

WEATHER AND CLIMATE RESILIENCE

IMPACTS

S.C. Sea Grant Consortium Compiles Archive of State Resilience Planning Efforts

Taylor Allred, Susan Lovelace, and Matt Gorstein, S.C. Sea Grant Consortium

RECAP: The South Carolina Resilience Planning Archive is a new research tool on the S.C. Sea Grant Consortium website that provides easy access to recent resilience planning documents from local governments and other entities and has been used by the SC Office of Resilience in the development of a statewide resilience plan.

RELEVANCE: The archive was developed for the South Carolina Office of Resilience (SCOR) and State Climatology office. Prior to launch, SCOR struggled to answer the question, “what is everyone doing on resilience?” The archive is the first central hub for South Carolina resilience plans and resolves the impracticality of local planners needing to search for hundreds of plans individually to identify best practices.

RESPONSE: The S.C. Sea Grant Consortium graduate resilience assistant Taylor Allred gathered, coded, and uploaded relevant reports available online from local governments, state and federal agencies, and non-governmental organizations. Allred also developed an online resilience plan submission form and reviewed the included plans to determine and code in the archive whether they considered future environmental conditions, considered affordable housing, when the next plan update is expected, among other fields.

RESULTS: As of April 10, 2023, the archive contains 542 plans. The archive is being used by the South Carolina Office of Resilience in the ongoing development of the first Strategic Statewide Resilience and Risk Reduction Plan. Communications rack cards have been sent to every public planner in S.C. and another set has been developed for residents to learn how their community is planning for resilience.

PARTNERS: Carolinas Integrated Sciences and Assessments, S.C. Department of Natural Resources, S.C. Office of Resilience

S.C. Sea Grant Consortium Engagement Leads to New Sandbag Locations During the Run-up to Tropical Cyclone Events

Sarah Watson and Susan Lovelace, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium (Consortium) identified a gap in the City of Charleston’s (City) preparation for tropical cyclone events in their distribution of sandbag locations prior to impacts.

RELEVANCE: A common method used in South Carolina to mitigate impacts of storm and tide flooding is to use sandbags to seal off the lower level of entryways as temporary flood barriers. Before tropical cyclone events, the City has several locations where they regularly dump sand and provide empty bags to residents to fill up and take back to their properties to prepare for flooding.

RESPONSE: The Consortium, working with partners, including the City of Charleston, developed engagement

sessions as part of a 2016 NOAA Resilience Grant. Through conversations with community members, it was identified that people in the eastside neighborhood of the City, a neighborhood consisting of predominately African American residents, felt that their access to sandbags was limited.

RESULTS: During the run-up to Hurricane Ian impacting South Carolina in 2022, the City used that information and placed a sand bag location near the eastside neighborhood to provide better access to these resources for the residents there.

PARTNERS: City of Charleston

Consortium Provides Coordination and Technical Assistance for Beaufort County Long-Term Resilience Strategy

Sarah Watson, Matt Gorstein, Amanda Guthrie, and Crystal Narayana, S.C. Sea Grant Consortium
Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

RECAP: Beaufort County (County) developed a long-term resilience strategy plan and updated its comprehensive plan with technical assistance from S.C. Sea Grant Consortium (Consortium).

RELEVANCE: Beaufort County has substantial vulnerabilities to flooding and sea-level rise. As such, the County has worked with the Consortium since 2012 on sea-level rise planning. The Consortium developed (in partnership with the former Carolinas Integrated Sciences and Assessments) a sea-level rise action plan for the County in 2015—recommendations from which were incorporated in the County’s comprehensive plan.

RESPONSE: The Consortium provided technical guidance and reviewed the County’s draft of the long-term resilience plan to the County for it to revise and finalize. The Consortium has partnered with the County on a research grant awarded by the Adaptation Sciences grant program through NOAA’s Climate Program Office that will evaluate climate impacts on groundwater.

RESULTS: The County has finalized a new long-term resilience plan that highlighted specific steps the County can take to increase resilience. Municipalities that served on the task force can incorporate the recommendations into their future planning work. Several recommendations in the draft plan have been woven throughout the comprehensive plan which was adopted in fall 2021.

PARTNERS: Beaufort County

Consortium Conducts Tidal Vulnerability Assessment for Town of Pawleys Island Sea-level Rise Adaptation Plan

Landon Knapp and Duncan Williamson, S.C. Sea Grant Consortium and College of Charleston
Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University
Norman Levine, College of Charleston

RECAP: In response to increasing flood vulnerabilities, the S.C. Sea Grant Consortium (Consortium) responded to a request from the Town of Pawleys Island, S.C., to conduct a high-resolution flood mapping analysis of the barrier island community. Results of the analysis drove the selection of planning horizons by the town and were incorporated into a sea-level rise adaptation plan (which is currently under review for adoption by Town Council).

