



SOUTH CAROLINA SEA GRANT CONSORTIUM
~ 2015-2016 IMPACTS AND ACCOMPLISHMENTS ~

SUSTAINABLE COASTAL DEVELOPMENT AND ECONOMY

IMPACTS

S.C. Sea Grant Consortium research evaluating wetland function supports community low impact development decision-making

Drs. Daniel Hitchcock, David White, and Anand Jayakaran, Clemson University

Relevance: While ponds have been the standard practice for stormwater management in the region, stormwater control measures (SCMs) that include vegetation-based practices are becoming more common. Low impact development (LID) practices are increasing in use for site design in coastal South Carolina. Properly sited, selected, and designed SCMs that incorporate vegetation into system design for water quality improvement can complement or replace ponds in the stormwater treatment train while also enhancing the managed landscape. In coastal areas with shallow water tables and low gradient topography, surface and groundwater coupling complicates decision-making with respect to low-impact development (LID) and stormwater management. Groundwater-surface water interactions are not appropriately considered in the stormwater management practice siting, selection, and design process.

Response: S.C. Sea Grant Consortium researchers at Clemson University continued investigating the ecohydrological function of natural and engineered wetland systems for stormwater quantity and quality management in lower coastal plain landscapes typified by shallow water tables and seasonally high evapotranspiration rates.

Results: Building on prior work developing best management practices (BMP) design and siting criteria, researchers designed a stormwater wetland as part of the new Murrells Inlet Watershed Plan. Also based on BMP siting and selection guidelines, a new bioretention system has been designed for the city of Myrtle Beach in partnership with the landscape architectural firm TruDesign, Inc. Researchers also developed a geospatial LID suitability index with information layers that indicate appropriate sites for wetland (retention-based) versus bioretention (infiltration-based) systems in Georgetown County. Based on the Coastal SC LID Manual and SCDHEC BMP Manual siting criteria, this exercise demonstrated that for Georgetown County – given its soils, low gradient topography, and shallow water table conditions – a larger percentage of land area favors wetland LID systems over bioretention systems.

Recap: S.C. Sea Grant Consortium-supported research at Clemson University led to design of a stormwater wetland as part of the Murrells Inlet Watershed Plan and a new bioretention system for the city of Myrtle Beach. Researchers also developed a geospatial LID suitability index tool that differentiates sites best-suited for wetland versus bioretention systems in Georgetown County. The tool will be adapted for use in other South Carolina counties.



ACCOMPLISHMENTS

S.C. Sea Grant Consortium builds foundation for statewide stormwater pond research and management

M. Richard (Rick) DeVoe, S.C. Sea Grant Consortium

The S.C. Sea Grant Consortium created the S.C. Stormwater Pond Research and Management Collaborative in 2014 to (1) satisfy the information needs and concerns of existing local communities, homeowners' associations, businesses, and industries surrounding stormwater pond design, ecology, efficiency, effectiveness, and management, (2) characterize coastal stormwater ponds to understand their functionality, durability, benefits, and costs, and (3) ultimately develop new and innovative engineering and construction practices to ensure current and future stormwater ponds function without concerns about possible ecological impacts or additional economic costs associated with their management and maintenance. Initial activities, conducted by Consortium staff and member institutions scientists and students and supported with funding provided by the National Sea Grant Office and the State of South Carolina, included the development of an inventory and classification of existing stormwater ponds in the eight coastal counties; (2) a State of the Knowledge Report, which synthesizes current knowledge regarding stormwater ponds within the state's coastal area and; (3) a strategy for public awareness and outreach messaging, all of which will be completed in 2016.

