IMPACTS

City of Folly Beach Improves CRS Rating from Class 7 to Class 4 with Assistance Provided by the S.C. Sea Grant Consortium

Elizabeth Fly and Sarah Watson, S.C. Sea Grant Consortium

Relevance: The City of Folly Beach is a small barrier island community that faces a variety of coastal hazards, including the threat of rising seas from both the ocean and marsh sides of the island. The highest elevation is 16 feet. The city requested technical assistance from the S.C. Sea Grant Consortium (Consortium) to take a more proactive approach in planning for current and future sea level rise hazards.

Response: The city worked with the Consortium and a consultant to find ways to improve its Community Rating System (CRS) rating. Among the key suggestions were improving record-keeping as well as better documentation of existing preserved open space and properties that have repetitive losses. Additionally, revised base flood insurance rate maps released by FEMA lowered required base flood elevations, which meant fewer properties were at or below base flood elevation.

Results: The city's CRS program underwent its three-year review in the fall of 2017. The suggestions identified by consultants and the Consortium resulted in a rating improvement from a Class 7 to a Class 4. This results in a 30 percent premium discount for all policy holders in the city, which amounts to $444,000 per year

Recap: The city council of Folly Beach, SC worked with S.C. Sea Grant Consortium and others to identify ways to improve flood resilience and use those actions to increase its Community Rating System (CRS) rating. By better documenting its open space preservation and new flood maps that reduced base flood elevations, the city's CRS rating increased from a class 7 to a class 4 during its 2017 program review. This will provide residents a 30 percent discount on their flood insurance plans.

Folly Beach Sea Level Rise and Adaptation Report Adopted and Endorsed by City Council

Elizabeth Fly and Sarah Watson, S.C. Sea Grant Consortium

Relevance: The City of Folly Beach is a small barrier island community that faces a variety of coastal hazards, including the threat of rising seas from both the ocean and marsh sides of the island. The highest elevation is 16 feet. The city requested technical assistance from the S.C. Sea Grant Consortium to take a more proactive approach in planning for current and future sea level rise hazards.

Response: As part of our technical outreach to coastal communities, the Consortium, in collaboration with Elko Consulting and the Carolinas Integrated Sciences and Assessments program, facilitated a Vulnerability, Consequences, and Adaptation Planning Scenarios (VCAPS) workshop with 13 key decision-makers from the city to discuss and prioritize strategies for dealing with sea level rise on the island. A draft report with recommended actions was produced and presented at public meetings in Spring 2017 for further input and prioritization.

Results: After review by the public, the draft was finalized and presented to City Council June 13, 2017 as Resolution 22-17 and passed unanimously. The report suggested specific studies be conducted to

improve resiliency in the city. Some are already in progress and others are shovel-ready. City officials continue to be engaged in other projects and programs with the Consortium

Recap: The city council of Folly Beach, South Carolina adopted and endorsed the recommended actions of a 2017 Sea Level Rise Report that was produced though a facilitated process involving community members and city staff and led by the S.C. Sea Grant Consortium. Several actions to improve the city's resilience are underway and others are planned, including developing marsh and beach management plans and bolstering oceanfront building codes.

Beaufort County Changes Stormwater BMP Regulations to Reflect 30-year Projections of Sea Level Rise

Elizabeth Fly and Sarah Watson, S.C. Sea Grant Consortium

Relevance: Beaufort County, S.C., is located at the heart of the Lowcountry—a coastal region so-named because most of its land sits just above sea level. During 2014 and 2015, stormwater managers and community leaders recognized their potential vulnerability to long-term sea level rise and partnered with the S.C. Sea Grant Consortium and Carolinas Integrated Sciences and Assessments program to engage in a participatory process to discuss adaptation strategies. Strategies to protect estuarine waters from development were considered in the report. Also, in recent years stormwater ponds have been the best management practice for collecting runoff from developed areas and allowing sediment and contaminants to settle before the water exits to receiving waters. The county considers protection of water quality a primary activity as the area grows. Planners asked the Consortium to assist with long-term planning for sea level rise.

