



2018-2019 IMPACTS AND ACCOMPLISHMENTS

HEALTHY COASTAL ECOSYSTEMS

ACCOMPLISHMENTS

S.C. Sea Grant Consortium Publishes Executive Summary of its 2018 State of Knowledge Report Stormwater Ponds in Coastal South Carolina

M. Richard DeVoe and Hamed Majidzadeh, S.C. Sea Grant Consortium

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 by trapping sediment and nutrient loadings from surface waters. In order to maintain and enhance the functionality of the stormwater ponds, which are the primary stormwater best management practices used in residential developments, we need to ensure that our coastal residents, stormwater managers, and researchers have access to the most recent relevant information, tools, and resources needed to make sound management decisions, communicate their efforts, and inform sustainable behaviors.

The S.C. Sea Grant Consortium brought together 22 researchers from six of the Consortium's member institutions to develop a current state of knowledge (SOK) regarding stormwater ponds in South Carolina. The SOK, which was supported with funding from Sea Grant and from South Carolina appropriations, includes an updated inventory of existing ponds, a comprehensive literature review, and recommendations for enhancing public awareness and outreach, and it offers a listing of knowledge gaps regarding stormwater ponds in South Carolina. The executive summary provides a summary of findings from the comprehensive report, which can be used as a stand-alone outreach product to improve public knowledge regarding stormwater ponds.

The executive summary was provided to audiences, including homeowners association representatives, researchers, and resource managers, at several regional conferences related to stormwater ponds; more than 300 copies have been distributed. This product has been used by other extension and outreach organizations such as Clemson Extension and the Ashley Cooper Stormwater Education Consortium. The online version of the executive summary has been downloaded more than 120 times.

S.C. Sea Grant Consortium Researchers Update the Inventory of Stormwater Ponds in Coastal South Carolina for Use by Scientists and Decision-makers

M. Richard DeVoe and Hamed Majidzadeh, S.C. Sea Grant Consortium

Stormwater ponds are the most commonly used best management practices in the coastal region of South Carolina. Given continued high rates of coastal development, previous estimates of pond numbers and locations were outdated, leading to a potentially large underestimate of the current inventory of coastal ponds. In addition, previous estimates of coastal ponds implicitly assumed all ponds identified in aerial imagery were constructed expressly for the purposes of stormwater control and could thus be classified as stormwater ponds. This has likely skewed estimates of the number of true stormwater ponds, given the known popularity of recreational fishing ponds along the coast of South Carolina as well as the prevalence of agricultural irrigation ponds in the western portion of some of the state's coastal counties.

In October 2014, the S.C. Sea Grant Consortium initiated the Stormwater Ponds Research and Management Collaborative (Collaborative), an effort that gathered scientists and resource managers to investigate and address the challenges associated with these systems. One of the first projects conducted through the Collaborative was to perform a detailed update of the current inventory of stormwater ponds in the eight coastal counties of South Carolina. This project was supported with funding from Sea Grant and from South Carolina appropriations, and involved a collaboration among the University of South Carolina, North Inlet-Winyah Bay National Estuarine Research Reserve, S.C. Department of Natural Resources, and ACE Basin National Estuarine Research Reserve.

The updated inventory was completed for use by stakeholders in 2018. GIS files of the updated inventory have been shared with the scientific community and decision-makers upon their request through S.C. Sea Grant Consortium. Indeed, this updated inventory has been the foundation of three research studies at Clemson University, University of South Carolina, and Coastal Carolina University, respectively. In addition, the city of North Charleston updated its inventory of stormwater facilities using these GIS files. This updated inventory is now being used in a Consortium-funded project to develop a tool to predict impacts of sea level rise on the functionality of stormwater ponds.

Regional Stormwater Pond Conference Held to Update Stakeholders on Stormwater Pond Management Co-organized by S.C. Sea Grant Consortium

Hamed Majidzadeh, S.C. Sea Grant Consortium

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. Stormwater pond systems can play a significant role in watershed function, providing for flood management, pollution mitigation, and other amenities to communities. They also create a unique set of management issues if not properly managed, especially as they age. Without regular inspections and proper maintenance, stormwater ponds can be transformed from pollutant sinks to pollutant sources, having implications for the downstream ecosystem and human health.

