



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

**HAZARD RESILIENCE IN COASTAL COMMUNITIES**

**IMPACTS**

*Folly Island, SC includes sea level rise considerations in its 2015 comprehensive plan update with assistance of the S.C. Sea Grant Consortium*

**Dr. Elizabeth Fly, 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 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:** The Consortium facilitated public discussions and educational sessions on the threats of sea level rise to the city of Folly Beach. Scenarios from NOAA’s Sea Level Rise Viewer were used to help visualize potential future inundation. The Consortium provided information on the nature of the impacts from this inundation. The Consortium’s outreach effort enhanced understanding among city leaders about the options available to plan for sea level rise.

**Results:** Folly Beach took a significant step in increasing its resilience to sea level rise by including consideration of this threat in its municipal Comprehensive Plan. This initial consultation with the Consortium led to engagement through public forums, grant opportunities, and plans for a vulnerability assessment on the island.

**Recap:** The S.C. Sea Grant Consortium provided technical climate-related assistance to the city of Folly Beach, S.C., which allowed the community to incorporate planning for sea level rise into its 2015 Comprehensive Plan update.

*City of Charleston looks to S.C. Sea Grant Consortium for assistance in developing a sea level rise strategy*

**Dr. Elizabeth Fly, S.C. Sea Grant Consortium**

**Relevance:** Charleston, S.C., has experienced a 409% increase of nuisance flooding days since the 1960s. The city is making a concerted effort to incorporate planning for future inundation into all activities by developing a sea level rise (SLR) strategy. An important first step for the city was to determine the range of SLR scenarios to use.

**Response:** The city sought the expertise of the Consortium when deciding what SLR scenarios to use in planning for the future. Consortium staff, along with representatives from NOAA Office for Coastal Management and NOAA National Weather Service, met with city officials to analyze current flooding trends and future SLR projections from the National Climate Assessment.

**Results:** In consultation with the Consortium and NOAA, the city determined planning for a SLR of 1.5 ft by 2040 and 2.5 ft by 2060 worked best for the city’s current needs. The city will reassess



these projections every five years. After deciding on this range of SLR, the city developed a sea level rise strategy, a comprehensive inventory of initiatives that are a guiding framework to make the city more resilient to sea level rise and recurrent flooding.

**Recap:** To increase its resilience to future flooding due to sea level rise, the city of Charleston consulted with the S.C. Sea Grant Consortium to define the issue and to develop a detailed sea level rise strategy, which was presented to City Council.

***S.C. Sea Grant Consortium assists in developing training modules for the Association of Climate Change Officers***

**Dr. Elizabeth Fly, S.C. Sea Grant Consortium**

**Relevance:** The international Association of Climate Change Officers (ACCO) defines, develops, and supports the functions, resources, and communities necessary for effective organizational leadership in addressing climate-related risks and opportunities. One of its activities is a CCO Certification™ program, given to participants who have developed a satisfactory capacity to assess the implications of climate change for their organization in the context of their job functions. Participants must take a core curriculum, developed by working groups.

**Response:** The S.C. Sea Grant Consortium’s Climate Program Specialist participated on a committee that developed “Climate-103: Basics of Sea Level Rise and Impacts on Coastal Assets and Infrastructure.” The 10-member committee developed curriculum related to the science of sea level rise globally and locally and case studies on local impacts of sea level rise, and provided a list of tools to assess these impacts at a local scale.

**Results:** The committee developed a presentation and list of sea level rise visualization and planning tools. The training was held at the 2015 Climate Strategies Forum in Washington, D.C., in June 2015, with 23 people attending. In addition, the training was offered regionally in Fort Lauderdale, Fla., (45 participants), Boston (34 participants), and Washington, D.C., (51 people).

**Recap:** The S.C. Sea Grant Consortium participated in curriculum development for the international Association of Climate Change Officers to develop a sea level rise impact workshop that is being offered nationwide.