S.C. Sea Grant Consortium promotes multi-disciplinary and collaborative research for stormwater ponds

Dr. Melody Hunt and M. Richard (Rick) DeVoe, S.C. Sea Grant Consortium

The S.C. Sea Grant Consortium developed the SC Stormwater Pond Research and Management Collaborative (Collaborative) to investigate and address the challenges and identify information needs associated with stormwater ponds in coastal SC. To facilitate collaborative efforts and promote multidisciplinary research among the collaborators, the Consortium hosted three science/extension workshops in the Charleston area in 2015 (April 14, August 26, and October 30). Each workshop drew 25-30 people. To guide the activities of the Collaborative, the Consortium created a Stormwater Pond Advisory Council (SPAC) with members representing stormwater managers and consultants, stormwater pond practitioners, realtors, government representatives, and scientists. Members of the SPAC participated in the October workshop and provided further practical input and direction to the researchers. The Consortium's coastal environmental quality program manager also made presentations at three statewide events - Stormwater Pond Conference in Beaufort (100 attendees); the Coastal Waccamaw Stormwater Education Consortium meeting in Myrtle Beach (~25 attendees), and the S.C. Association of Stormwater Managers quarterly meeting in Columbia (100 attendees) – describing the Collaborative and educating audiences about on-going efforts.

S.C. Sea Grant Consortium researchers test hydrology and pollutant removal performance in coastal plain detention ponds

Dr. Erik Smith, University of South Carolina, and Dr. Richard Peterson, Coastal Carolina University

Stormwater ponds, especially detention ponds, are by far the most common best management practice (BMP) for controlling stormwater runoff from developed landscapes in coastal South Carolina. S.C. Sea Grant researchers at the University of South Carolina and Coastal Carolina University are conducting an assessment of the hydrologic and water quality control services provided by ponds of the lower coastal plain. Understanding surface and groundwater inputs is essential to assist coastal communities in



managing stormwater and to preserve vital coastal water quality and aquatic resources. In consultation with Horry County stormwater management personnel, two ponds were selected for sampling during the first phase. Initial project results were vetted with local end-user representatives, and a collaborative decision was made to continue sampling in one of the original ponds and to sample a new pond that had a contrasting shape (increased length/width ratio). Nearly continuous records of all parameters required to quantify the complete water budgets for each pond were collected throughout the two-year period. The bathymetry of the second pond was mapped and, when combined with continuous records of water levels, allowed researchers to assess changes in pond volume over time. A total of 31 rain events were sampled in each pond to assess total nutrient load and suspended sediments. Preliminary results indicate pond input source waters had significantly higher mean concentrations of pollutants than did output waters, with the notable exception of *E. coli* concentrations in groundwaters, which were either not significantly different or lower than concentrations in output waters. In general, concentrations of all pollutants were highest in sheetflow runoff samples, followed by piped inflow samples, followed by groundwater samples.

Sea Grant Consortium research generating a geospatial inventory for stormwater ponds in coastal South Carolina

Dr. Erik Smith, University of South Carolina, and Dr. Denise Sanger, S.C. Department of Natural Resources

The S.C. Sea Grant Consortium developed the S.C. Stormwater Pond Research and Management Collaborative to investigate and address the challenges and identify information needs associated with stormwater ponds in the state's coastal counties. A series of studies were initiated to determine the current knowledge and information gaps. Consortium researchers from the University of South Carolina and S.C. Department of Natural Resources is developing a geospatial inventory of the number, size and geographic distribution of stormwater ponds in the eight coastal counties. Ponds were classified based on their surrounding landscape attributes, and evaluations were conducted to determine location of ponds within the coastal landscape and to estimate rates of pond construction. The tool development and results of analyses were documented in the draft report "A Stormwater Pond Inventory for the Eight Coastal Counties of South Carolina." Initial analyses revealed the majority of ponds, and especially those associated with developed landscapes, are situated within one mile of major surface receiving waters. In the southern portion of the state, these development-related ponds are predominantly located in the state coastal zone management Critical Area, with the majority low in elevation and well within one mile of major surface receiving waters. Another initial finding was that in both the greater Charleston region and along the Grand Strand (coastal Georgetown and Horry counties), the total area represented by ponds increased at a rate of more than 4 percent per year between 1994 and 2013. This stormwater pond inventory will be incorporated into the Consortium's VizPort visualization portal tool. It also will be used to provide additional evaluations and inform stormwater pond management needs. After external peer review, the report will be used to complete a state of knowledge report for stormwater ponds in South Carolina to be produced in 2016.