Some of the most common barriers to pond maintenance include lack of awareness of responsibility, misinformation on best management techniques, and financial costs. S.C. Sea Grant Consortium, along with several partners, responded by co-organizing and co-leading a regional pond conference in Charleston on November 14, 2018, extending the latest scientific information on stormwater ponds to public- and private-sector pond managers and owners in an effort to encourage and promote proper pond maintenance. The event was intended to increase awareness as to the purpose of ponds and their need for regular maintenance, provide information and tools to overcome common challenges in pond management, and integrate pond owners and pond managers with service providers to assist in inspections and management actions.

One hundred and thirty (130) participants, including community and property association representatives, pond management professionals, and stormwater management professionals (private and public sector), 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 resource information and continuing education credits.

Coastal pond research, pond inspection and maintenance, integrated weed management, shoreline and upland management, capital reserves planning, and wildlife control were among the topics addressed. Conference evaluations indicated 96% of participants increased their knowledge of ponds/pond management as a result of the training offered, and 92% said they learned something new to apply in their future work. Overall, participant feedback revealed that attending this event was a good use of their time (100%).

S.C. Sea Grant Consortium Examines Coastal Water Quality Response to Increasing Nitrogen Inputs

James Pinckney and Erik Smith, University of South Carolina

In the Southeast U.S. region, nitrogen is typically the nutrient that controls primary production in estuaries. Excessive nitrogen inputs from anthropogenic sources have been identified as contributing to a general decline in related water quality, including hypoxia, anoxia, fish kills, and harmful algal blooms. Concerns about this decline have led to development of targets for pollution reduction that are meant to ensure a minimum level of acceptable water quality for both ecosystem and public health.

Researchers from the University of South Carolina (USC) Baruch Institute met with staff from the S.C. Department of Health and Environmental Control (SCDHEC) Bureau of Water to discuss the agency's priority research needs and select sites in Winyah Bay and North Inlet for sampling. SCDHEC agreed to provide phytoplankton from their summer surveys to the USC researchers, who quantified nutrient responses of different algal groups (diatoms, cyanobacteria, etc.) and calculated nitrogen uptake rates of the samples. Preliminary results demonstrate that planktonic diatoms were the algae most responsive to elevated nitrogen inputs, though no obvious significant changes to community composition were observed.

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

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. 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. Researchers have had success collecting significant data on salt marsh production and related environmental drivers.

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

Andrew Tweel & Denise Sanger, S.C. Department of Natural Resources Marine Resources Research Institute

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 predict and manage potential decreases in environmental quality before water bodies are classified as impaired. 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. Preliminary analysis identified high density development with a positive correlation to sediment toxicity and degraded water quality, and a negative correlation to benthic community integrity.

Consortium Leads Long Branch Creek Watershed Restoration Team in Growing Support for Project

Susan Lovelace, S.C. Sea Grant Consortium

The S.C. Sea Grant Consortium continues to gain support for using a holistic approach to restore a wide range of ecosystem services to the Long Branch Creek Watershed. Most recently the group received the support of the West Ashley Revitalization Commission, which includes members of city and county councils, the Charleston mayor, and other leaders. The commission supports this project because it meets many of the objectives of the Plan for West Ashley (also known as the West Ashley revitalization plan, the West Ashley area being that part of Charleston west of the Ashley River).

Specifically, this project will address these aspects of the plan: protect and heal natural resources, encourage green infrastructure, and provide high-quality, useful, convenient open spaces. The principles in the project continue to engage policy-makers and residents as they look for resources for the planning and restoration. Previously, the group gained the support of the City of Charleston, Charleston County, and Pulte Homes, a developer whose property abuts the northwestern edge of the creek.

S.C. Sea Grant Consortium Researchers Test the Use of Benthic Microalgae as Indicators of Estuarine Health

Craig Plante, College of Charleston

Coastal waters support high biodiversity and provide myriad goods and services, yet they are sensitive to a variety of human activities. Assessment of environmental integrity of marine and estuarine environments is central to successful management, and numerous protocols have been devised for this purpose. Though benthic macroinvertebrates are the standard bioindicator, benthic microalgae (BMA) are emerging as promising indicators of estuarine health for several reasons. Changes in community structure are relevant because they are key primary producers in estuarine food webs. Modern molecular approaches promise to be less expensive and relatively simple for microbial community analysis.

