

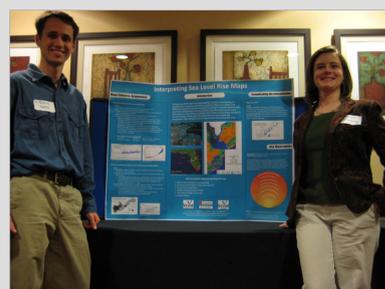
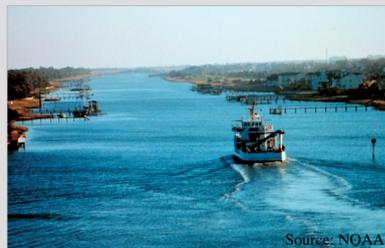
Introduction



Coastal Carolinas face stresses ranging from current development and population growth to the climate change-related threats of sea level rise and changing precipitation patterns. The Carolinas RISA (CISA) is linking work on drought with coastal management issues through several projects and collaboration with North and South Carolina Sea Grant Extension Programs. We present one example of outreach related to sea level rise and introduce ongoing research in support of adaptation decisions related to salinity intrusion, local community vulnerabilities, and drought early warning system needs for coastal ecosystem management.

Collaboration with NC/SC Sea Grant

CISA is collaborating with North and South Carolina Sea Grant Extension to inform and educate coastal decision makers of the implications of climate variability and change for major coastal issues including erosion, invasive species, salt-water intrusion, health of fisheries, agriculture, tourism, coastal community development, and natural hazards. With the support of NOAA's Climate Program Office and the National Sea Grant Program, we created a new position of Regional Climate Extension Specialist and hired Dr. Jessica Whitehead to lead these efforts. This entails developing tailored, decision relevant information on the implications of climate variability and change for coastal decision makers ranging from residents to government officials to business people. The merger of resources increases the capacity of the Sea Grant network regionally and nationally to research and deliver outreach programs on the impacts of climate variability and change for coastal stakeholders.



Sea Level Rise Maps

CISA projects work to provide people with climate information and the tools to process this information to make decisions. CISA recently developed a FAQ sheet to assist stakeholders in interpreting sea level rise (SLR) maps. This FAQ sheet describes many of the assumptions and choices that go into the development of these maps and discusses what issues people need to be aware of when interpreting these maps.

The checklist below summarizes key issues in interpreting SLR maps. By identifying the challenges in creating and interpreting SLR maps, we increase the transparency of information for concerned citizens in evaluating potential risks.

What to be aware of when interpreting SLR maps



- ✓Rate of SLR
 - Source of sea level data
 - Constant or accelerated rate
 - High or low end estimate
 - Rate of ice loss
- ✓Quality and sensitivity of DEM
- ✓Tidal datum (high or low tide)
- ✓Impact shown (permanent or temporary)

Assessing the Impact of Salt-Water Intrusion in the Carolinas Under Future Climatic and Sea-Level Conditions

This study will allow stakeholders in the Yadkin-Pee Dee River basin of South and North Carolina to prepare for potential changes in the frequency and magnitude of salt-water intrusion under future climatic and sea level conditions. The potential increase in extreme events in the future requires the thorough evaluation and understanding of the complete hydrological system to reliably assess the impact of future salt-water intrusion events. This work expands on a recent study that evaluated salt water intrusion in the Waccamaw River portion of the Pee Dee drainage basin using more contemporary data sets of stream discharge and specific conductance measurements. The ongoing study uses the hydrologic water quality and Artificial Neural Network modeling to assess the likelihood of variability in discharge through the entire Yadkin-Pee Dee river system. Working with the Pee Dee River Coalition and with members of state and federal agencies, this program will provide information on potential future scenarios to assist stakeholders in planning for their operations. The study will develop a new, web-based Decision Support System (DSS) for stakeholder and government agency use in evaluating potential changes in the hydrologic system of the Pee Dee River under different climatic regimes.

Yadkin-Pee Dee Drainage Basin



Methods

Better Assessment Science Integrating point and Non-point Sources (BASINS) is a GIS-based program that allows the user to visualize different watershed characteristics. Characteristics such as soil properties and land use and atmospheric inputs can be downloaded through the BASINS Data Download Tool. This information is incorporated into Hydrologic Simulation Program Fortran (HSPF), a water quantity/quality model that must then be calibrated.

Preliminary Results

Salinity intrusion results from the interaction of three different forces: streamflow, mean tidal water levels, and tidal range. The Southeast's record-breaking drought from 1998-2002 resulted in salinity intrusions that inundated a coastal municipal freshwater intake, limiting water supplies to the local community. To better understand this phenomenon, Artificial Neural Network models were trained to learn the variable interactions that cause these salinity intrusions. Model results from Pawleys Island stream gage (USGS station 02110125), near a municipal freshwater intake, indicate that 30.5 cm of SLR would double the frequency of water with a specific conductance value of 2,000 microsiemens/cm. At a specific conductance above 2,000 microsiemens/cm water is no longer acceptable for municipal use. A 61 cm rise in sea level would quadruple this frequency (Conrads et al. 2010).