RELEVANCE: Pawleys Island is a small, low-lying barrier island that is experiencing impacts from flooding and sea-level rise. The Town's economy is entirely dependent on the water that surrounds it, while flooding has been identified as one of the top issues needing to be addressed. In May 2022, the town began an effort to plan for adaptation to sea-level rise and requested the Consortium's support to provide science-based information to guide the process.

RESPONSE: The Consortium (in collaboration with the College of Charleston) conducted a high-resolution, local flood mapping analysis of the Town of Pawleys Island. The study analyzed the vulnerability of key community assets such as roads, parcels, buildings, and businesses to tidal flooding (including future sea-level rise conditions). Results were communicated to town administrators and residents at an engagement event using touch screen monitors and via an interactive online tool.

RESULTS: The Town of Pawleys Island utilized the results of the Consortium's flood mapping analysis to draft a sea-level rise adaptation plan (which has been finalized and is currently under review for adoption by Town Council). Results of the tidal vulnerability analysis conducted by the Consortium revealed a tipping point at 2-ft of sea-level rise, which the town subsequently selected as their planning target over the next 30 years. The plan draft can be found at this link <https://www.townofpawleysisland.com/wp-content/uploads/2022/12/6C.-Pawleys-SLR-Adaptation-Plan-Draft-v5-1.pdf>.

PARTNERS: College of Charleston, Town of Pawleys Island, SC, Elko Coastal Consulting

Assessing Flood Risk in Rosemont, S.C., Through Water Quality Analysis, Hydrology Mapping, and Bioremediation

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

Lara Noren, National Oceanic and Atmospheric Administration

Brian Walter, Charleston Community Research to Action Board

Omar Muhammed, Lowcountry Alliance for Model Communities

Sheelah Bearfoot, Anthropocene Alliance

Norman Levine and Vijay Vulava, College of Charleston

RECAP: The S.C. Sea Grant Consortium (Consortium) is collaborating with researchers from the College of Charleston to conduct flood assessments and water quality analyses for a situationally vulnerable and historically underserved community.

RELEVANCE: Rosemont is a historic neighborhood in Charleston, S.C., bordering salt marshes, the Ashley River, and a major interstate. This community faces acute threats from legacy industrial pollutants, poor air quality, and flood risk that is exacerbated by sea-level rise.

RESPONSE: The Consortium is collaborating with researchers from the College of Charleston to conduct water quality analyses and hydrologic mapping of tidal and precipitation-based flooding. A citizen science program has been designed and is being implemented where community members are being trained to collect and store water samples for analysis. Funding and permitting for installation of a water level sensor have been secured for a tidal creek within the community (which will be installed in 2023).

RESULTS: A citizen science program has been designed and is being implemented where community members are being trained to collect and store water samples for analysis. Funding and permitting for installation of a water level

sensor have been secured for a tidal creek within the community (which will be installed in 2023).

PARTNERS: Charleston Community Research to Action Board, Lowcountry Alliance for Model Communities, AGU Thriving Earth Exchange, National Oceanic and Atmospheric Administration, Anthropocene Alliance, College of Charleston, Rosemont Community Association

S.C. Sea Grant Consortium Conducts Groundwater Table and Marsh Vulnerability Studies to Guide Nature-Based Solutions

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

Lee Bundrick, Kiawah Conservancy

Norman Levine, College of Charleston

RECAP: With the growing importance of understanding characteristics of the groundwater table for both hazard mitigation and environmental health, S.C. Sea Grant Consortium (Consortium), alongside a team of experts, conducted a long-term monitoring study with the installation of a network of groundwater wells across a barrier island system and mapping the vulnerabilities of the salt marsh system and mitigation options.

RELEVANCE: While much attention is paid to the flow and accumulation of surface water, little is known about the characteristics of the groundwater table and its influence on the plant, animal, and human communities in coastal areas. The depth and salinity of subsurface groundwater are major factors influencing the health of coastal ecosystems and flood conditions impacting people. The marsh also provides critical ecosystem services to humans and wildlife and faces a variety of stressors.

RESPONSE: The Town of Kiawah Island and National Fish and Wildlife Foundation funded a collaborative research project led by the Consortium, Kiawah Conservancy, and the College of Charleston. The project funded graduate-level students to install 18 monitoring wells to sample groundwater conditions across different elevations, soil types, and locations. Five wells additionally recorded salinity. The vulnerability of salt marsh habitat was mapped with recommendations for oyster-based living shoreline implementation to mitigate marsh losses.

