

2019-2020 IMPACTS AND ACCOMPLISHMENTS

SUSTAINABLE COASTAL DEVELOPMENT AND ECONOMY



IMPACT

S.C. Sea Grant Consortium Scientists Design Tool that Allows Evaluation of Stormwater Best Management Practices

Marzieh Motallebi, Clemson University; Erik Smith, University of South Carolina; Dan Hitchcock, Clemson University; Susan Lovelace, S.C. Sea Grant Consortium

Recap: S.C. Sea Grant Consortium research results in stormwater managers using cost-benefit methodologies to implement BMPs and related cost-benefit information being incorporated into a realtor continuing education course "Calling the Coast Home."

Relevance: Effectively managing stormwater has been an ongoing challenge in coastal South Carolina. Coastal development dramatically increases rates of stormwater runoff and impacts coastal resources. Stormwater management is thus a vital and required component of coastal zone development in the state. A great deal of research has been conducted in South Carolina on stormwater management practices, and a wealth of information exists on the design, management, and maintenance of a variety of stormwater best management practices (BMPs). In 2014, the Consortium and several of its partners published *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Guide), describing a variety of stormwater BMPs. While the Guide provided an initial economic analysis of the cost of implementing various BMPs, the limited analysis focused primarily on installation costs. Stormwater management research has been lacking in informing a full socioeconomic understanding regarding the various options for BMP implementation decisions.

Response: S.C. Sea Grant Consortium researchers at Clemson University and the University of South Carolina Baruch Institute built from the foundation provided in the Guide by adding necessary socioeconomic knowledge to better inform stormwater decision-making in coastal South Carolina. The effort examined detailed operation and maintenance costs, cost effectiveness, and benefit valuation of BMPs.

Results: Researchers designed a participatory story map (<https://clemson.maps.arcgis.com/apps/MapJournal/index.html?appid=5edfc174e5dc4cc08430b3a2df25e8a5>) for stormwater managers to include type and costs of their installed BMPs in the eight coastal counties, as well as a survey to select the most common BMPs in different coastal counties. Several economic analyses were performed to determine costs of installing and maintaining BMPs, and residential willingness-to-pay for related measures. As a result, the South Carolina Association of Stormwater Managers (SCASM), Town of Mt. Pleasant, and Town of Bluffton will be using this methodology for cost benefit analyses of implementing BMPs in their areas. Additionally, cost-benefit information is being incorporated into a realtor continuing education course, "Calling the Coast Home."

ACCOMPLISHMENTS

S.C. Sea Grant Consortium Develops Methods to Document the Status and Trends of South Carolina's Ocean Economy in a Recurring Fashion

Matt Gorstein, S.C. Sea Grant Consortium

Recap: S.C. Sea Grant Consortium develops ocean economy report to detail the status, trends, and future outlook for South Carolina's ocean economy.

Relevance: Documenting and monitoring the market and non-market economic benefits of ocean and coastal natural resources is important when evaluating policy decisions, and for understanding the level of dependence that a given coastal community may have on ocean and coastal natural resources. South Carolina's ocean and coasts support a wide variety of industries including commercial fishing, recreational fishing, aquaculture, tourism, ports/harbors, shipbuilding, and sand mining.

Response: Datasets and relevant studies were identified, and a South Carolina ocean economy report was drafted. The purpose of this report was to provide an overview of South Carolina's ocean economy based on the data that are available; expand upon information provided by the National Oceanic and Atmospheric Administration (NOAA) to examine other market and non-market economic values, impacts, and contributions derived from ocean resources; identify ocean economy sectors for potential future growth; and discuss how the health of natural resources provides a foundation for economic activities along South Carolina's coast. Also contained in this report is an examination of often overlooked non-market ecosystem service values provided by coastal habitats in South Carolina, including shoreline protection, carbon storage, and water quality. The report will be accompanied by an infographic, designed for a more general audience.