Sea Grant Consortium researchers characterize ecosystem function of stormwater ponds in coastal South Carolina

Drs. Dianne Greenfield and Erik Smith, University of South Carolina; Drs. Andrew Tweel and Denise Sanger, S.C. Department of Natural Resources

The S.C. Sea Grant Consortium developed the S.C. Stormwater Pond Research and Management Collaborative to investigate and address the challenges and identify information needs associated with



coastal stormwater ponds in the state. Consortium scientists from the University of South Carolina and the S.C. Department of Natural Resources reviewed and documented processes and mechanisms that influence the fate and transport of contaminants in stormwater ponds. The information was documented in the draft report “Characterizing the State-of-the-Knowledge of South Carolina Stormwater Detention Ponds: Ecosystem Function within the Coastal Landscape,” which included an annotated bibliography. Recommendations for future research directions include: increasing emphases on nutrient and microbial/algal process-based studies; integration of genomics and molecular tool development and application to understand processes, toxins/exogenous compounds, and species populations; increased research on native and non-native vegetation; and elucidating trophic, pathogenic, and parasitic interactions. The authors further declared an urgent need for research focusing on the impact of further enrichment, climate change, and sea level rise on stormwater ponds across a changing coastal landscape. After external peer review, the report will be used to complete a state of the knowledge report for stormwater ponds in the state to be produced in 2016.

S.C. Sea Grant Consortium research leads to evaluation database of non-point source contaminants for stormwater ponds

Drs. Mohammed Baalousha and Geoffrey Scott, University of South Carolina

The S.C. Sea Grant Consortium developed the S.C. Stormwater Pond Research and Management Collaborative to investigate and address the challenges and identify information needs associated with stormwater ponds in the state’s coastal counties. Consortium researchers from the University of South Carolina performed evaluations to identify the concentrations of metal, organic, and microbial contaminants in stormwater ponds and adjoining tidal creeks throughout coastal areas. The literature was surveyed, and a database was developed from existing sampling studies. Information was extracted from the database for contaminants in surface waters, sediments and tissue used to develop statistical relationships between land-use and the non-point source chemical and microbial contaminant concentrations. Although engineered and constructed primarily to reduce runoff peak discharges and to retain sediment and non-point pollutants, stormwater ponds are increasingly used as amenities by communities, often providing aesthetic value, recreational opportunities, and habitat for wildlife. These additional uses increase the potential for human and wildlife contact with the ponds, and the initial results indicated the potential for environmental and public health risks posed by numerous chemical and microbial contaminants within stormwater ponds should be further evaluated. The results are documented in the draft report “An Assessment of Non-Point Source Contaminants in Stormwater Ponds Systems in South Carolina.” In addition, the report presented a literature review and summary of our knowledge of nanomaterials, which are a class of contaminants of emerging concern (CECs), along with recent retention pond measurements made in North Carolina to highlight the potential effects of CECs. After external peer review, the report will be used to complete a state of the knowledge report for stormwater ponds in the state to be produced in 2016.

S.C. Sea Grant Consortium researchers synthesize the current understanding of contaminants in stormwater ponds

Drs. Vijay Vulava and Barbara Beckingham, College of Charleston

The S.C. Sea Grant Consortium developed the S.C. Stormwater Pond Research and Management Collaborative to investigate and address the challenges and identify information needs associated with stormwater ponds in coastal SC. A series of studies were initiated to characterize the current knowledge and identify information gaps associated with stormwater pond construction and management. Consortium scientists from the College of Charleston reviewed and documented current knowledge



regarding the processes and mechanisms which influence the fate and transport of contaminants in stormwater ponds, including the roles of surface water and groundwater hydrology, environmental geochemical processes, and sediment processes. Research needs specific for the Atlantic Coastal Plain of the U.S. Southeast were identified, and the team concluded that an interdisciplinary approach that includes information on pond location and classification, management actions, and biological function is needed. The information was documented in the draft report “Sources, Fate and Transport of Contaminants in Engineered Stormwater Structures.” The report highlights the need for applied efforts to explore how future climate, precipitation, and evapotranspiration, as well as water balance and flow, may impact the modern South Carolina coastal landscape and its growing number of engineered stormwater ponds. Gaps in general understanding regarding pond design, the nature of contaminants in runoff, and biogeochemical processes in stormwater ponds are also addressed. After external peer review, the report will be used to complete a state of the knowledge report for stormwater ponds in the state to be produced in 2016.