RESULTS: The Kiawah Conservancy (with support from the Consortium) published the *Nature-Based Solutions Manual for Kiawah Island*, which focused on highlighting novel concepts and solutions for addressing community resilience. The manual includes best practices for addressing challenges to the changing coastal environment through nature-based solutions, in addition to methods and results of the collaborative studies. The manual was utilized in the creation of the Town of Kiawah Island comprehensive marsh management plan, released in November 2022.

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PARTNERS: Kiawah Conservancy, College of Charleston, Town of Kiawah Island

ACCOMPLISHMENT

S.C. Sea Grant Consortium Researchers Create Real-Time Road Flooding Map for Charleston Area Businesses and Residents

Norman Levine, Lancie Affonso, and Kendra Stewart, College of Charleston
Emma Paz, City of Charleston

RECAP: To provide a user-friendly app of likely road closers around the Charleston area, a database was created using pre-modeled tidal flooding severity for every road in Charleston County, linking intervals of tide height to corresponding flood intensity for each road segment. A digital elevation model incorporating 8,000 culverts in the study area was shared with NOAA-OCM for incorporation into the Sea Level Rise Viewer.

RELEVANCE: Road closures and flood-based hazardous conditions are a significant threat to safety and mobility in the South Carolina Lowcountry, with significant and frequent disruptions for Charleston-area residents and businesses. A usable tool that combines road structure elevation with predictions to coastal flood conditions and rain events would enable municipal decision-makers to prioritize street closures and drivers to find alternative routes in real time. Additionally, such a tool could be used to prioritize infrastructure maintenance and changes.

RESPONSE: S.C. Sea Grant Consortium-funded researchers developed an online spatial database (including Android and Apple platforms) to model the likelihood of flooding under precipitation and tidal conditions for every road within Charleston County. NOAA-OCM's Coastal Change Analysis Program provided 1-m resolution land cover data and NOAA's NWS advised the project team on NWS tidal prediction and precipitation methodologies. In addition to a published report, 12 professional presentations associated with the project were given.

RESULTS: A digital elevation model incorporating 8,000 culverts in the study area was shared with NOAA-OCM for incorporation into the Sea Level Rise Viewer and as a supplemental dataset for use by the Coastal Change Analysis Program. These datasets and models were shared on the SCGIS laboratory online portals and made accessible to all groups that requested data for their projects, including the GIS Public Lowcountry Users Group and the county-level Coastal GIS Users Group.

PARTNERS: ESRI, NOAA-OCM, NOAA-NCCOS

S.C. Sea Grant Consortium Creates Coastal Watershed Community Engagement Specialist Position

Ke'Ziyah Williamson, Susan Lovelace, and Matt Gorstein, S.C. Sea Grant Consortium
Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

RECAP: The S.C. Sea Grant Consortium (Consortium) secures funding to create a coastal watershed community engagement specialist position to continue valuable programs and implement new ones.

RELEVANCE: Increasingly, decision makers (including the S.C. Office of Resilience) are considering watershed scales in their priorities. On top of that, inland underserved communities that live near rivers within the coastal watershed need information on nearby water levels to help inform planning and disaster response efforts, having been highly impacted by Hurricanes Matthew and Florence.

RESPONSE: Recognizing that watersheds that drain into the coast encompass communities that are further inland than coastal counties themselves, the Consortium hired Ke’Ziyah Williamson as a Community Engaged Intern (CEI) in 2022 to expand a network of real-time water level sensors to underserved communities in the Pee Dee River region.

RESULTS: Leveraging funds from the Southeast Coastal Ocean Observing Regional Association (SECOORA) and other grant funds Williamson has stayed on full time as the coastal watershed community engagement specialist to continue identifying possible locations and working with communities to install water level sensors., She is also the engagement lead on a project examining community experiences with and perceptions about buyout programs.

PARTNERS: Francis Marion University, Southeast Coastal Ocean Observing Regional Association

Consortium and Collaborators Expanding Water Level Sensor Network in the Pee Dee Watershed

Ke’Ziyah Williamson, S.C. Sea Grant Consortium

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Paul Gayes, Coastal Carolina University

Jeff Steinmetz, Francis Marion University

Debra Hernandez, Southeast Coastal Ocean Observing Regional Association

RECAP: The S.C. Sea Grant Consortium collaborated with the Southeast Coastal Ocean Observing Regional Association (SECOORA), Francis Marion University (FMU), and Coastal Carolina University (CCU) to install water level sensors in situationally vulnerable communities throughout the Pee Dee watershed to provide decision-support for communities and provide data to enhance flood modeling.

RELEVANCE: South Carolina’s low-lying coastal region is highly vulnerable to tidal flooding, having experienced repeated impacts from extreme and chronic flooding over the last decade. The complexity of tidal systems combined with the lack of widely distributed monitoring equipment has resulted in poor understanding of the preparation and response needed for local communities. The connection of tidal systems with upland watersheds calls for the installation of water level sensors throughout the Pee Dee watershed.