Response: The Consortium, in partnership with Beaufort County, the Carolinas Integrated Sciences and Assessments, North Carolina Sea Grant, and the Social and Environmental Research Institute, published the report "Sea Level Rise Adaptation Report: Beaufort County, South Carolina." The report contains 23 adaptation strategies vetted by a stakeholder group and public workshop participants. After publication, the report was presented to the Rural and Critical Lands Preservation Program and the Natural Resources Committee of Beaufort County. In 2016 the report's strategies were incorporated into the county's Comprehensive Plan and Hazard Mitigation Plan.

Results: As a result of these actions, an engineering code change implemented in 2017 requires the outlets of stormwater ponds, the go-to best management practice for developed areas, to be built at heights that would allow outflow based on 30-year projections of sea level rise. This action protects local receiving waters from sediment and other contaminants while providing developed areas with adequate stormwater retention for the immediate future.

Recap: Because of work facilitated by the S.C. Sea Grant Consortium and partners, Beaufort County implemented an engineering code change in 2017 that requires the outlets of stormwater ponds, the go-to best management practice for developed areas, to be built at heights that would allow outflow based on 30-year projections of sea level rise and thus protect receiving waters from contaminants and to provide protection for homes and communities.

ACCOMPLISHMENTS

S.C. Sea Grant Consortium Supplies Technical Input to City of Charleston Emergency Operations Plan

Elizabeth Fly and Sarah Watson, S.C. Sea Grant Consortium

Charleston, SC, has seen a 409% increase in tidal flooding days since the 1960s. The city previously solicited technical assistance from the S.C. Sea Grant Consortium for their active sea level rise (SLR) strategy. Now a founding member of the Charleston Resilience Network, a network shepherded by the Consortium, the city continues to learn how to best incorporate information into its planning and response procedures. The city contacted the Consortium's Coastal Climate Extension Specialist for assistance to incorporate long-term threats of sea level rise into its emergency operations plan. She provided a summary of risks for the plan and for use by the director of the city's Emergency Management Division and the mayor.

S.C. Sea Grant Consortium Secures U.S. Department of Homeland Security Funding to Analyze and Tailor Tools for Coastal Resilience in the Charleston, SC Region

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

Residents and visitors of the Charleston, S.C., region are increasingly being affected by daily, weekly, and monthly episodes of flooding in low-lying areas, exacerbated by "King tide" events, coastal storms, regular thunderstorms, occasional rain "bombs," stormwater runoff, and gradual coastal erosion and land subsidence. These events have attracted the attention of residents, tourists, and government officials. As a means by which to address these challenges, the Consortium submitted and received support for its proposal on behalf of the Charleston Resilience Network to the U.S. Department of Homeland Security's 2016 National Infrastructure Protection Plan Security and Resilience Challenge. The project is analyzing multi-hazard indices and tools for coastal resilient infrastructure assessment and adaptation for small business, municipalities, and individuals for application and /or adaptation in the Charleston region. This two-year project is being conducted in phases to allow for (1) Identification and analysis of existing information (including existing indices and tools) related to critical infrastructure, (2) Customization of indices and tools for the Charleston, SC region, (3) Stakeholder engagement in the development and testing of the indices and tools, and (4) Final roll-out and implementation of the refined indices. The project is building awareness and promoting safety in the Charleston region regarding the vulnerability of the region's critical infrastructure to these increasing conditions affecting businesses, municipalities, and neighborhoods. The effort will also enhance our collective ability to support advanced planning, safety, and science-based infrastructure-investment decisions, which are crucial for the region.

Multi-Hazard Coastal Resiliency Assessment and Adaptation Indices and Tools Analyzed for Application and Adaptation for the Charleston, SC Region

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

The project aims to design, develop, and implement a tool or set of multi-hazard tools to address coastal resiliency and adaptation in the greater Charleston region. More than 50 tools have been analyzed against 61 parameters to identify gaps in available tools for the Charleston, SC region. Facilitated discussions to identify the resilience needs of the Charleston, SC region; a local "Hackathon" to develop the necessary suite of tools and applications to address those needs, as stated by the stakeholders. The

results of this effort, which is focusing on the business, local government, and neighborhood sectors, and on water and stormwater, transportation, and energy infrastructure, will not only position the Charleston region for enhanced resilience and adaptive capacity, given Charleston's booming population growth and position in several national planning efforts, but will also be adaptable to communities up and down the South Carolina and southeastern U.S. coast.

