“Marsh Madness”: Marsh Monitoring with the North Carolina National Estuarine Research Reserve

Estuarine marshes are productive ecosystems that provide a variety of services to coastal communities. Marshes provide habitat for birds, fish, and shellfish. They can also help prevent erosion and reduce the impact of waves during storm events. In order to conserve salt marshes and their valuable ecosystem functions, it is important to “get the big picture” about what kinds of plants make up a particular marsh, and how marshes change over time. Getting a broad view of marsh dynamics is the ultimate goal of a marsh monitoring project underway at the North Carolina Coastal Reserve and National Estuarine Research Reserve (NCNERR).

Intern Danielle maintains the data sheets during marsh monitoring with Dr. Fear

The marsh monitoring initiative began as the biological monitoring component of the System-wide Monitoring Program (SWMP) for the National Estuarine Research Reserve System (NERRS), which collects “quantitative measurements of short-term variability and long-term changes in the water quality, biological systems, and land-use / land-cover characteristics of estuarine ecosystems” at sites around the country. The NCNERR is responsible for contributing marsh data from the Rachel Carson, Masonboro Island, and Zeke’s Island Reserve components, but has also expanded its monitoring capabilities to include additional sites that provide a richer picture of long-term environmental change in the region. The additional monitoring sites include marshes at the N.C. Aquarium at Pine Knoll Shores and two sites in Beaufort, NC: Pivers Island, and N.C. Maritime Museum property along Gallents Channel. Work at these sites was initiated by Carolyn Currin, NOAA, Center for Coastal Fisheries and Habitat Research, and continues through an ongoing collaboration between NOAA and NCNERR. The relevance of multiple long-term datasets, NCNERR Research Coordinator Dr. John Fear states, “increases our ability to detect long term climate driven changes out of the noise due to interannual variability.”

Dr. Fear sets up a transect to count marsh plants

In the field, marsh monitoring involves hot days and multipleresearch teams working to determine key parameters in the designated marsh area. The marsh monitoring process uses a transect design to generate data about plant species, species

abundance, and marsh grass height. The parameters can be tracked through multiple years to describe how the marsh is changing over time. For example, if annual comparisons show species that are common closer to the water being replaced by species found at higher elevations, that marsh area is probably gaining elevation. Conversely, if common low marsh species are thinning out and even disappearing over time, it might indicate elevation loss and possible erosion. The height and density parameters tell scientists about the marsh's potential for trapping sediments and dissipating wave energy, two important ecosystem services that have tangible benefits.

Supplies needed for a day of marsh monitoring include transects, tape measures, rulers, and lots of water!

Intensive, annual research requires collaboration and dedication from a variety of partners. In particular, Graduate Research Fellowship recipient Rachel Gittman has contributed to marsh monitoring data collection for several years as part of her Fellowship responsibilities. The NERRS Graduate Research Fellowship provides funds and logistical support for graduate level research occurring within NERRS components that focus on issues of interest to Reserve managers. The fellowship encourages strong collaboration between the graduate students and NERRS advisors by requiring the graduate students to participate in Reserve activities as part of their fellowship. Marsh monitoring data is an important component of her Fellowship research on the effects of shoreline hardening and sea level rise on marsh ecosystem engineers and marsh productivity, and alternative shoreline stabilization methods influence salt marsh function and dependent nekton communities.

Marsh monitoring takes place in mid-summer, when marsh biomass reaches its annual peak. It generally takes the NCNERR research team several weeks to monitor the different marsh sites. The marsh monitoring process is designed to be repeatable, not require advanced equipment, and incorporate a simple protocol for researchers and their assistants to follow. This guarantees that the annual data collection will provide standardized and reliable information for both regional analyses and national monitoring efforts. While marsh monitoring is an intensive process, the data generated can help scientists better understand the value of marsh ecosystems and how they change over time.