Results: The ocean economy contributed almost \$4.8 billion to South Carolina's gross domestic product (GDP) in 2017, 7.6% of total GDP in the eight coastal counties. Over 80,000 people were employed in the ocean economy in 2017, 12.2% of total employment in the eight coastal counties. Since the end of the recession (2009), ocean economy real GDP has increased by 53%, compared to 22% for the entire state economy.

LID Hot Topics: Costs, Perceptions, and Maintenance of Low Impact Development Practices in Coastal S.C.

April Turner, S.C. Sea Grant Consortium

Recap: The S.C. Sea Grant Consortium co-organized a workshop series for 147 stormwater management professionals, design engineers, developers, and landscape architects, providing training focused on economic costs and benefits, perceptions, and maintenance of low impact development practices for better site design implementation in South Carolina coastal communities.

Relevance: Many coastal decision-makers, stormwater management professionals, and design engineers find it challenging to implement low impact development (LID) techniques for mitigating stormwater impacts. They need expertise, guidance, and resources to remove barriers to implementing LID practices on the community level, neighborhood scale, and site scale. Despite the availability of a South Carolina-specific guidance manual published five years ago, there are still perception issues surrounding the use of LID, a lack of understanding on how to use the manual tools, and a need for more trainings for local government staff and design engineers.

Response: The Consortium and partners launched the LID Hot Topics Workshop series in August 2019 in two coastal locations (Charleston County and Myrtle Beach) for stormwater managers, engineers, landscape architects, developers, and other design and maintenance professionals. These were full-day events, organized to provide training focused on better site design principles and LID practices to successfully manage stormwater in an effort to dispel some of the misconceptions and concerns about implementing these practices instead of more conventional practices.

Results: The workshops were well-attended, with 97 individuals at the Charleston event and 49 at the Myrtle Beach event. Participants heard from researchers and design engineer experts about stormwater best management practices, and in particular LID strategies, including information on coastal S.C. residents' perceptions of these practices, the application and use of a maintenance cost calculator tool for better site design, and successful local case study examples. The planning, organization, and administration provided by the Consortium for these workshops is estimated to have provided an economic benefit of \$8,101 based on the provision of professional development hours (PDHs) at a discounted rate, registration fees, travel costs, and opportunity costs of time.

S.C. Sea Grant Consortium Assists McClellanville with Planning for a Sustainable Working Waterfront

April Turner, S.C. Sea Grant Consortium

Recap: The S.C. Sea Grant Consortium and partners assisted the Town of McClellanville with developing a working waterfront master plan to help sustain the local seafood industry. The plan report identifies options for retaining this critical economic asset in the community and explores approaches for cooperative ownership and operation of a seafood wholesale and distribution business to benefit the harvesters and ensure the long-term sustainability of the town's working waterfront.

Relevance: Traditional uses of waterfront properties are diminishing as property values soar and development increases along the coast. Much of the South Carolina commercial seafood industry has been affected by the changes in waterfront property use, and commercial fishermen find it increasingly difficult to secure dependable and affordable docking space, fuel, and ice. In the small coastal community of McClellanville there are two commercial docks used for larger vessels and as shore-side support facilities by the entire industry. One of these docks, Carolina Seafood, also serves as the town's largest employer and purchaser of harvest from local fishermen. The owner is approaching retirement without a succession plan, and the likelihood the land will be sold and converted to other uses is cause for concern among the local commercial fishermen and the community. The town reached out to the Consortium for assistance.

Response: Building on the Consortium's previous work identifying and assessing issues and exploring priorities for maintaining, preserving, and enhancing traditional working waterfronts, it collaborated with the town and other partners to successfully obtain a Hometown Economic Development Grant (\$25,000) awarded by the Municipal Association of South Carolina. The project team is using the funding to develop a master plan for McClellanville's working waterfront.