S.C. Sea Grant Consortium researchers evaluate stormwater pond management approaches and costs
Drs. Christopher Mothorpe and Wesley Burnett, College of Charleston

The S.C. Sea Grant Consortium developed the S.C. Stormwater Pond Research and Management Collaborative to investigate and address the challenges and identify information needs associated with coastal stormwater ponds in the state. Consortium researchers from the College of Charleston examined the economic aspects of stormwater pond management. In the draft report “Pond Management Approaches and Costs: An Economic State-of-Knowledge Review and Synthesis,” the researchers presented a review of the economics literature, a stakeholder survey, and a theoretical model to explain the optimal level of stormwater pond management. Results indicate the lack of knowledge regarding stormwater pond maintenance and costs leads to lower annual levels of maintenance. The researchers recognized a great deal of uncertainty related to responsibilities, regulation and compliance enforcement. Given this uncertainty, it was hypothesized South Carolina stormwater ponds are not managed optimally, which may adversely affect the state’s many watersheds and marine ecosystems. After external peer review, the report will be used to complete a state of the knowledge report for stormwater ponds in the state to be produced in 2016.

Sea Grant Consortium analyzes existing laws, policies, and regulations for stormwater pond in coastal South Carolina

Drs. Jeff Allen, Lori Dickes, Donna London, and Katie Buckley, Clemson University

The S.C. Sea Grant Consortium developed the S.C. Stormwater Pond Research and Management Collaborative to investigate and address the challenges and identify information needs associated with coastal stormwater ponds in the state. Consortium researchers from Clemson University documented the policy and regulatory framework for stormwater pond management in South Carolina. An overview of the regulatory framework for stormwater management from the federal and state levels was examined by describing existing laws and policies at these levels. Online surveys and focus groups were used. Initial findings are documented in the draft report “An Assessment of Stormwater Policy, Regulation and Management for the Coastal Counties of South Carolina.” This work was a first step in collaborative efforts to provide information on the effectiveness of stormwater pond management at the local level and how policies and management are integrated up through the state and federal levels. The report will be updated with additional local level policy analyses and, after external peer review, the report will be used to complete a state of the knowledge report for stormwater ponds in the state to be produced in 2016.



S.C. Sea Grant Consortium supporting analysis of outreach efforts to improve stormwater pond maintenance and awareness

Drs. Katie Buckley, Amy Scaroni, Melinda Weathers, and Guinn Wallover, Clemson University

The S.C. Sea Grant Consortium developed the S.C. Stormwater Pond Research and Management Collaborative to investigate and address the challenges and identify information needs associated with stormwater ponds in the state's coastal counties. Consortium researchers and outreach specialists from Clemson University drafted a communication strategy to support improvements in stormwater pond outreach efforts, emphasizing pond awareness and maintenance. While stormwater ponds can provide positive attributes to property owners, such as aesthetic value, wildlife viewing, and recreational opportunities, improper maintenance can lead to degraded water quality, reduced localized flood protection, expensive repairs, and an eyesore for the community. This work, documented in the draft report "Development of a Strategic Outreach Plan to Improve Long-term Stormwater Pond Awareness and Maintenance," identified responsible parties and their roles in stormwater pond maintenance. It also provided draft recommendations for communicating and messaging regarding the complexities of ponds' system function, management, and maintenance. The report inventoried methodologies, needs, and successes of stormwater pond efforts in South Carolina, using research, surveys, and interviews with experts. This information is being used to prioritize issues that could be minimized if educational efforts prompted behavior changes. The outreach plan includes suggestions for targeted messaging, activities, and programs to increase awareness, instruct, and involve target audiences in sustainable actions to improve long-term stormwater pond management and function. After external peer review, the report will be integrated in a state of the knowledge report for South Carolina stormwater ponds to be produced in 2016.