S.C. Sea Grant Consortium Scientists and Staff Linking Parcel-level Flood Mapping with Neighborhood Engagement in the Greater Charleston, SC Region through a NOAA Regional Coastal Resilience Grant

Norman Levine, College of Charleston; Sarah Watson and M. Richard (Rick) DeVoe, S.C. Sea Grant Consortium

The Charleston, S.C., region is home to more than 500,000 people and is one of the fastest growing areas of the country. The economy of Charleston is strong and diverse, with concentrations on tourism, shipping, manufacturing, health care, education, and an emerging technology sector. Each of these sectors, along with the individuals employed therein, depends on transportation, water, energy, and other critical infrastructure facilities for continuity, successful daily operations, and quality of life. Effective long-term regional preparedness and resilience planning and implementation requires a concerted and coordinated effort among governmental entities, businesses and industries, non-governmental organizations, and owners/operators of critical infrastructure. This $500,000 project, secured on behalf of the Charleston Resiliency Network, has generated a suite of data products which, on a parcel-level scale, provides a high resolution presentation of flood vulnerabilities in the Charleston region, and identified the capacity (or limits thereof) of its critical infrastructure to effectively absorb impacts of flooding events, both in the short term and long term. These products are forming the basis for a series of four neighborhood engagement exercises which will assist a diversity of local stakeholders and organizations, and foster a sense of mutual responsibility, as they move from resiliency planning to implementation.

Advancing Understanding of Risk: Increasing Accuracy of Hazard Damage Assessment Tools by Improving Base Data and Analyzing Opportunities and Barriers for Use in Adaptation

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

Coastal communities are at risk from the flooding from storm surges, intense rainfall and in the future, sea level rise. Rural communities lack the resources of large metropolitan areas to conduct the analysis of risk to their infrastructure from those threats and to do the necessary planning. The Sea Grant programs of the southeastern Atlantic region formed a partnership with the NOAA Office of Coastal Management to co-fund a 2-year project in which a regional research team is doing hands-on work with a coastal rural community in each state (Monroe County, FL; Liberty County, GA; Nags Head, NC; and Beaufort, SC). The aim is to use visualization tools and other approaches to help residents and decision-makers understand flooding risks and adaptation options. Because the project communities have each been significantly affected by hurricanes or tropical storms over the two years of the project (Matthew and Irma), some project modifications have been made to respond to community needs arising out of these events, particularly related to conducting traditional VCAPs assessments. For example, Monroe County (the Florida Keys) sought assistance with improving their CRS rating and is likely to be, after our assistance, the first community in the nation to develop a Sea Level Rise Plan for CRS credit. Research results include a series of draft white papers that are currently being finalized related to the legal and policy issues that have arisen as these communities seek to address coastal hazard risks as well as findings related to improving HAZUS assessments.

S.C. Sea Grant Consortium Supports the Charleston Resilience Network's First Knowledge Exchange Event with the Norfolk, Virginia Region

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

In an effort to gain more insight on increasing the resilience of the Charleston region, the Charleston Resilience Network hosted a coastal resilience knowledge exchange with officials from Hampton Roads, VA, to share lessons learned from dealing with coastal hazards. This event took place on June 15th-June 16th 2017 in Charleston, SC. Both Hampton Roads, VA and Charleston, SC are actively working to mitigate chronic flooding, and this event provided 60 audience members (made up of local environmental professionals such as engineers, planners, legislators, academics, architects, students, and concerned citizens) with background information on the Charleston region, and information about how Hampton Roads has dealt with their flooding issues. There were eight presentations from Hampton Roads, focused on Planning, Strategies to Live with Water, and FEMA/NFIP and the Role of Non-profits. A number of key takeaways emerged from the discussions, including the importance of (1) keeping in mind the concept of "living with water" in both short term and long-term planning initiatives, (2) integrating solutions for multiple positive outcomes, addressing short term flooding solutions and long-term adaptation strategies with methodologies to provide a cleaner environment, and (3) the Federal Emergency Management Agency's Community Rating System Program's value in helping communities to plan for flood mitigation and increased resilience.