Results: As part of the planning process, the project team met with local seafood industry wholesalers and harvesters to gather input. The Consortium also convened and facilitated several community meetings to solicit input from more than 90 local residents, business owners, and local government officials who attended. Identified in the plan report were options for retaining this critical economic asset in the community. Approaches for cooperative ownership and operation of a seafood wholesale and distribution business were also explored

to benefit the harvesters and ensure the long-term sustainability of the town's working waterfront and thriving seafood trade. The project team will continue to work with the town to implement the actions outlined in the plan, including working to negotiate and secure funding for a conservation easement to permanently protect dock space and the associated wholesale and retail business facilities. The planning, organization, and administration provided by the Consortium for the two McClellanville stakeholder engagement meetings is estimated to have provided an economic benefit of \$4,723 based on travel costs and opportunity costs of time.

National Extension Tourism Strengthens Partnerships within Sea Grant, with Land Grant Extension, and Other Partners

April Turner, S.C. Sea Grant Consortium

Recap: Through the leadership of S.C. Sea Grant Consortium and Georgia Sea Grant as part of the National Extension Tourism (NET) Design Team, greater integration and participation with the NET Network has provided opportunities for increasing Sea Grant's ability to share best practices and strengthen relationships with Land Grant and other extension professionals working in tourism.

Relevance: Tourism plays a significant role in the economies of our coastal and Great Lakes states, with significant contributions to jobs, tax revenues, and quality of life. Science-based management of tourism in coastal communities is a vital need. Sea Grant has the opportunity to greatly increase the well-being of our coastal communities by taking on a prominent role in tourism and outdoor recreation management science and community training through its research, extension and outreach, and communication programs. The first step in accomplishing this goal was to create the National Sea Grant 2018-2028 Sustainable Coastal Tourism Vision Plan. One important recommendation was to re-establish/build upon relationships with other extension professionals working in the realm of tourism through the National Extension Tourism (NET) Network.

Response: The Consortium and Georgia Sea Grant worked with the NET Design Team to re-establish and strengthen relationships with Land Grant Extension engaged in tourism-related programming. The Consortium's Coastal Community Specialist was asked to serve on the NET Design Team, whose members were responsible for organizing the 2019 NET Conference in Astoria, Oregon from October 8-11, 2019. In addition to assisting with conference planning, the Consortium and partners organized a Sea Grant meeting as part of the conference.

Results: More than 80 people participated in the NET Conference in Astoria, Oregon from October 8-11, 2019. Attendees included Sea Grant staff from various state programs, the majority of which had never previously attended a NET event. This significantly increased Sea Grant participation at a predominantly Land Grant event. Prior to the conference a national survey was administered to assess the status of tourism extension efforts across the country (both Land Grant and Sea Grant), and results were shared during a conference session. As part of this concurrent session, the Consortium presented an overview of the National Sea Grant Office visioning planning process. The biennial meeting was also an opportunity for Sea Grant to share and learn about best practices for working with tourism stakeholders across the country and re-establish itself as an active member of the NET network. As a result of this re-established relationship between Land Grant/Sea Grant at the NET Conference, the next NET conference will be hosted by Georgia Sea Grant and the Consortium in 2021.

Calling the Coast Home: Developing Accredited Continuing Education Courses for Real Estate Professionals

Susan Lovelace, April Turner, and Liz McQuain, S.C. Sea Grant Consortium

Recap: S.C. Sea Grant Consortium collaborated with academic, organizational, and agency partners to develop a continuing education program for coastal real estate professionals.

Relevance: South Carolina's coastal population is rapidly growing. In recent years, it has become clear that real estate professionals (REPs) are a key audience for training, information, and resources because they are often the first contact for newcomers to the coast. They also participate in an industry that relies on healthy coastal resources and resilient coastal communities. Therefore, REPs are not only conduits to new residents and business owners but can also influence natural resource policy and decisions.

Response: As part of a S.C. Coastal Information Network (SCCIN) project to provide science-based information on important coastal topics and issues, the Consortium collaborated with academic, organizational, and agency partners to develop a continuing education program for coastal REPs. Key real estate and insurance industry professionals served in an advisory capacity, providing insights throughout the curriculum development.