RESPONSE: As part of the Consortium’s Community Engaged Internship Program, an intern was hired to build connections in communities interested in water level sensors. The intern connected with five communities. A specialist (in partnership with SECOORA) was then hired to continue the work, resulting in connecting with two additional communities. This initiative aims to enhance flood modeling throughout the Pee Dee watershed while providing communities the tools to understand and respond to localized water level changes.

Results: The Grant Consortium identified and collaborated with five counties, Lancaster, Marlboro, Florence, Marion and Lee. After coordinating with researchers at Coastal Carolina University, the county and the S.C. Department of Transportation, plans are near completion to install the first of these in Bennettsville, S.C.

PARTNERS: Southeast Coastal Ocean Observing Regional Association, Francis Marion University, and Coastal Carolina University

Understanding the Perceptions and Impacts of Buyout Programs as a Mitigation Response for Resilience in Rural Communities

Ke'Ziyah Williamson, S.C. Sea Grant Consortium

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

Scott Curtis, The Citadel

Jennifer Helgeson, National Institutes for Standards and Technology

Jamie Kruse, Anurdha Mukherji, and Ausmita Ghosh, East Carolina University

RECAP: The S.C. Sea Grant Consortium partnered with East Carolina University, The Citadel, and the National Institute of Standards and Technology to examine the full impact of buyout programs in two rural communities in the Carolinas. Ultimately, rural communities should be better prepared for and recover sooner from compound flood events and coastal inundation.

RELEVANCE: Many of the low-income, rural communities of S.C. have been underserved by past environmental initiatives. Several of the rural counties in the state also experience chronic flooding and are currently undergoing buyout programs as a response to flooding from extreme events such as Hurricane Matthew and Florence.

RESPONSE: Following engagement with the S.C. Office of Resilience, Bennettsville, S.C., was chosen for an impacts of buyout programs study (as it is a rural, flood-prone, low-income community undergoing the buyout process). In fall 2022, a specialist was hired to build connections and trust within the community, resulting in built connections with four community leaders and grassroots organizations. This team will conduct one-on-one interviews with community leaders and host focus groups with community members.

RESULTS: The team is engaging and building partnerships with programs such as the Center for Heir's Property and S.C. State University Extension Program for assistance in contacting and interviewing community leaders and householders.

PARTNERS: The Citadel, East Carolina University, National Institutes for Standards and Technology

S.C. Sea Grant Consortium and Partners Conduct Beach Erosion Research and Monitoring

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Paul Gayes, Coastal Carolina University

RECAP: The S.C. Sea Grant Consortium and Coastal Carolina University calculated the sediment volume change on beaches at Surfside, Garden City and North Myrtle Beach to help characterize and manage erosion as part of annual survey profiles required to determine future work in the Grand Strand Renourishment Project by the U.S. Army Corps of Engineers. Volume changes were also conducted as a result of Hurricane Ian impacting the area in September 2022.

RELEVANCE: The Grand Strand beaches in Horry County are major tourist destinations that support the local and state economy. The beaches experience shoreline changes from various coastal processes. The health of the beaches is important to track and maintain in order to help communities manage their shoreline changes. The U.S. Army of Engineers requires that Horry County and the City of North Myrtle Beach monitor annually to assist in their future renourishment project planning.

RESPONSE: The Consortium processed and analyzed the beach profile surveys for 83 transects covering 19 miles of

oceanfront shoreline within Horry County.

RESULTS: Two separate reports were produced that provided graphical and textual explanations of the shoreline changes observed in 2021 and 2022. For Horry County, a third report was also developed to explain changes post Hurricane Ian. These reports were delivered to Horry County, City of North Myrtle Beach, and U.S. Army Corps of Engineers to assist in determining timing of the next renourishment event.

S.C. Sea Grant Consortium and Partners Use Virtual Reality Storm Surge Simulations to Increase Risk Awareness

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Amanda Guthrie, S.C. Sea Grant Consortium

Jill Gamble and Nina Sassano, Marine Extension and Georgia Sea Grant

Sun Joo Ahn, University of Georgia

Matt Browning, Clemson University

RECAP: The S.C. Sea Grant Consortium (Consortium) and its partners provided training and piloted a tandem virtual reality simulation to help drive home the concepts and risks associated with storm surge for individuals throughout coastal Georgia and South Carolina.

RELEVANCE: Storm frequency and coastal populations in the Southeast are increasing, but many people have not experienced a hurricane. They are unfamiliar with storm surge, the damage it can cause, and actions they can take to protect their home. Using a virtual reality storm surge simulation offers the chance to “redo” the experience after taking preventative actions. This project is important in improving how extreme weather risks and their associated preparative actions are conveyed.