**ACCOMPLISHMENTS**

***Beaufort County continues discussion on sea level rise with report produced by the S.C. Sea Grant Consortium***

**Dr. Elizabeth Fly, S.C. Sea Grant Consortium**

Concerned citizens, staff, and elected officials from the city of Beaufort and town of Port Royal formed a sea level rise task force to develop recommendations to address current and future flooding. This task force relied on the S.C. Sea Grant Consortium and Carolinas Integrated Sciences and Assessments (CISA) to provide the technical expertise to determine what areas of the city and town are at the most risk to future flooding due to sea level rise and to begin to develop recommendations for adaptation. With assistance from the Consortium and CISA, the task force presented its findings to city council and town council. Both councils encouraged the task force to continue its work and educate the public. The task force then made presentations to



seven neighborhood associations, reaching 35 people, to increase awareness of the threat of sea level rise and discuss public and private strategies for adaptation.

### ***S.C. Sea Grant Consortium fosters the southeastern and Caribbean coastal climate community of practice***

**Dr. Elizabeth Fly, S.C. Sea Grant Consortium**

The Southeast and Caribbean Climate Community of Practice (CoP) brings together individuals from local, state, and federal governments, academia, non-profit organizations, and the private sector in the Southeast U.S. (N.C., S.C., Ga., Fla., Puerto Rico) to apply climate science and assess how coastal communities and ecosystems can adapt to the impacts of climate variability and change. The CoP held meetings in 2010 and 2012, but has lacked leadership and funding in the following several years. The S.C. Sea Grant Consortium Coastal Climate Extension Specialist became the chairperson of the CoP in 2014 and fostered the resurgence of the CoP to maintain momentum and reach into communities in the region. On behalf of the CoP, the Consortium was awarded a grant from the National Sea Grant Office to host an in-person meeting in 2016. In addition to successfully acquiring funding for another in-person meeting, the CoP hosted two webinars. The first focused on leveraging the Community Rating System for climate adaptation, and was attended by 51 people. Among the attendees, 70.8% indicated their knowledge of the National Flood Insurance Program and the Community Rating System increased due to the webinar. The second webinar was in response to the October 2015 flood event and focused on Charleston as a case study. This webinar was attended by 75 people and 94% of attendees felt their understanding of flood mitigation efforts increased as a result of the webinar. With the Consortium's efforts, the CoP expanded its members by 22% in the past year.

### ***S.C. Sea Grant Consortium initiates transfer of vulnerability assessment methodology to a Maryland coastal community***

**Dr. Elizabeth Fly, S.C. Sea Grant Consortium**

After successful implementation of the Vulnerability, Consequences, and Adaptation Planning Scenarios (VCAPS) process in Beaufort County, S.C., staff members from the S.C. Sea Grant Consortium presented a webinar on the effort to a Sea Grant Climate Network. This fostered a relationship with the Eastern Shore Land Conservancy (ESLC) in Maryland, which was looking to complete a similar project with Kent County, a coastal county on the Eastern Shore. Consortium and North Carolina Sea Grant staff assisted ESLC in writing a grant proposal to secure funding to bring VCAPS to Maryland. Upon securing this grant through the Maryland Department of Natural Resources, Consortium staff provided VCAPS training to an audience in Maryland, including staff of Maryland Sea Grant. Members who received training will help conduct a VCAPS workshop with key stakeholders in Kent County, to foster a discussion of resilience to sea level rise and help county planners incorporate this issue into their planning process.

### ***S.C. Sea Grant Consortium secures NOAA climate program office grant to assess water infrastructure vulnerability and implications for public health***

**Dr. Elizabeth Fly, S.C. Sea Grant Consortium**

Coastal water infrastructure is becoming more widely recognized as vulnerable to several chronic threats such as sea level rise, increasing extreme precipitation events, stronger storm surge, and riverine flooding. The failure of water and wastewater systems is not only problematic from an infrastructure standpoint, but the vulnerability of these systems has acute public health risks. The S.C. Sea Grant Consortium received a \$270,606 NOAA Coastal and Ocean Climate Applications (COCA) grant to study



the potential for public health exposure when extreme floods, strong storm surge, or rising sea levels impact coastal drinking water and wastewater systems. The project is a two-year study in collaboration with researchers from University of South Carolina, East Carolina University, North Carolina Sea Grant, and Saint Louis University. Charleston, S.C., and Morehead City, N.C., were chosen as the pilot study areas because they represent a cross section of coastal cities in the Southeast region. The project team will gather data on water infrastructure and evaluate it under current conditions, higher sea levels, and a combination of storm surges and higher sea levels. The researchers then will use the data to generate maps of the most vulnerable areas and identify at-risk populations living and working near coastal waters. A simple, customizable tool called a Susceptibility Index will be developed for decision makers to assess the health risks of these populations under a range of weather and climate scenarios. In addition, a guidebook on how to use the Susceptibility Index tool will be produced, giving coastal communities in the Southeast access to the knowledge and tools to evaluate and respond to potential public health exposures.

