

IMPACT OF SEA LEVEL RISE ON COASTAL WETLANDS: AN INTERDISCIPLINARY STUDY

Historically, Sea Level is rising about one foot per century along North Carolina's coast. Most models expect the rate to increase in the 21st Century because of Global Warming. The Cape Fear Estuary is the perfect model to study a potential increase in Sea Level (SLR) because it has already experienced an increased rate of SLR. Human alteration of the lower estuary through dredging and widening channels along with natural SLR has increased the tidal amplitude near Wilmington 1.7 feet during the 20th Century. A hydrological model of an ongoing project by the U.S. Army Corps of Engineers predicted that the tidal amplitude might increase another three inches as a result of the project. Consequently, the Corps of Engineers has funded a 3 million dollar study of the upper Cape Fear Estuary and adjacent wetlands to determine 1) if there are impacts to fauna and flora and 2) what effect these impacts will have on important plant and animal species. The primary impacts are expected upstream of Wilmington, NC where tides are lower than ocean tides and especially where wetlands were previously not impacted by salt water.

Most fauna and flora in freshwater wetlands are very sensitive to salt water. Thus, sampling is concentrated on both sides of the salt-freshwater boundary in the estuary and lower river (Figure 1). Increased flooding by more saltwater might negatively impact freshwater systems and at the same time provide more habitat for marine and estuarine fishes, especially juveniles of important commercial species.



Figure 2. Data collection platform recording water level and salinity every six seconds.

Twelve Data Collection Platforms (Figure 2) have been established within the estuary (Figure 1) and continuous data on water level, salinity, and temperature within the river and stream channels. An individual tidal wave can be followed as it moves up the estuary into the various tributaries and even into adjacent swamps and marshes (Figure 3). Belt Transects are located adjacent to nine of the 12 stations (Figure 4) and extend from the river edge through wetlands to the upland/wetland boundary. Six subsites are located within these transects and various wetland attributes evaluated.

The study began in 1998 with the establishment of study sites. The first data was collected summer 1999 and will likely continue through at least 2006 providing the largest data set to date on tidal marsh and swamp ecosystems.

Research Components and Collaborators

Project Management – Dr. Courtney Hackney

Hydrology – Dr. Lynn Leonard and Dr. Courtney Hackney

Biogeochemistry – Dr. Brooks Avery

Benthic Invertebrates and Epifauna – Dr. Martin Posey and Mr. Troy Alphin

Vegetation – Dr. Courtney Hackney and Mr. Dave DuMond

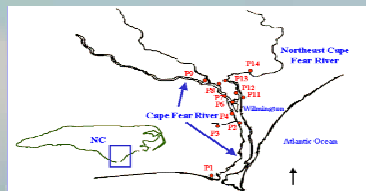
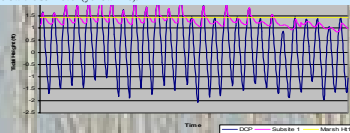


Figure 1. Sampling sites along the Cape Fear Estuary.

Figure 3. Water level (purple line) within a swamp and in the adjacent river at P13, subsite 1, during a two-week period. Note that water level within the swamp can be below the soil level (yellow line).



Water level instrument being downloaded at a subsite within a belt transect.

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Dr. Courtney T. Hackney is a Community Ecologist who has studied coastal wetlands on all three coasts of the United States for over 30 years. His research has resulted in more than 60 publications in national and international journals focused on a wide variety of topics. He has been the lead Principal Investigator for over 3 million dollars of grants and contracts since 1994. He was the senior editor of the Aquatic Volume of the *Biodiversity of the Southeastern United States* and recently published a book on Orchids. He has taught a variety of courses at UNCW and regularly teaches **Bio 366 - Ecology**, **Bio 495 - Senior Seminar on Wetlands**, and **Bio 560 - Estuarine Biology**. He has also served the state of North Carolina as a member of the Coastal Resources Commission and is currently the Vice-Chair of that Commission.



Figure 4. Typical belt transect, 50m wide, located adjacent to the Northeast Cape Fear River (P13) showing six subsites within the swamp forest where water level, salinity, temperature and soil biogeochemistry are measured. Transects extend from the river's edge to the upland boundary. Absolute elevation has been determined relative to the NSVD '88 datum at each substitution. The station benchmark is located next to the river (yellow triangle). Areas of salt-sensitive vegetation were identified year land denoted by the red polygon adjacent to the river. Aerial extent, density, and species diversity of this vegetation is determined each year using GPS technology. At the conclusion of the study, this transect will be re-photographed and gross changes in vegetation determined using GIS and GPS technology.

Education Components of Research

Graduate Students – Numerous graduate students have been funded through this study and gained valuable research and field experience. A series of theses in Earth Science and Marine Science have been completed on a variety of topics using data and/or research sites from the larger study.

Undergraduates – Many undergraduates in several departments gain their first real field experience while working on one of the research components of this study. Individuals that enjoy working outdoors, on boats, and in marshes and swamps learn everything from sophisticated instrumentation to techniques that allow investigators to avoid sinking into unconsolidated sediments, the "quicksand" of Hollywood. Some undergraduates that have gained experience in this project go on to graduate school, while others use their experience to get jobs with consulting companies where their field skills are always in demand. **Honors Students and Directed Independent Study students** have also used different components of the project around which to develop their research.