RESPONSE: The Consortium continued to provide expertise on the development of the virtual reality simulation in addition to the training modules on storm surge and mitigation actions.

RESULTS: Consortium staff developed and distributed a survey to state, county, and local emergency managers to collect feedback on the preferred format and topics of the training modules to be developed. Five main topics were identified: introduction to hurricanes, hurricane risks & changing conditions, short-term hurricane preparation, resilience to hurricanes, and post hurricane recovery.

Consortium Identifies Two Locations to Deploy Temporary Weather Towers Ahead of Storms Expanding Multi-State Effort

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Brian Phillips, University of Florida

Britt Raubenheimer, Woods Hole Oceanographic Institution

RECAP: S.C. Sea Grant Consortium established two locations in South Carolina to expand the Project Sentinel effort, which deploys temporary weather towers before landfall of a tropical cyclone in order to measure real-time wind speed, water depth, and wave heights.

RELEVANCE: Existing monitoring stations generally report wind or hydrodynamic conditions, but not both. Further, these monitoring stations may not be close to the landfall of a hurricane or are not engineered to operate during

extreme conditions. The data collected from Project Sentinel stations provides real-time data to weather apps, news outlets, and emergency operations centers, and can be used for modeling. This project has partners in North Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

RESPONSE: The coastal processes specialist contacted seven cities and towns in SC to identify communities who would like to host a tower. The opportunity was shared at the S.C. Beach Advocates meeting and city council meetings. Field visits occurred with interested cities to determine the most accessible and appropriate location. Finally, coordination occurred to write a protocol for install, encompassing who within the city would be notified (including turtle patrol).

RESULTS: The Consortium was able identify two potential sentinel tower locations at Folly Beach and North Myrtle Beach. Written agreements and deployment procedures with these cities were established in the event that either city is in the path of a hurricane. The plan was to deploy during Hurricane Ian in September 2022; however, the deployment team (based in Florida) was severely impacted by Hurricane Ian and unable to mobilize in time.

S.C. Sea Grant Consortium Coordinates New Coastal Processes Extension Advisory Committee

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

RECAP: The Consortium's coastal processes program specialist continues to build meaningful programs with input from external partnerships within the established Coastal Processes Extension Advisory Committee.

RELEVANCE: In October 2021, the Consortium hired a coastal processes specialist to establish a sustainable extension program within the Weather and Climate and Resilience programmatic focus area to address issues related to the connection between coast and inlands of South Carolina. Building a successful extension program requires inclusive and constructive collaboration with partners throughout the state to enhance the reach into the communities served.

RESPONSE: In March 2022, the Consortium convened a Coastal Processes Extension Advisory Committee meeting. The purpose of the committee is to discuss and identify current issues impacting coastal natural resources and the communities dependent upon them while assisting with the formulation of solutions to address the identified needs of constituents through strategic planning priorities. Several relevant stakeholder groups with an interest in weather and climate resilience participated, resulting in a committee of five partners.

RESULTS: Feedback was gathered through the initial 2022 meeting, specifically focused on efforts within the Coastal Climate and Resilience program. Input is continually sought to build and support programming efforts. This committee will continue to be critical to the growth and continued successes of the Coastal Processes Extension program.

S.C. Sea Grant Consortium Assess Sea-Level Rise and Climate Change Impacts on Groundwater in Beaufort County

Amanda Guthrie, Sarah Watson, Brita Jessen, and Susan Lovelace, S.C. Sea Grant Consortium

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

Abi Locatis Procheska, ACE Basin NERR and S.C. Department of Natural Resources

Alicia Wilson and Dami Abioye, University of South Carolina

Norman Levine, Matt Nowlin, Duncan Williamson, and Lauren Greenwood, College of Charleston
Robert Merchant and Kristen Forbus, Beaufort County

RECAP: The S.C. Sea Grant Consortium (Consortium) and partners received funds from the NOAA Climate Program's Adaptation Sciences Program to assess groundwater levels and its impact on communities and on underground infrastructure in Beaufort County (County). Fifteen ground water wells were installed along with community engagement.

RELEVANCE: Coastal communities have approached planning for sea-level rise in varying ways. However, many of these methods focus on flooding without necessarily connecting surface inundation with what happens below ground and to the systems that allow communities to function in built environments. Co-production methods are being increasingly emphasized as means to achieve advancements in resilience to climate change.

RESPONSE: The Consortium formed an interdisciplinary team of researchers and extension professionals to investigate the "so what" part of how sea-level rise affects communities by studying how these systems may be disrupted by extreme events and sea-level rise. By taking a proactive approach, we can help communities better plan for these failures and reduce the disruption and damage that will come as sea level continues to rise.