Results: Priority topics were identified for course development with the assistance of the REP Advisory Committee. Coastal ecosystem/biodiversity, water quality at the neighborhood level, flooding and flood maps, and rebuilding regulations were the topics developed into four courses titled: Coastal Lifestyle for Clean Water; Living with Water; The Land-Water Connection; and Tidelands, Water, and Beach: Regulations and Rebuilding. Once the state approval process was completed, each of these two-hour courses was piloted at one of the regional real estate associations, where a total of 215 REPs received licensing credit in January 2020. A clearinghouse of resources accessible through the SCCIN website was compiled for the REPs to use to help their prospective clients navigate policies, regulations, and other potential challenges associated with coastal home and business ownership. The planning, organization, and administration provided by the Consortium for the "Calling the Coast Home" trainings are estimated to have provided an economic benefit of \$6,146 based on the provision of continuing education credits (CEUs) at a discounted rate, travel costs, and opportunity costs of time.

S.C. Sea Grant Consortium Organizes Two South Carolina Coastal Information Network Meetings, One in Spring-Summer and One in Fall-Winter

April Turner and Matt Gorstein, S.C. Sea Grant Consortium

Recap: The S.C. Sea Grant Consortium (Consortium) planned and organized two meetings for the South Carolina Coastal Information Network (SCCIN), together yielding a total economic benefit of \$2,091.

Relevance: The SCCIN grew out of the shared goals of coastal institutions and organizations to enhance coordination of community outreach efforts in the state. Established in 2006 and led by the Consortium, the SCCIN includes partners from more than 20 federal and state agencies, regional government entities, and private organizations seeking to coordinate and/or jointly deliver outreach programs that target coastal community constituents. As the SCCIN has developed and expanded, it has fostered inter-agency communication and cooperation.

Response: The Consortium organized two SCCIN meetings in FY2019, one in June and one in December. Outreach educators from local, regional, and state agencies and universities attended as well as coordinated the addition of

resources and activities to the SCCIN web portal.

Results: In addition to sharing information and locating partners for outreach activities, meetings this year also helped coordinate a realtor education program developed by the SCCIN. The planning, organization, and administration provided by the Consortium for the two SCCIN meetings is estimated to have provided an economic benefit of \$2,091 based on travel costs and opportunity costs of time. Fifteen and ten participants attended the June and December meetings, respectively. Participants traveled an average of 40 and 30 miles to attend the June and December meetings, respectively. Based on the General Services Administration's (GSA's) privately owned vehicle mileage reimbursement rate of \$0.545 per mile, each June participant incurred ($40 * \$0.545$) \$21.80 in vehicle travel costs, and each December participant incurred ($30 * \$0.545$) \$16.35 in vehicle travel costs. The occupations of the attendees were mixed. Based on the U.S. Bureau of Labor Statistics (BLS) occupational employment statistics program's mean hourly wages for all occupations in South Carolina (US BLS, 2019), the mean hourly wage of participants is assumed to be \$21.34. Participants obtained value from these meetings as attending was deemed an appropriate use of their time by either themselves or their supervisor, they deviated from normal work duties to attend the workshop, and they obtained knowledge and skills. Each meeting lasted 3 hours, therefore each participant has an associated opportunity cost of time of \$64.02 ($\$20.78 * 3$). Summing with travel costs (\$21.80), and multiplying by the number of participants (15) yields a total economic benefit of \$1,287 for the June meeting. Summing opportunity costs (\$64.02), travel costs (\$16.35), and multiplying by the number of participants (10) yields a total economic benefit of \$804 for the December meeting. Summing these two figures together yields a total economic benefit of \$2,091.

S.C. Sea Grant Consortium Provides Leadership to Nature-Based Travel and Tourism in South Carolina

April Turner, S.C. Sea Grant Consortium

Recap: The support of the S.C. Sea Grant Consortium and the activities of the Coastal Communities Specialist assisted the S.C. Nature-Based Tourism Association with its 25th Annual Conference and website redesign to help ensure an economically viable and resource-sustainable nature-based tourism industry in South Carolina, promoting recreation opportunities and accessibility.