S.C. Sea Grant Consortium Researchers Developing Adaptability Toolkit to Address Resiliency of South Carolina's Coastal Water Infrastructure to Predicted Sea Level Rise

Kalyan Piratla, Ashok Mishra, and Brandon Ross, Clemson University; Daniel Harrison, Lander University

Sea level rise and climate change will have societal impacts in the southeastern United States, especially in low-lying regions like the coastal plain of South Carolina. Addressing inadequate and outdated water infrastructure is necessary for instilling hazard resilience in coastal communities. In many coastal areas, stormwater infrastructure managers are faced with the challenges of inundation risks, inadequate pumping capacity, and insufficient storage capacity. However, limited research has been conducted on the impacts of sea level rise to stormwater infrastructure in the region. S.C. Sea Grant Consortium researchers from Clemson and Lander universities are collaborating with water infrastructure agencies and consumer groups to predict future impacts of sea level rise on water infrastructure, develop appropriate adaptation strategies, and evaluate the strategies relative to South Carolina's coastal regions. They also are analyzing implications on cost, environment, and social well-being. Researchers also developed a model incorporating low impact development (LID) practices to simulate runoff due to different storm scenarios in these watersheds. Simulations indicate that daily runoff decreased after inclusion of these practices, and researchers are using this information to explore whether impacts from the October 2015 flood could have been diminished with additional LID practices in place. The project team also reviewed sea level rise policies and strategies in 14 coastal states and disseminated an online survey to numerous coastal water agencies to determine the prevalence and suitability of various adaptation measures to specific sea level rise issues. Phone interviews with the respondents will allow researchers to examine feasibility of implementing these adaptation measures in South Carolina.

S.C. Sea Grant Consortium Scientists Develop Low Impact Development Technologies to Respond to Increased Rainfall, Stormwater

Nigel Kaye and Will Martin, Clemson University

Climate change will lead to increased rainfall frequency and intensity across South Carolina. At the same time, the South Carolina coastal plain faces increased flooding impacts from sea level rise. This additional flooding will stress existing stormwater infrastructure, which was designed to control historical flooding levels and is insufficient for projected future rainfall amounts. One way to mitigate the impacts of increased rainfall and sea level is the use of low impact development (LID) stormwater management technologies. These technologies retain rainfall onsite by allowing infiltration or evapotranspiration to occur, reducing runoff peak and total flow. Examples of LID technologies include porous pavements and green roofs. For LID technologies to be widely accepted, the hydraulic and hydrologic behavior of a technology needs to be well quantified, models need to be developed for use in performance-based designs of stormwater infrastructure, and economic and engineering benefits need to be identified and clearly communicated to all stakeholders. S.C. Sea Grant Consortium researchers at Clemson University will provide stakeholders with increased decision-making capability on the use of LID stormwater management techniques, particularly green roofs and porous pavement, in coastal South Carolina. Researchers developed a test rig to quantify performance of green roofs, using a detachable artificial rainfall system and load cells for continuously weighing the modules to establish water retention. Initial results demonstrated that current modular green roof systems do not retain rainfall long enough to significantly reduce runoff, and improved design engineering is needed to increase water retention. Researchers are in the process of enhancing the test rig by adding humidity sensors to track evapotranspiration, modifying hydrologic models to include LID features that may improve stormwater management performance of green roof systems and porous pavements, and quantifying the economic benefits of LID features.