S.C. Sea Grant Consortium helps create low impact development guide for coastal decision-makers

April Turner, S.C. Sea Grant Consortium (and partners)

Many coastal decision-makers lack the expertise, guidance, and resources to implement low impact development (LID) techniques for mitigating stormwater impacts. The S.C. Sea Grant Consortium collaborated with its partners to develop an interdisciplinary, user-defined 425-page manual, Low Impact Development in Coastal South Carolina: A Planning and Design Guide (LIDCSC), to meet the needs of the intended users, serving as an effective planning and decision-making tool appropriate for current and future landscape and climate conditions. The LIDCSC provides stormwater engineering specifications, land-use planning resources, and site design practices tailored to the conditions of the South Carolina coast, and thereby removes barriers to implementation of LID practices on the community level, neighborhood scale, and site scale. In addition to the 400 printed copies distributed to project stakeholders, including staff from all S.C. coastal municipalities, the LIDCSC was available for download from the Consortium's website. LIDCSC downloads numbered 27,908 from April 2015-January 2016. The LIDCSC provides an overview of LID terminology and benefits; outlines federal, state, and local stormwater regulations; offers regulatory and planning strategies for LID implementation; covers conservation principles, neighborhood site design considerations, and landscaping practices; identifies specifications for LID stormwater best management practices (BMPs); highlights case studies from the region; and addresses climate change predictions integrated into the manual's BMP design.



Communities work to adopt low impact design strategies with guidance of S.C. Sea Grant Consortium
April Turner, S.C. Sea Grant Consortium

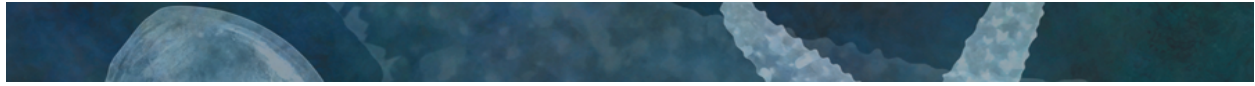
Many coastal decision-makers lack the expertise, guidance, and resources to implement low impact development (LID) techniques for mitigating stormwater impacts. With funding from the National Estuarine Research Reserve Science Collaborative, the S.C. Sea Grant Consortium worked with partners to develop a 425-page manual, *Low Impact Development in Coastal South Carolina: A Planning and Design Guide (LIDCSC)*, to provide guidance for coastal communities working to implement best management practices. Documented community use in 2015 includes the following:

- The city of Charleston has been working on revisions to the current Stormwater Management and Flood Control Ordinance and associated Stormwater Design Standards Manual. The intent of the revisions were to catch up with the current general permit requirements for new development and redevelopment projects as well as those for illicit discharge detection and elimination. The city recognizes the utility of the *LIDCSC* for incorporation of LID approaches to meeting current stormwater management requirements. The city presented drafts of both documents to development and conservation communities for review and comment, and it plans a stakeholder forum to present and discuss the proposed modifications in the year ahead.
- The town of Bluffton's Stormwater Management Division has been using *LIDCSC* for LID practices and is working towards making revisions to ordinances and encouraging the design community to use it.
- The town of Mount Pleasant encourages the use of practices/strategies offered in the *LIDCSC* to the development community when they plan projects and when the projects come up for review by providing a link to download the manual from the Consortium website.
- Charleston County is in the process of updating its stormwater manual and regulations and plans to incorporate elements from the *LIDCSC* into policies and ordinances.

S.C. Sea Grant Consortium evaluates "cause and effect" linkages of coastal development on tidal creek headwaters

Drs. Denise Sanger and George Riekerk, S.C. Department of Natural Resources

Correlations have been established between coastal development and tidal creek environmental quality. However, decision-makers have consistently asked whether the relationships can be directly attributed to coastal development. Historical data available since 1994 provide a unique opportunity to restudy a number of these upland-tidal systems, some of which have experienced further development since then. A number of these systems have changed land-uses, and many of the undeveloped watersheds have been developed since requirements for best management practices (BMP), mainly stormwater pond installations. S.C. Sea Grant researchers at S.C. DNR-Marine Resources Research Institute identified 48 previously sampled tidal creeks in South Carolina, North Carolina, and Georgia as the population for this study. Spatial analyses indicated population density, impervious cover, development-related ponds, and stormwater runoff increased significantly from the 1990s to the 2010s. Field sampling in the creeks is underway to assess cause-and-effect linkages between coastal development and tidal creek environmental quality. Simultaneously, the outreach component of the project was initiated with the development of a headwater tidal creek website, which can be found at <http://www.dnr.sc.gov/marine/mrri/tidal/index.html>. In addition, the NOAA Restoration Office requested project data for Charleston Harbor to determine if a method can be developed to purchase land as compensatory mitigation, as opposed to creating salt marsh or other measures.