Relevance: A 2016 study by the S.C. Department of Natural Resources documented that the total impact of natural resources to the state economy increased by 15% over the past decade to \$33.4 billion. More than 28% of the state's 4.96 million residents live in the eight coastal counties, and tourism is now a \$20.1 billion industry within those coastal counties, accounting for approximately 65% of the statewide total. People are increasingly drawn to the South Carolina coast, with both residents and tourists taking advantage of the opportunities the state's natural and cultural resources provide.

Response: The Consortium supports sustainable statewide, nature-based tourism through its involvement with the S.C. Nature-Based Tourism Association (SCNBTA).

Results: The Consortium's Coastal Communities Specialist serves the SCNBTA as its Past President on the Board of Directors, providing technical guidance and leadership service, including program planning for the quarterly board meetings and annual conferences, as well as coordination and development of marketing and membership strategies. As the conference co-chair, the specialist organized the SCNBTA annual event in Newberry, S.C. Additionally, the specialist spearheaded the redesign for the SCNBTA website that began in the fall of 2019. The specialist surveyed the membership for input into the redevelopment process, organized a website redesign team,

and coordinated weekly meetings with the web designer. The website is scheduled to be publicly launched in February 2020. The overhauled website should aid in the promotion of the state tourism regions and the support of nature-based tourism and recreation businesses. By providing increased exposure to potential clientele, the website should boost the sustainability and viability of the SCNBTAs. The planning, organization, and administration provided by the Consortium for the SCNBTAs Annual Meeting are estimated to have provided an economic benefit of \$14,935 based on registration fees, travel costs, and opportunity costs of time.

S.C. Sea Grant Consortium Coastal Economics Specialist Gives Guest Lectures at Consortium Member Institutions

Matt Gorstein, S.C. Sea Grant Consortium

Recap: S.C. Sea Grant Consortium Coastal Economics Specialist gives guest lectures at Consortium member institutions on topics related to ecosystem service valuation, both market and non-market techniques.

Relevance: In an era of climate change and frequently occurring coastal hazards, addressing complex environmental issues with interdisciplinary science has become increasingly important. This involves the marriage of socioeconomic research with existing natural science research, including the estimation of ecosystem service values. Ecosystem services refer to the benefits that humans receive from healthy functioning ecosystems; and while their values are often overlooked when making policy decisions, they are important to track.

Response: In an effort to raise awareness about ecosystem service concepts, which ecosystem services are provided in South Carolina, and techniques used to value ecosystem services, S.C. Sea Grant Consortium Coastal Economics Specialist Matt Gorstein gave two guest lectures on these topics: in an environmental economics graduate class at the College of Charleston and in a forestry economics undergraduate class at Clemson University. The main themes included ecosystem service classification, use and non-use benefits, market versus non-market valuation techniques, cost benefit analysis, and conceptual models. These guest lectures also served as an opportunity to share information on student fellowship and other funding opportunities.

Result: University students are exposed to coastal ecosystem services and methods to evaluate them.

S.C. Sea Grant Consortium Scientists Examine Socioeconomic Aspects of Stormwater Control Measures to Guide Decision-Making in Coastal South Carolina

Marzieh Motallebi and Dan Hitchcock, Clemson University; Erik Smith, University of South Carolina; Susan Lovelace and Matt Gorstein, S.C. Sea Grant Consortium

Recap: S.C. Sea Grant Consortium researchers investigate the costs and benefits associated with low impact development stormwater control measures.

Relevance: Effectively managing stormwater has been an ongoing challenge in coastal South Carolina. Coastal development dramatically increases rates of stormwater runoff and impacts coastal resources. Stormwater management is thus a vital and required component of coastal zone development in the state. Stormwater management research that informs a full socioeconomic understanding regarding the best management practices (BMPs) has been lacking.

Response: A great deal of research has been conducted in South Carolina on stormwater management practices, and a wealth of information exists on the design, management, and maintenance of a variety of stormwater BMPs.