### ***S.C. Sea Grant Consortium co-hosts a Coastal Vulnerability Workshop with the North Inlet/Winyah Bay NERR***

**Dr. Elizabeth Fly, S.C. Sea Grant Consortium**

S.C. Sea Grant Consortium staff worked with the North Inlet/Winyah Bay National Estuarine Research Reserve Coastal Training Program to develop and implement a coastal vulnerability workshop meant to increase local decision maker's knowledge of coastal vulnerability issues related to sea level rise. The workshop held for local government staff, elected and appointment government officials, and concerned citizens or members of home owners associations, provided the state of the science of sea level rise in South Carolina, introduced several tools to improve vulnerability analyses for local areas, and highlighted the efforts of a local sea level rise task force. The workshop, held in Georgetown, SC, was attended by 42 people, and 96% of participants agreed or strongly agreed that the event was a good use of their time while 72% learned something new they would apply to their work.

### ***S.C. Sea Grant Consortium studies community perceptions of climate impacts to working waterfronts***

**Dr. Elizabeth Fly, S.C. Sea Grant Consortium**

To better understand the capacity and challenges faced by four of our working waterfront communities, the S.C. Sea Grant Consortium, working with graduate students at the College of Charleston, completed 22 surveys with community planners, commercial fishers, seafood wholesalers, local officials and other community members. The goal was to learn about changes to working waterfronts from pressures due to increasing population, land conversion, and sea level rise in four communities -- Murrells Inlet, Georgetown, McClellanville and Shem Creek. Early results were presented at the National Working Waterfront Symposium in November 2015. They indicate that each of our study working waterfronts are quite different, with one undergoing turbulent change, one wanting to limit change, another ripe for change, and one with an identity issue when considering the future. It seems planning for the future may be different for each. All expect negative impacts from changing climate. This work is part of a larger initiative to help communities define and plan for their future, including a *Study Group* project focused specifically on the challenges of the commercial fishing waterfront. Additional activities are to be conducted in the next year.

### ***S.C. Sea Grant Consortium and CISA provide technical assistance to Lowcountry sea level rise task force***

**Dr. Elizabeth Fly, S.C. Sea Grant Consortium, and Dr. Kirstin Dow, University of South Carolina**



Concerned citizens, staff, and elected officials from the city of Beaufort and town of Port Royal formed a sea level rise task force to develop recommendations to address current and future flooding. This task force relied on the S.C. Sea Grant Consortium and Carolinas Integrated Sciences and Assessments (CISA) to provide the technical expertise to determine what areas of the city and town are at the highest risk to future flooding due to sea level rise and to begin to develop recommendations for adaptation. With assistance from the Consortium and CISA, the task force presented its findings to city council and town council. Both councils encouraged the task force to continue its work and educate the public. The task force then made presentations to seven neighborhood associations, reaching 35 people, to increase awareness of the threat of sea level rise and discuss public and private strategies for adaptation.

***Charleston Resiliency Network uses the Sea Grant Consortium’s S.C. Coastal Information Network as its outreach platform***

**Dr. Elizabeth Fly, April Turner, M. Richard “Rick” DeVoe, and Dr. Susan Lovelace, S.C. Sea Grant Consortium**

The Charleston Resilience Network (CRN) is a volunteer-based effort composed of public and private sector stakeholder organizations within the Charleston, S.C., metropolitan area that have a collective interest in the resilience of communities, critical infrastructure and socio-economic continuity to episodic natural disasters and chronic coastal hazards. The CRN’s mission is to foster a unified strategy and provide a forum to share information, educate stakeholders, and enhance long-term planning decisions for critical infrastructure. The goal is to implement effective hazard mitigation strategies and recovery efforts to episodic and chronic flooding events. The CRN decided to utilize the Consortium’s S.C. Coastal Information Network (SC-CIN) portal – which was identified as a best management practice by a National Sea Grant Site Visit Evaluation Team in 2015 – as its initial platform for extending and sharing information on CRN and its activities.