S.C. Sea Grant Consortium research demonstrates microplastic particle and contaminant impacts on estuarine organisms

Dr. Stephen Klaine, Clemson University, and Dr. John Weinstein, The Citadel

Particle pollution is becoming more widespread and may have direct adverse effects on organisms and indirect effects through delivery of adsorbed contaminants. Previously, investigators at the College of Charleston reported the discovery of synthetic microfibers, likely remnants of clothes removed in the wash, in the tissues of local oysters. While some collection and characterization of plastic debris has occurred, no study has been conducted within estuaries. Further, little work has been performed to identify the direct and indirect adverse effects of plastic particles on the health of estuarine organisms. S.C. Sea Grant Consortium researchers at Clemson University and The Citadel conducted a study of microplastic particles in the Charleston Harbor and Winyah Bay estuaries, and categorized them by source, type, shape, erosion, color, and size class. Particle toxicity was assessed using salt marsh-tidal creek organisms such as grass shrimp and amphipods. Microplastic particles were found on the sea surface of both Charleston Harbor and Winyah Bay and in the sandy intertidal areas of both estuaries. There were significantly higher levels of microplastic particles in Winyah Bay than Charleston Harbor. There was no difference in the *size* of microplastic particles collected between sites; however, there was a difference in the *type* collected. In Charleston Harbor, fragments and foam were significantly more abundant than spheres, while in Winyah Bay, fibers and foam were significantly more abundant than spheres. Additionally, there were significantly higher levels of microplastic particles in the sediments of Charleston Harbor than in Winyah Bay. Particle ingestion impacted organismal development even at statistically insignificant levels, slowing growth dramatically in copepods. Toxicity testing resulted in a 100% mortality rate when contaminants were introduced with the microplastics, as opposed to a 50% mortality rate with the particles alone. Freshwater amphipods also demonstrated significant contaminant uptake when in the presence of microplastics.

S.C. Sea Grant Consortium-funded research takes Citadel Cadet Brittany Crocker to Capitol Hill

Dr. John Weinstein, The Citadel

Senior Cadet Brittany Crocker of The Citadel presented her S.C. Sea Grant Consortium-funded research at the 19th Annual “Posters on the Hill” event on April 22-23, 2015 in Washington, D.C. Crocker’s poster, one of 60 selected out of nearly 500 submissions nationwide, was presented to members of Congress and representatives of federal agencies as part of this annual showcase of undergraduate research. Crocker’s study, “From Plastic to Microplastic: Decomposition of Three Common Plastic Polymers in a Salt Marsh Habitat,” examined the process by which microplastic particles form from plastic debris. Most previous studies examining this process have occurred in the laboratory under controlled conditions. What makes her study unique is the fact that she conducted this study in the salt marsh, where the plastics were naturally exposed to a variety of ever changing abiotic and biotic factors. According to her research advisor, Dr. John Weinstein, Professor and Department Head of Biology, “Her findings have the potential to revolutionize the way scientists think about microplastic particle formation. Conventional thinking is that the decomposition of plastic debris into microplastics in the environment takes many years. Surprisingly, she has found that the plastic she set out in the marsh last June started producing microplastics in as little as eight weeks.”



S.C. Sea Grant Consortium research developing genetic identification tool leads to discovery of harmful algal bloom species previously found only in Pacific

Dr. Dianne Greenfield, University of South Carolina, and Dr. William Jones, Medical University of South Carolina