In 2014, the S.C. Sea Grant Consortium (Consortium) and several of its partners published *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* (Guide), describing a variety of stormwater BMPs. While the Guide provided an initial economic analysis of the cost of implementing various BMPs, the limited analysis focused primarily on installation costs. Consortium researchers at Clemson University and the University of South Carolina are building from the foundation provided in the Guide by adding necessary socioeconomic knowledge to better inform stormwater decision-making in coastal South Carolina.

Results: Researchers determined that proximity to stormwater ponds has a positive effect on property values in Charleston, Horry, Beaufort, Georgetown, and Berkeley counties. South Carolina residents were surveyed concerning their preferences and willingness to pay for ecosystem services associated with dry stormwater ponds. The survey found that residents are willing to pay for flood reduction, pollutant removal, biodiversity, and aesthetic/scenic beauty when considering trade-offs in stormwater pond management. Finally, a “Low Impact Development – Hot Topics” workshop was convened to share information on the benefits of low impact development BMPs with researchers, engineers, property developers, and local government staff.

S.C. Sea Grant Consortium Researchers Evaluate the Economic Impact of Nature-Based Tourism in South Carolina

Lauren Duffy, William Norman, and Lori Dickes, Clemson University; Ray Rhodes, College of Charleston

Recap: Tourism is one of the largest industries in South Carolina and nature-based tourism, as analyzed in this study, makes a substantial impact to the eight coastal economies, generating up to 21,000 related jobs and \$1.5 billion total economic contribution.

Relevance: What is known about the economic impact of tourism in South Carolina comes from travel models, accommodation tax revenue, occupancy rate, average room rates, and calculations of revenue per available hotel room. Developing and sustaining nature-based tourism (NBT) has the potential to generate a number of economic benefits. However, when it comes to sub-sector niche markets, such as those that result from NBT, it can be much more difficult to ascertain accurate measures of economic contributions.

Response: Through a two-phase mini-proposal, S.C. Sea Grant Consortium researchers at Clemson University analyzed existing information to develop an initial estimate of the overall economic impact of the NBT industry in South Carolina, particularly within the eight-county coastal region, and identified gaps in this information. During Phase Two, on-site and phone surveys were conducted, and the USTA’s Travel Economic Impact Model and IMPLAN were used to estimate NBT economic impacts in the eight coastal counties.

Results: Phase Two results showed 2019 estimated coastal NBT economic contribution to the state of South Carolina ranging from \$766.8 million-\$1.5 billion. The total employment contribution ranged from 10,576 part- and full-time positions supported, to over 21,000 positions attributable to the economic contribution of NBT S.C. coastal tourism. For 91.5% of the tourist sample, the S.C. coast was the primary destination for their trip and when asked if, “nature or nature-based recreation” activity was a primary motivation for selecting the S.C. coast for their trip, 67.6% indicated that it was, with a similar majority classifying themselves as a NB tourist.

S.C. Sea Grant Consortium Researchers Assess Stormwater Drainage and Compound Flooding in a First-Order Tidal Creek

Tim Callahan, College of Charleston

Recap: S.C. Sea Grant Consortium researchers developed a model that predicts tidal influence within the drainage ditch attached to the tidal creek and updated streamflow rating curve models.

Relevance: The threat of increasing rates of climate change has presented unique problems to all types of land and environmental managers. Predictive scenarios indicate the future holds sea-level rise, increased intensity of precipitation events, and increased urbanization. Any one of these occurrences has the potential to present consequences, yet Charleston, S.C. will likely experience all of them. Complicating this issue is the issue with aging infrastructure, including roads, bridges, septic tank systems, and sanitary sewer pipes crossing over and under the coastal environments. It is of great importance to gain a better understanding of the relationship between tidal flow and stormflow to provide guidance on better stormwater controls and to predict the impacts of flooding events.

Response: S.C. Sea Grant Consortium researchers at the College of Charleston proposed to create a model of stormflow, tidal discharge, and stream flow response of tidal creeks. The model will be used to better understand the responses of tidal creeks to both tidal and stormflow flows. Existing data from other studies will be tested at a controlled site which has a stormwater drainage ditch that has an outfall into Church Flats Creek, a tidal creek that connects to the Stono River.