***S.C. Sea Grant Consortium secures NOAA Regional Coastal Resiliency Grant to build flood resilience in Charleston region***

**M. Richard (Rick) DeVoe and Dr. Elizabeth Fly, S.C. Sea Grant Consortium; Dr. Norman Levine, College of Charleston; and partners**

The Charleston, S.C., region is home to more than 700,000 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 require a concerted and coordinated effort among governmental entities, businesses and industries, non-governmental organizations and owners/operators of critical infrastructure. On behalf of the Charleston Resilience Network ([www.coastalresilience.net](http://www.coastalresilience.net)), the Consortium was awarded over \$500,000 in funding from NOAA’s Regional Coastal Resilience Grant program to advance a collaborative approach to address specific stakeholder informational needs. The goal is more effective implementation of infrastructure planning and operation, land use planning, and water management. This will be accomplished through localized place-based modeling and mapping, community awareness and engagement, and integrative and collaborative capacity-building.



***S.C. Sea Grant Consortium represented the Charleston Resilience Network at Homeland Security's partnerships conference***

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

In June 2014, the U.S. Department of Homeland Security – Office of Infrastructure Protection (DHS), in collaboration with Federal Emergency Management Agency and NOAA, sponsored a Climate Adaptation Exercise in Charleston, S.C. Critical infrastructure stakeholders were brought to the table to develop strategies, discuss decision support, and help coordinate planning efforts related to climate change preparedness and critical infrastructure security and resilience. This exercise led to the engagement of DHS in resiliency efforts in the Charleston area, and to the formation of the Charleston Resilience Network (CRN). The Consortium has been heavily engaged in the DHS effort and in the maturation of the CRN; indeed, the Consortium's Executive Director was invited on behalf of the CRN to participate in DHS's "Building Resilience through Public-Private Partnerships" Conference in December 2015 as the only formal local government representative on the agenda. The relationship among the Consortium, CRN, and DHS resulted in the preparation of a significant proposal to the DHS National Infrastructure Protection Plan's Security and Resilience Challenge competition, which seeks to develop indices and tools to assess for coastal resiliency and adaptation vis-à-vis critical infrastructure.

***S.C. Sea Grant Consortium participates in effort to improve storm surge measurements***

**Dr. Michael Slattery, Coastal Carolina University and the S.C. Sea Grant Consortium**

Working in collaboration with other NOAA Southeast and Caribbean Regional Team (SECART) members, the S.C. Sea Grant Consortium contributed to the manual "Collaboratively Improving Water Level Measurements for Significant Storm Surge Events." The manual will be used to train SECART members and their partners in measuring storm surge. Having more people on the ground will improve the coverage of data for future modeling and thus our understanding of storm surge and its impacts. While there are real-time monitors in place along coastal estuaries, oceanfront, and in the nearshore ocean, the coverage is inadequate. Although there have been efforts to gather post storm information, gaps still exist. The manual outlines a method to improve and increase the availability of storm surge measurements following an event with quality-assured data eventually being posted in a centralized location. Workshops will take place in the coming year.

***S.C. Sea Grant Consortium researchers document wind resistance performance for cross-laminated timber buildings***

**Drs. Weichiang Pang and Thomas Cousins, Clemson University**

High winds and water intrusion can cause substantial damage to coastal South Carolina buildings. Cross-laminated timber (CLT) is an emergent building system that has a history in Europe and Canada. However, little is known about its performance characteristics in a humid, subtropical climate such as South Carolina's. Currently, the U.S. model building code, *Minimum Design Loads for Buildings and Other Structures*, suggests a wind tunnel test for buildings with large balconies or other projections. This is not practical or economically feasible for many mid-rise buildings. Engineers need to know how to design for the unique wind loads, and architects need to be familiar with cladding design issues specific to CLT. S.C. Sea Grant Consortium researchers at Clemson University are testing a method engineers can use to determine the design wind loads for a particular CLT structure. The investigation involved a series of wind tunnel studies on scale models of CLT buildings in various configurations to gather data on



surface wind pressures and overall wind forces. The initial results indicate there is a difference between the pressures measured at the surface of the building versus on the balcony face. The most notable difference is the increase in pressure experienced when the balconies are on the leeward face, or the side sheltered from the wind. The balconies create a cavity and actually end up producing some areas of localized high pressures. The research team also is in the process of constructing a rainwater intrusion test setup. Researchers expect to develop recommendations for changes to the U.S. model building code guidance on wind design.

