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

PI: Jessica Whitehead

The ability of humans to adapt to future climatic change and the impacts of that change, particularly stakeholders who rely on the environmental resources to maintain or improve on their socioeconomic status, is especially challenging in coastal regions of the world. The East Coast of the United States especially falls into this category given the high number of people living along the Atlantic seaboard and the added strain on resources as populations continue to increase, particularly in the Southeast. In addition, increased temperatures and changes in regional precipitation regimes will have a great impact on existing hydrological systems in the region, as will the increase in sea level. In fact, the balance between hydrological flow conditions within a coastal drainage basin and sea level governs the characteristics and frequency of salt-water intrusion into the estuarine environment and beyond.

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. 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 proposed study will use the hydrologic and water quality Hydrologic Simulation Program-Fortran (HSPF), a part of the BASINS modeling package distributed and supported by the USEPA to assess the likelihood of variability in discharge through the entire Yadkin-Pee Dee river system under different climatic scenarios and with projected sea level rise in Winyah Bay at the mouth of the Pee Dee River. Furthermore, the potential increase in extreme events in the future, and especially should the severity and frequency of droughts increase, requires the thorough evaluation and understanding of the complete hydrological system to reliably assess the impact of future salt-water intrusion events. This study will undertake such an effort. Working with the Pee Dee River Coalition and with members of state and federal agencies, this proposed program will provide information on potential future scenarios to assist stakeholders in planning for the possibility of future severe salt water intrusion events and particularly the positioning of fresh-water intakes for their operations. This aspect of this proposed study also expands on the Decision Support System (DSS) developed in the recent study on the Waccamaw River. The proposed study will develop a new, web-based DSS for stakeholder and government agency use in evaluating potential changes in the hydrologic system of the Pee Dee River under different climatic regimes. In addition, participatory workshops and focus groups will be organized for receiving feedback on the type of information needed by stakeholders in preparing for future environmental changes, and as a means to disseminate the results of the modeling project and the Decision Support System. Overall, our results and development of a DSS based on our findings will increase the resilience of the region regarding future salt water intrusion.