Results: Initial results indicate that this new model better predicts the amplitudes of tidal discharge associated with specific tidal cycles (i.e., king tide events). Additionally, results demonstrate that the tidal influence will increase such that the entire drainage system will be nearly completely tidal by 2050. Infrastructure has altered the catchment basins of first-order tidal creeks in the area, and in some extreme cases this has caused runoff delivered to these first-order systems to change by >100% in some extreme cases.

S.C. Sea Grant Consortium Research Suggests Algal Production May Be Primary Source of Dissolved Oxygen Impairment in Stormwater Ponds

Erik Smith, University of South Carolina Baruch Institute

Recap: S.C. Sea Grant Consortium research on stormwater conveyances and control structures suggests that reducing particulate and algal loading from runoff could reduce oxygen demand in local receiving waters.

Relevance: The presence of a sufficient minimum concentration of dissolved oxygen (DO) is a fundamental requirement for sustaining aquatic life in coastal waters. Low DO is the number one cause of impairment to the ability of waters to support aquatic life use in South Carolina's coastal zone; however, preventing the occurrence of low DO remains a challenge for water quality management. Understanding the impacts of coastal development on water quality impairment, and specifically the prevalence of DO impairment, in coastal waters is vital to sustaining aquatic resources.

Response: S.C. Sea Grant Consortium researchers at the University of South Carolina Baruch Institute are examining how stormwater conveyances and control structures impact inputs of oxygen-demanding substances in coastal waters, measured as biochemical oxygen demand over a five-day period (BOD5). Samples were collected during rain events and dry periods from sites representing a variety of land uses and stormwater management practices.

Results: Preliminary results demonstrated that algal production was a dominant source of BOD5 in stormwater ponds, and all sites had higher measurements of BOD5 than the downstream receiving waters of the Waccamaw River. There was little significant difference in BOD5 concentrations among land use categories or stormwater management practices and much of the variability in BOD5 can be predicted by particulate matter concentrations, especially chlorophyll-containing particulate material, suggesting the importance of reducing particulate and algal loading from stormwater runoff as a means of reducing oxygen demand in local receiving waters. Analysis continues, but researchers anticipate efforts could lead to improved stormwater management and more realistic regulatory targets for inputs of oxygen-demanding substances in coastal receiving waters.

S.C. Sea Grant Consortium Researchers Investigate Water Quality Impacts of Development in Tidal Creek Watersheds to Improve Land Use Planning

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

Recap: Research supported by the S.C. Sea Grant Consortium revealed greater salinity, fecal coliform, and enterococcus fluctuations in areas of high development intensity.

Relevance: The rate of coastal population growth and associated development has increased rapidly along the South Carolina coast and ranks among the highest nationally. Impervious cover increases proportionately with development, and these surfaces contribute to increases in stormwater runoff. This runoff can alter coastal salinity regimes, lead to shifts in biological communities, and is associated with increases in fecal coliform and other contaminants. Coastal communities are responsible for developing and implementing stormwater management plans, but significant knowledge gaps remain as to watershed characteristics that are associated with the greatest impacts, and how these impacts vary within and between tidal creek systems.

Response: S.C. Sea Grant Consortium (Consortium) researchers at the S.C. Department of Natural Resources are quantifying watershed characteristics associated with stormwater impacts, the spatial extent of such impacts, and how they may respond to predicted changes in climate and weather patterns. To achieve this, Consortium researchers are investigating how water quality following rain events varies along the length of tidal creek systems in areas with various types and intensity of development. Spatial analysis of candidate tidal creek systems was performed using a variety of factors like impervious cover, shellfish harvesting, soil permeability, and stormwater pond coverage. Four study systems were selected: Guerin, Seaside, Toomer, and Dupont-Wappoo creeks. Salinity and weather data were collected from each site.

Results: Analysis of a full year of data from each site suggests greater salinity fluctuations in areas of high development intensity. Fecal coliform and enterococcus also followed this gradient. The Dupont-Wappoo system exhibits several signs of water quality degradation and is also the most densely developed system.