Incidences of harmful algal blooms (HABs) are increasing globally. In coastal South Carolina, HABs are associated with one out of every four fish kills, and phycotoxins are routinely detected, making HABs an environmental and public health threat. Traditional methods for identifying and quantifying HABs use time-consuming microscopy. Moreover, many species are morphologically similar, which is problematic for early warnings and timely management decision-making. S.C. Sea Grant Consortium researchers at the University of South Carolina and the Medical University of South Carolina, and their partners, are developing a novel and economical molecular tool (sandwich hybridization assay; SHA) that aids rapid and accurate HAB assessments in the field. Initially, researchers planned to develop assays are for three locally abundant HAB species: *F. japonica*, *C. subsalsa*, and *P. pseudodelicatissima*. One of the fascinating findings is the identification of a toxigenic (domoic-acid [neurotoxin] producing) species of *Pseudo-nitzschia*, *P. fukuyoi*, that is entirely new to this continent. In fact, this species was only recently described (2013), and to date, only in Asian waters. Detection of this HAB species in the Southeast has far-reaching implications for *Pseudo-nitzschia*'s biogeography and *P. fukuyoi*'s likely impact on the region's public and environmental health. As a result, this species was included in the tool development efforts for detection and quantification of harmful algal bloom species responsible for declining water quality and fish kills in the South Carolina coastal zone.

S.C. Sea Grant researcher represents Consortium in special session on harmful algal blooms at international conference

Dr. Dianne Greenfield, University of South Carolina, and M. Richard "Rick" DeVoe, S.C. Sea Grant Consortium

The NOAA National Sea Grant Office hosted a special session at the 2015 Soil and Water Conservation Society International Annual Conference (July 26-29, 2015, in Greensboro, N.C.) on "Detection, Monitoring, Prediction and Prevention of Harmful Algal Blooms (HABs)." The S.C. Sea Grant Consortium was invited to present at the session and chose Dr. Dianne Greenfield, research scientist with the University of South Carolina and the S.C. Department of Natural Resources, to participate and present on our behalf. She was joined by scientists from the Gulf of Mexico and the Great Lakes. Dr. Greenfield focused on a range of HAB activities in South Carolina, including HAB and algal-related programs and activities associated with the S.C. Sea Grant Consortium. Special emphasis was placed on outreach, networking, and education activities sponsored by the Consortium, including the creation of the S.C. Task Group for Harmful Algae, the results of the five-year Centers for Disease Control-funded monitoring and outreach program, the establishment of a HABs and Health Educator position, and the newly (in 2015) formulated Stormwater Pond Research and Management Collaborative.

S.C. Sea Grant Consortium provides leadership to nature-based travel and tourism in South Carolina
April Turner, S.C. Sea Grant Consortium

A 2009 study by the Darla Moore School of Business at the University of South Carolina documented that the state's diverse natural resource sectors contributed \$29.1 billion and 236,110 jobs to the state's economy in 2008. Tourism is now a \$15 billion industry in South Carolina, with its eight coastal counties accounting for approximately 50 percent of that total and supporting almost 81,000 jobs. The S.C. Sea Grant Consortium supports sustainable statewide, nature-based tourism by providing technical



assistance, leadership service, committee participation, and annual conference programming and workshops. The goal is to support an industry sector which seeks to balance the vitality and abundance of coastal and marine resources with the economic health of the tourism industry that depends on them, and to assist rural coastal communities in developing and promoting economically, environmentally, and culturally sustainable tourism practices. The Consortium's Sustainable Coastal Community (SCC) Specialist provides guidance and support to the S.C. Nature-Based Tourism Association (SCNBTA) as technical advisor to its board, with program planning for the annual conference and workshops, as well as participation on its "green," web, and marketing and membership committees. Due to the activities of the SCC Specialist, there is increased support and exploration of coastal natural resource-based tourism and recreation businesses in South Carolina as well as continued sustainability and viability of the SCNBTA.

S.C. Sea Grant Consortium Study Group develops blueway-greenway examples as models for communities

Dr. Norman Levine and Ashley Buffington, College of Charleston; Vonie Gilreath, BCD-COG; and April Turner, S.C. Sea Grant Consortium