RESULTS: Fifteen groundwater wells were installed across four communities in Beaufort, South Carolina. The groundwater data can inform County priorities and policies to reduce climate change impacts. One community meeting was held to share information about the project and learn about community experiences and priorities. Additionally, the Consortium was interviewed and published in Yale Climate Connections ([yaleclimateconnections.org/2023/03/rising-seas-could-cause-septic-system-failures-in-beaufort-county-south-carolina/](https://climateconnections.org/2023/03/rising-seas-could-cause-septic-system-failures-in-beaufort-county-south-carolina/)).

PARTNERS: ACE Basin NERR, S.C. Department of Natural Resources, University of South Carolina, College of Charleston, Beaufort County

S.C. Sea Grant Consortium Works to Address Heat Health Concerns in the City of Charleston

Amanda Guthrie and Susan Lovelace, S.C. Sea Grant Consortium
Scott Curtis, The Citadel James B. Near Center for Climate Studies
Geno Olmi, NOAA Southeast and Caribbean Region Team
Janice Barnes, Climate Adaptation Partners

RECAP: The S.C. Sea Grant Consortium and partners received funds from the NOAA Climate and Equity Roundtable funding opportunity to assess heat health risk within the City of Charleston. Led by the Consortium, the team worked with residents in a public housing neighborhood to assess temperatures in a variety of areas in the neighborhood as well as coming from building materials.

RELEVANCE: In the United States, heat kills more people than any other weather-related hazard. Due to climate change, days and nights will be hotter, creating an additional stressor that will harm outdoor workers, low wealth and marginalized communities, people with chronic health conditions, and many others. As heat is seen as a normal part of life in the Southeast, there is an increasing need to raise awareness of and reduce heat health impacts.

RESPONSE: The Consortium has partnered with state and federal agencies to better assess heat within the City of Charleston. After the Charleston Peninsula was mapped to identify heat islands, additional funding was secured

through the NOAA Climate and Equity Roundtables to more equitably reduce heat island effects and heat-health stress in the city.

RESULTS: In collaboration with local residents and volunteers, the project team, which included graduate students from multiple Consortium member institutions, measured the different temperature of different building materials and materials used at other outdoor spaces (e.g., playgrounds, trees) at a public housing complex. They also measured the thermal stress due to sun radiation, wind, temperature, and humidity at multiple points within the complex. Further, a tabletop planning exercise will be developed to help the City of Charleston formally develop a heat-reduction plan.

PARTNERS: City of Charleston, The Citadel, Climate Adaptation Partners, Medical University of South Carolina, NOAA Southeast and Caribbean Region Team, University of South Carolina and National Weather Service

S.C. Sea Grant Consortium Supports Discussions and Collaborations About Climate-Induced Displacement and Relocation

Amanda Guthrie and Susan Lovelace, S.C. Sea Grant Consortium
Mona Behl, UGA Marine Extension and Georgia Sea Grant

RECAP: The S.C. Sea Grant Consortium (Consortium) served on the overall research team and on the steering committee for the Southeastern and Gulf of Mexico workshop for the People on the Move in a Changing Climate (PEMOCC). The workshop held in December 2022. provided an opportunity for researchers, practitioners and government agencies to explore climate migration in the region.

RELEVANCE: Climate change impacts have and will continue to make some places unlivable (permanently or temporarily) in coastal regions. One consideration to address these changes is for people to relocate from at-risk areas. There is a lack of knowledge on how socioeconomic, cultural, political, and environmental processes impact these population shifts. As climate-induced retreat can be a controversial topic, this strategy is not often discussed or shared among communities, practitioners, and researchers.

RESPONSE: Led by Georgia Sea Grant workshops were held as part of the People on the Move in a Changing Climate (www.pemocc.org/) research coordination network. These workshops facilitated transdisciplinary collaborations among researchers, practitioners, resource managers, and coastal stakeholders to improve understanding of how climate change drives human populations both towards and away from coastal regions. The Consortium served on the steering committee for the Southeast and Gulf of Mexico workshop and hosted panels with experts in the field.

RESULTS: Over 40 people attended a workshop held in Atlanta, GA, to discuss climate-induced displacement and relocation within the Southeast and Gulf of Mexico. S.C. Sea Grant Consortium hosted two panels at the workshop. Since the closure of the December workshop, the workshop attendees have met to discuss follow-up steps that were formulated during the workshop.