Reference

Conrads, P. et al. 2010. Estimating Salinity Intrusion Effects Due to Climate Change Along the Grand Strand of the South Carolina Coast. In: *Proceedings Paper for the 4th Federal Interagency Hydrologic Modeling Conference*. June 27- July 1, Las Vegas, Nevada.

Mediated Modeling: An Interactive Risk-Based Vulnerability Assessment Tool

Planning for climate change in the context of such diverse stresses poses a significant challenge for coastal managers and communities. They must understand how stresses interact to produce impacts, how different impacts are related to differences in vulnerability, and how vulnerabilities and impacts can be mitigated via short-term adjustments and longer-term adaptations. Successful adaptation and mitigation of hazard impacts requires the generation of realistic risk and adaptation scenarios and models and processes that produces knowledge, inform decision-making, and build community acceptance.

This computer-based tool enables users to construct and display causal pathways that link hazard events, exposures, and consequences and highlight the ways that consequences are mediated by vulnerability. We are working with coastal managers and community members to evaluate how this decision support modeling tool can structure the gathering and analysis of decision-relevant information, inform adaptive action and resilience strategies, and highlight critical data gaps to inform future monitoring and research activities. This research is conducted in collaboration with the Social Environmental Research Institute (SERI), Seth Tuler, PI. It is supported by the NOAA Sectoral Applications Research Program.

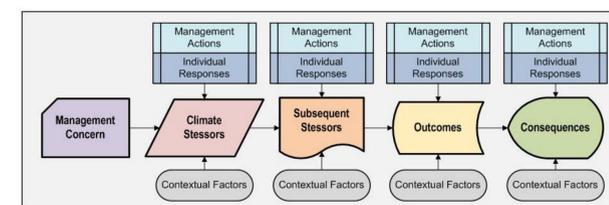


Figure 1: Basic causal model.

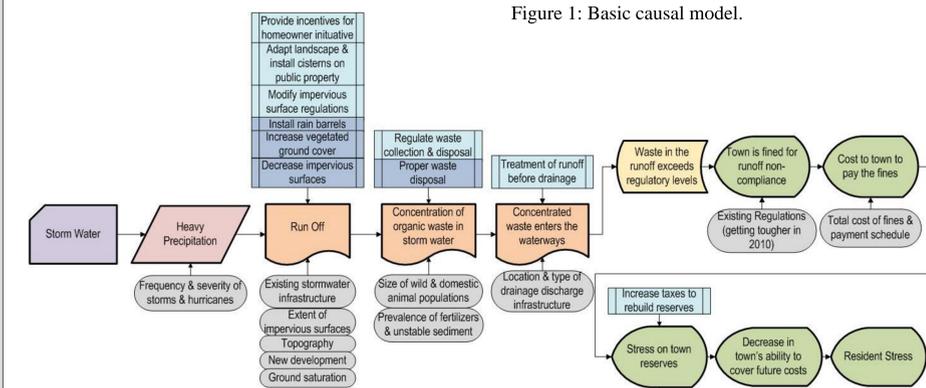


Figure 2: Application of the causal model to increased storm water threats.

Supporting the Development of Drought Early Warning Systems

CISA conducted online surveys and facilitated workshops with SC coastal ecosystem stakeholders to learn about impacts and concerns; stakeholders' use of drought data; and preferences for new tools and information. This research aids National Integrated Drought Information System (NIDIS) efforts to develop an early warning system in the Southeast. Topics discussed include:

- Primary concerns range from impacts to estuarine and river ecosystems; water quality changes and saltwater intrusion; lack of understanding about groundwater-surface water interactions; and ability to balance environmental and human needs.
- Short-term impacts to particular organisms may be well understood, but overall knowledge about drought and coastal ecosystems is poor. Researchers lack adequate long-term biological and ecological data at various spatial scales. Priorities include basic research to assess existing data quality and to identify the appropriate variables to monitor and assess drought impacts.
- Drought management is often a "reactive" response to impacts or conducted through "stop-gap" measures. Ecosystem issues are not well-integrated into other management regimes, including state-level drought response processes.
- Cross-agency communication and coordination is limited. The Coastal Information Network may provide a means to distribute drought-related ecosystem information. However, decision-makers prefer locally based studies, and the region lacks studies that demonstrate linkages between 1) drought and broader water supply issues and 2) human uses and ecosystem needs and processes.