The S.C. Sea Grant Consortium *Study Group* project "Blueways-Greenways: Developing Examples as Models for Other Communities" (DEMOC) provided materials to communities to facilitate trail projects and to foster partnerships across the state. The Berkeley-Charleston-Dorchester (BCD) Council of Governments and the National Park Service (NPS) collaborated with local stakeholders to create the BCD Regional Blue Trails plan for the tri-county area. The DEMOC project was designed to dovetail with this regional plan to provide education and outreach, assistance to communities in creating trails for recreation, and a model for a state network among municipalities in promoting the development and use of trails. The group designed a template for communities with limited resources to assist in establishing local blueway and greenway systems. Tools and resources produced include: a general information brochure on blueways and greenways; a brochure on funding opportunities; a comprehensive map highlighting the main features of the blueways and greenways in the BCD region; and an interactive web-mapping application accessible from any mobile device. The app enables the public to search and view greenway and blueway trail features such as water access points, points of interest, weather and tide gauge information, and train infrastructure. Surveys, focus groups, interviews, GIS technologies, and participatory-GIS were used to develop the map, brochures, and online mapping application. Additionally, the project team organized five public workshops to garner input from local residents, outdoor enthusiasts, and community staff and officials for the regional blue trails plan. Presentations promoting the project were delivered at state conferences and other regional and local events. Project results will serve to guide future blueway and greenway trail planning at the community level and possibly increase the number of blueways and greenways projects across the state. Those projects could ultimately promote nature-based tourism, enhance related recreational opportunities, stimulate the local economies, protect and enhance water quality, address obesity among youth and adults, and increase participation of disadvantaged groups.

S.C. Sea Grant Consortium supports production of Historic Ashley River Blue Trail Map **April Turner, S.C. Sea Grant Consortium**

Dorchester County, in conjunction with American Rivers, MeadWestvaco, Ashley Scenic River Advisory Council, and the town of Summerville, created a shared vision for the Ashley River Blue Trail to ensure the health, beauty, critical habitats, and recreational values of the river are protected and enhanced



through land conservation, improved access, and strong community support. The S.C. Sea Grant Consortium awarded a \$2,500 Coastal Community Initiative Program mini-grant to Dorchester County Parks Department to assist with the design and printing of 5,000 copies of a waterproof high-quality recreational blue trail map of the historic Ashley River for paddlers. The map includes a river conservation message as well as information about access points, historic landmarks, parks and conserved lands. Equally as important as the map is the collaborative process used to create it. The map serves as a vehicle to build community awareness of the river's economic, recreational, and other community benefits, as well as promote the need for long-term protection of its assets. The Dorchester County Parks and Recreation Master Plan, currently under development, will benefit from the blue trail mapping project, as it will support waterway-related recreation and conservation recommendations in the plan.

S.C. Sea Grant Consortium supports a Connected Land Conservation Plan for the East Cooper region
April Turner, S.C. Sea Grant Consortium

The S.C. Sea Grant Consortium, in conjunction with the East Cooper Land Trust and the College of Charleston, received a Green Infrastructure technical assistance grant from the S.C. Forestry Commission to develop a Connected Land Conservation Plan for the East Cooper region. The purpose of the plan is to take a regional look at the development patterns and natural resources in the area between the Cooper and Santee Rivers, including the communities of Mount Pleasant, Daniel Island, Cainhoy, Sullivan's Island, Isle of Palms, Awendaw, McClellanville, and unincorporated sections of Charleston County. The project team is partnering with these communities to create a plan that will allow the municipalities to review where their highest quality natural assets exist on a regional scale and to develop strategies to conserve them while still promoting economic growth. Natural asset planning is a strategic landscape approach to open space conservation whereby local communities, landowners, and organizations work together to identify, design, and conserve their local land network in order to maintain healthy wildlife and human communities. It can be used to prioritize land that should be conserved or restored, and also point to areas more appropriate for development. Development of this plan began in September of 2015 and is scheduled to be complete in December 2016. The project team will synthesize technical knowledge regarding urban and regional planning, landscape architecture, and ecology to develop a cross-jurisdictional land conservation plan.

S.C. Sea Grant Consortium supports information sharing and collaboration among national Sea Grant networks
April Turner, S.C. Sea Grant Consortium

The National Sea Grant College Program has established informal and formal networks and communities of practice in order to collaborate and share information with each other and a variety of stakeholders. There has been discussion and desire across the networks to increase cross-coordination, collaboration and training. As part of a collaborative effort with the Climate Network, a subcommittee was formed to plan a joint network interactive training event at the National Adaptation Forum in St. Louis, Mo., in May of 2015. The S.C. Sea Grant Consortium, in partnership with other Sea Grant programs, organized and facilitated this one-day training session open to all Sea Grant members attending the forum. Some 37 people from across the Sea Grant networks (including Climate, Legal, and Sustainable Coastal Community Development) participated in the event.