Marine and Coastal Science; US Geological Survey (US DOI, USGS); Clemson University Cooperative Extension; National Oceanic and Atmospheric Administration (US DOC, NOAA)

S.C. Sea Grant Consortium Develops Methods to Document Ecosystem Service Benefits of Beaches and Barrier Islands

Matt Gorstein, S.C. Sea Grant Consortium

Recap: An outreach document and methods appendix to document the economic benefits of beaches and barrier islands in South Carolina were both drafted and reviewed by external experts

Relevance: South Carolina's beaches and barrier islands, including beaches, dunes, and wetlands produce a wide variety of benefits, contributing to the culture, lifestyle, and well-being of its residents. South Carolina's beaches and barrier islands provide its residents and visitors with jobs, recreational opportunities, coastal protection, critical habitat for bird and turtle species, and aesthetic beauty, among other ecosystem services.

Response: An investigation of existing data and literature was conducted to better characterize the estimated economic benefits of South Carolina's beaches and barrier islands, including both market and non-market benefits. Ecosystem service valuation studies are selected for benefit transfer based on the appropriateness of the estimate(s) for South Carolina. Employing this method allows us to utilize an ecosystem service framework to estimate the economic benefits of beaches and barrier islands in South Carolina, at statewide scale.

Results: The Consortium was able to estimate value ranges for the following ecosystem services provided by beaches and barrier islands in South Carolina: Recreation (\$1.52 billion - \$3.09 billion per year); coastal protection provided by wetlands (\$329 million - \$447 million per year); carbon storage (\$1.72 million - \$5.12 million per year); water quality protection (\$66.54 million - \$83.08 million per year); water supply protection (\$4.21 million - \$5.33 million per year); and the presence of sea turtle habitat (\$8.80 million - \$12.55 million per year).