***S.C. Sea Grant Consortium team assesses the effectiveness of enhanced rip current awareness signs***  
**Dr. Eric Koepfler, Dr. Holly Tankersley, and Jon-Erik Taylor, Coastal Carolina University; Dr. Michael Slattery, S.C. Sea Grant Consortium**

Tourism is big business along the Grant Strand area of South Carolina, which includes Myrtle Beach. It accounted for an estimated \$4.3 billion in direct spending for the fiscal year ending 2011. However, vacationers and tourists traveling to the Grand Strand may not be aware of rip currents found in nearshore waters. Available data shows non-residents are more likely to get caught in rip currents, which are potentially deadly. A S.C. Sea Grant Consortium *Study Group* tested the use of QR codes to improve methods for communicating rip current risk. The group partnered with three hotels in the Grand Strand study area to post rip current information signs enhanced with QR codes directing individuals to the National Weather Service Rip Current Warning for the local area. Surveys were conducted with more than 450 beachgoers along the three study beaches and along three control beaches over a period of three spring and summer months to determine beach activities, awareness of the signage, and knowledge of rip currents and preventive behavior. A sample of results is below.

- Ninety-two % of respondents were visitors to the area while 85% of all respondents self-identified as Caucasian, 7.3% African Americans, 4.6% Hispanic and 1.1% Asian.
- Only 24 participants correctly identified the rip current forecast for the day. Most agreed that they would change their behavior if there were a rip current warning.
- The QR code was scanned only nine times during the study months of May, June and July, thus the enhanced signage with the QR code was largely ineffective.
- When asked about where they got their information 30% reported getting information from television, 16.8% recalled seeing signs and 11.5% recalled hearing information from family. Increasing information on hotel television channels and hotel monitors might be an effective way to share NWS warnings and preventative information.

***Understanding views on climate change in S.C. coastal communities using cultural cognition and deliberative polling***

**Dr. Matthew Nowlin and Lorna Parkinson, College of Charleston; Dr. Elizabeth Fly, S.C. Sea Grant Consortium**

In South Carolina, coastal counties such as Beaufort, Charleston, Georgetown, and Horry have residents who may be highly vulnerable to the potential hazards of climate change. Coastal communities need to adopt adaptation policies and behaviors aimed at mitigating these threats. There is a need for the development of meaningful communication strategies and effective public processes to stimulate community action. The S.C. Sea Grant Consortium funded a *Study Group* project, involving a College of Charleston researcher and master's student and a Consortium extension specialist, to explore how residents of South Carolina's coastal counties perceive impacts of climate change and how their perceptions relate to worldviews using cultural cognition. Results support the notion that core values, represented by cultural cognition and political ideology, play a key role in support for policy options at



multiple governmental levels. Those who had both equitable and less individualistic characteristics were more likely than other cultural types to support a whole host of policy options, including measures to lessen carbon outputs and to plan for adaption and mitigation. The master's student successfully defended her thesis around this topic and is now employed as a contractor for the U.S. Environmental Protection Agency.

***S.C. Sea Grant Consortium touts social science in session at international conference***

**Dr. Susan Lovelace, S.C. Sea Grant Consortium**

The S.C. Sea Grant Consortium coordinated social scientists from throughout the National Sea Grant Network for a session presentation at the International Symposium on Society and Natural Resources (ISSNR) in Charleston, S.C., in June 2015. Different methods of engaging the public, capturing and analyzing data, synthesizing information, and targeting successful extension allow Sea Grant programs to provide materials that can be used for making decisions and adapting to change. Sea Grant program staff and researchers join as a Community of Practice to share methods, lessons and successes gained throughout the United States. This session highlighted some methods Sea Grant programs used to successfully address adaptation or mitigation and discussed pitfalls or unintended consequences of others.