PARTNERS: UGA Marine Extension and Georgia Sea Grant, Florida State University, Alaska Sea Grant, New Jersey Sea Grant Consortium, USC Sea Grant, Delaware Sea Grant, Illinois-Indiana Sea Grant, National Sea Grant Law Center, Pennsylvania Sea Grant, Ohio Sea Grant, Washington Sea Grant

S.C. Sea Grant Consortium Provides Technical Assistance to S.C. Office of Resilience for Statewide Resilience Planning

**Susan Lovelace, Amanda Guthrie, Matt Gorstein, and Sarah Watson, S.C. Sea Grant Consortium
Landon Knapp, S.C. Sea Grant Consortium and College of Charleston**

RECAP: The S.C. Sea Grant Consortium (Consortium) provided technical assistance and guidance to the S.C. Office of Resilience (SCOR) to advise development of a strategic statewide resilience and risk reduction plan.

RELEVANCE: The S.C. governor and state legislature recognized the need to address community resilience with a dedicated state agency after repeated flooding impacts. SCOR has been directed to develop, implement, and maintain a strategic statewide resilience and risk reduction plan (the first SC statewide resilience plan). The plan is intended to serve as a framework to guide state investment in flood mitigation projects and the adoption of programs and policies that protect South Carolina's people and property.

RESPONSE: The Consortium aided in training sessions on climate science and implications of climate change in S.C.; a presentation to SCOR's advisory task force; an analysis of out-of-state sea-level rise and climate planning scenarios; an analysis of plans to help SCOR identify the state of resilience activities; and communications training. The Consortium assisted in the development of a S.C. climate report. Consortium staff served on the Resilience Plan Advisory Committee and several ad hoc committees.

RESULTS: SCOR drafted a strategic statewide resilience and risk reduction plan with guidance from the Consortium, which is planned for completion on July 1, 2023. In collaboration with the Consortium, SCOR was awarded a grant (\$750,675) from the National Fish and Wildlife Foundation to conduct resilience planning at the watershed level (a main tenant of the draft statewide resilience plan).

PARTNERS: S.C. Office of Resilience

S.C. Sea Grant Consortium Researchers Develop Tool to Identify Real-Time Impacts of Coastal Hazards and Storms

Mostafa Batouli and Deepti Joshi, The Citadel

RECAP: Locally relevant vulnerabilities and impacts from coastal hazards and storms can be detected by combining social network data (e.g., Twitter) with Census, geographic, and infrastructure mapping. The study reveals that there are differences in how racial and ethnic groups perceive vulnerability (which should be addressed in communications).

RELEVANCE: Coastal storms and hazards (e.g., flooding) result in different impacts to communities based on locally relevant socio-economic, geographic, and infrastructure factors. Understanding how communities describe and respond to these impacts requires real-time social data combined with locally relevant mapping. Combined, the socio-economic and geo-spatial data can inform better decision making and prioritization of resources and actions.

RESPONSE: Consortium-funded researchers created a tool using "social sensing," based on Twitter data obtained following Hurricane Dorian (2019) combined with demographic, socioeconomic, and occupation data collected at the Census Tract level to develop a database of community characteristics. Locally specific flood events and power outages were detected through this method, providing a novel tool for on-time decision-making by disaster management agencies. The identification of both socioeconomic and physical vulnerabilities in affected regions also enables better hazard mitigation.

RESULTS: This project developed a novel approach for identifying the physical and socioeconomic vulnerabilities in areas affected by natural disasters based on social sensing. The method was tested for the impacts of the 2019 hurricane Dorian on South Carolina. The results showed the promising capabilities of the method in near real-time detecting of events such as flooding and power outages as well as identifying different types of vulnerabilities among various socioeconomic groups.

PARTNERS: The Citadel

S.C. Sea Grant Consortium Awarded \$500K Grant to Assess Feasibility of Thin Layer Placement in South Carolina

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Matt Gorstein and Brita Jessen, S.C. Sea Grant Consortium

Giulio Mariotti, Louisiana State University

Andrew Tweel, S.C. Department of Natural Resources

Ellie Lovellette, College of Charleston

RECAP: The S.C. Sea Grant Consortium (Consortium) was awarded nearly \$500,000 over four years from a joint grant competition of the NOAA National Sea Grant College Program and the U.S. Coastal Research Program to develop an assessment framework on the benefits and feasibility of thin layer placement (TLP) in SC. An advisory committee was established to guide the group evaluating TLP as a beneficial restoration technique to increase marsh resilience to sea-level rise and storms.

RELEVANCE: Chronic (e.g., sea-level rise) and episodic (e.g., storm impact) changes to the south Atlantic coast are increasing the vulnerability of coastal wetlands, past marshes' ability to recover naturally. TLP is a process where sediment removed from navigation channels during dredging is transported to a marsh and sprayed on the surface of the marsh. This sediment addition to marshes can be beneficial as a dredge material disposal site and increasing marsh resilience.