S.C. Sea Grant Consortium researchers at the College of Charleston are attempting to understand spatial and environmental influences on BMA community structure and biogeography as key considerations in assessing the organism's usefulness as an estuarine health indicator. Sampling on four barrier islands allowed for analysis of sediment characteristics, BMA biomass, and community composition.

These analyses showed that diatom communities differed on nearby islands and were dispersal-limited, suggesting that using related community structure as an indicator of environmental condition over regional (or larger) scales is unfeasible. Results did show, however, that certain environmental factors (sediment salinity, median grain size, phosphate, etc.) were significant indicators of environmental condition, so using species-level indicators may be feasible. Further studies will tease out associations between individual species and specific environmental factors.

S.C. Sea Grant Consortium Moderates NOAA Listening Session Featuring Rear Adm. Gallaudet

M. Richard DeVoe, S.C. Sea Grant Consortium

On October 22, 2018, the National Oceanic and Atmospheric Administration (NOAA) hosted a town hall in Charleston, S.C., featuring Rear Adm. Timothy Gallaudet, Acting NOAA Administrator, to solicit stakeholder input regarding implementation of the U.S. Department of Commerce 2018-2022 Strategic Plan and NOAA's "blue economy" interests, including advancing innovation, strengthening domestic commerce and increasing U.S. exports. The S.C. Sea Grant Consortium's Executive Director was invited to serve as the session moderator. In addition to Rear Adm. Gallaudet, the listening session panel included Dr. James Morris, NOAA National Centers for Coastal Ocean Science marine ecologist; Dr. Leslie Sautter, College of Charleston geology professor; Debra Hernandez, Southeast Coastal Ocean Observing Regional Association executive director; Dr. Mark Hamaan, SmartState Endowed Chair of Drug Discovery and Biomedical Sciences at the Medical University of South Carolina; Mark Wilbert, City of Charleston Chief Resilience Officer; and Dr. Albert George, S.C. Aquarium conservation director. The NOAA traveling team included Kevin Wheeler, NOAA Deputy Chief of Staff, and Charles "Kolo" Rathburn, Department of Commerce Office of Legislative Affairs. More than 150 people attended; much of the input

received from attendees focused on concerns regarding offshore oil and gas development in the South Atlantic Bight.

S.C. Sea Grant Consortium-organized Plenary Panel at Oceans'18 Sheds Light on Regional and Local Resilience Challenges

M. Richard DeVoe, S.C. Sea Grant Consortium

The Oceans Conference and Exposition events, led by the Oceanic Engineering Society-IEEE and the Marine Technology Society, are held twice per year throughout the world. In October 2018, OCEANS 2018 Charleston brought together more than 1,500 of the world's leading marine professionals in an active coastal setting to network, collaborate, and learn about cutting-edge research, innovations, technologies, and applications in the marine technology and engineering fields. In addition to serving as co-chair of the technical committee, the Consortium's Executive Director organized one of the conference's four plenary panel discussions entitled "Designing for Change: Addressing Regional and Local Coastal Resilience Challenges."

The panel engaged in conversation and dialogue to identify and address the resilience challenges facing our society at the regional and local level due to a rapidly changing weather and climate environment. Moderated by Dr. Paul Sandifer, director of the Center for Coastal Environmental and Human Health at the College of Charleston, the panelists included Dr. Anne D. Cope, senior vice president for research and chief engineer at Insurance Institute for Business & Home Safety; Rear Adm. Ann C. Phillips, United States Navy (Retired), member of the advisory board for the Center for Climate and Security; Joseph P. Riley, Jr., professor of American Government and Public Policy at The Citadel and executive in residence at the Joseph P. Riley, Jr. Center for Livable Communities at the College of Charleston; David E. Rivers, director of public information and community outreach at the Medical University of South Carolina; and Mark J. Wilbert, chief resilience officer for the City of Charleston.

Panelists described the work of their organizations, the issues on which they are focused, and ideas for the future which may bring us to a more resilient place.