S.C. Sea Grant Consortium-led Exercise Tests Tool for Community-wide Public Health Risk Assessment of Vulnerable Water Infrastructure in Coastal Cities

Elizabeth Fly and Sarah Watson, S.C. Sea Grant Consortium

The Southeast and Caribbean Climate Community of Practice (CCoP) brings together individuals from local, state, and federal governments, academia, non-profit organizations, and the private sector in the Southeast US (NC, SC, GA, FL, Puerto Rico) to apply climate science and assess how coastal communities and ecosystems can adapt to the impacts of climate variability and change. The S.C. Sea Grant Consortium, in partnership with the Carolinas Integrated Sciences and Assessments (CISA) program, has fostered momentum for the CCoP since 2014. The Consortium led the CCoP-hosted in-person workshop in 2017, “Preparing for New Extremes,” which was held in Charleston, SC with 85 attendees. Two field trips, one on natural solutions and the other built solutions, were included in addition to panels, presentations and plenary speakers. Based on the evaluation, 98% of attendees found the workshop valuable, 24% felt the workshop helped them gain new knowledge that they can apply to their job, and 39% felt that they made new connections with other people or organizations engaged in their area of work with similar interests. https://seacccop.wordpress.com/2017/05/19/our-2017-meeting-by-the-numbers/

S.C. Sea Grant Consortium Fosters Professional Engagement through the Southeast and Caribbean Climate Community of Practice

Elizabeth Fly and Sarah Watson, S.C. Sea Grant Consortium

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S.C. Sea Grant Consortium and Charleston Resilience Network Host NOAA Risk Communications Training Workshop

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

To facilitate conversations around resilience topics, it is important that Charleston Resilience Network member organizations understand how to communicate effectively with their audiences. With the help of S.C. Sea Grant Consortium's Resilience Program Coordinator and S.C. Sea Grant Consortium's Coastal Climate and Resilience Specialist, the Charleston Resilience Network hosted an all-day Risk Communication Training on December 6th, 2017, in Charleston, SC. The goal of this meeting was to teach CRN member organizations how to create an effective communications approach tailored to their area of expertise and intended audience. Twenty-eight members of the CRN attended this event, and the training was led by Sarah Watson (S.C. Sea Grant Consortium), Tashya Allen (NOAA Office for Coastal Management), and Stephanie Fauver (NOAA Office for Coastal Management). Upon completing this training, participants were able to recognize differing values and identify how and why people perceive and respond to risks the way they do, apply social science and risk communication principles when responding to difficult questions, respond to difficult questions with more confidence, and develop a risk communication strategy that incorporates social science and risk communication principles.

S.C. Sea Grant Consortium and Charleston Resilience Network Host "Rendezvous for Resilience"

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

One of the goals for the Charleston Resilience Network (CRN) in 2017 was to engage more stakeholders and facilitate resilience conversations across the region. On April 27, 2017, with support from the S.C. Sea Grant Consortium's Resilience Program Coordinator, the Charleston Resilience Network hosted a "Rendezvous for Resilience", which was the official launch of the Network as a public and private inclusive network. The purpose of the event, which was held in downtown Charleston, SC, was to increase the number of participating organizations, which in turn has helped increase public knowledge of the CRN's mission, events, and efforts. There were 40 professionals representing a variety of backgrounds who attended. In addition to general networking, attendees learned about the history of the CRN, how to become an active member of the CRN, and about upcoming events.

S.C. Sea Grant Consortium and Charleston Resilience Network Support Enough Pie's "Awakening V: King Tide" Event

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

Enough Pie is a local non-profit focused on helping residents of the Upper Peninsula in Charleston face the challenges that come with gentrification of the area by making sure their community is included and/or considered in development plans for the area. One way the organization achieves this goal is

through artistic expression. In May 2017, Enough Pie organized nine public artworks and 10 free community events as part of “Awakening V: King Tide” to raise awareness on flooding in Charleston, SC. Over 20,000 artistic takeaways were distributed to help people take personal, community, and civic action to offset rising water. More than 65 local scientists, artists, and civic and community leaders participated in talks, information sessions, and other events that covered topics like sea, marsh, and city ecosystems, and there were small group discussion tables set up with scientists, city officials, and citizens. The chair of the Charleston Resilience Network and S.C. Sea Grant Consortium’s Coastal Climate and Resilience Specialist both served on the steering committee for the event, and the S.C. Sea Grant Consortium provided support for the event.