RESPONSE: The Consortium and partners will develop a multisectoral framework to assist in decision making for potential TLP sites in S.C. Potential TLP locations will be assessed from an economic, regulatory, ecological, and socio-cultural lens, and then representative sites will be implemented in a geomorphological model (MarshMorpho2D) to evaluate the potential for success.

RESULTS: An advisory committee has been formed to guide the project including representatives from academia, federal and state government, and Army Corp of Engineers as well as environmental, tourism and community organizations.

S.C. Sea Grant Consortium Establishes Coast Snap Station in Horry County

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Ian Conery, U.S. Army Corps of Engineers, Engineer Research and Development Center

RECAP: The S.C. Sea Grant Consortium continued working with the U.S. Army Corps of Engineers Research and Development Center and installed a Coast Snap station in Horry County. The station allows people to take and submit photos of the shoreline from the same vantage point to measure how the beach is responding to various events such as king tides, storms, and sea-level rise.

RELEVANCE: The Grand Strand beaches in Horry County are major tourist destinations that support the local and state economy. The beaches experience shoreline changes as a result of various coastal processes. The numerous visitors to the beaches provide a valuable citizen science resource to assist in monitoring how areas are affected by various events. This project also presents an opportunity to educate the public on shoreline erosion and renourishment events.

RESPONSE: The Consortium with assistance from Coastal Carolina University students facilitated the installation process—students will continue to be involved in maintaining and processing the incoming data from the Coast Snap station. Future work will continue to refine how to most effectively disseminate the images and information from the Coast Snap station.

RESULTS: In November 2022, the coastal processes specialist installed a Coast Snap station on the Cherry Grove Fishing pier in North Myrtle Beach. The pier experienced damage during Hurricane Ian; however, the pier remains committed to participation, anticipating more engagement with the station in the following year (beyond the hurricane damage and station install occurring post-tourist season). Discussions are underway to install another Coast Snap station in Charleston County in 2023.

S.C. Sea Grant Consortium Participates in Development of Living Shorelines Education Course

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Abi Locatis Prochaska, ACE Basin NERR and S.C. Department of Natural Resources

Kim Morganello, Carolina Clear and Clemson Extension

RECAP: An online 4-week course is being developed to better educate coastal property owners and contractors on where living shorelines are suitable and best practices for installation. The course content is being developed by various education partners and being led by S.C. Department of Natural Resources (SCDNR) and Clemson Extension.

RELEVANCE: South Carolina coastal property owners and other stakeholders had expressed an increased interest for options to naturally stabilize shoreline within the estuarine environment. As a result (in 2016) the S.C. Department of Health and Environmental Control embarked on a five-year strategy to develop a regulatory definition and project standards for living shorelines in South Carolina. The living shoreline regulations were introduced to the S.C. General Assembly and became effective in May 2021.

RESPONSE: In an effort to educate contractors and other stakeholders on various aspects of installing living shorelines, SCDNR and Clemson Extension brought together education partners to develop an online 4-week, go-at-your-own-pace course with an accompanying field day.

RESULTS: The coastal processes specialist developed a module to explain site access during construction. This module covers best practices for limiting disturbance in the critical area and the best way to transport materials, stage materials, and work within the site. The full 4-week course offerings are expected to be available in the summer of 2023.

S.C. Sea Grant Consortium and College of Charleston Train GIS Students by Working on Real-World Issues

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

Norman Levine, College of Charleston

RECAP: The S.C. Sea Grant Consortium partnered with the College of Charleston to provide geographic information system (GIS) mapping resources to coastal communities by having student projects focus on real-world issues communicated by communities and collaborators.

RELEVANCE: Coastal communities of South Carolina require GIS mapping and analyses to address increasing community and environmental hazards, but many lack the necessary technical and financial resources.

RESPONSE: Partnering with Norman Levine at the College of Charleston, students learning GIS conducted class projects on issues of importance to coastal communities/collaborators. During spring 2022, an introductory vulnerability assessment was conducted for the communities of Pawleys Island and Murrells Inlet, SC. In fall 2022, an analysis of possible marsh migration routes was conducted based on ecological, geological, and societal factors.

RESULTS: The introductory vulnerability assessment for Pawleys Island and Murrells Inlet was used as the foundation for a full tidal vulnerability assessment for the Town of Pawleys Island. That assessment was utilized by The Town of Pawleys Island to draft a sea-level rise adaptation plan (which has been finalized and is currently under review for adoption by Town Council, <https://www.townofpawleysisland.com/wp-content/uploads/2022/12/6C.-Pawleys-SLR-Adaptation-Plan-Draft-v5-1.pdf>). The marsh migration analysis was communicated to stakeholders representing environmental organizations in South Carolina.

PARTNERS: College of Charleston