Westport River Watershed Alliance
Salt Marsh Degradation Study – Westport River

Principle Investigators:
Dr. Mark D. Bertness – Brown University, Dr. Patrick J. Ewanchuk – Providence College, and Dr. Catherine M. Matassa – University of Connecticut

Salt marshes are an ecologically important habitat along the New England coastline. They filter out pollution, provide habitat for wildlife, and protect homes from flooding. In addition, more than half of commercial fish species on the East Coast use salt marshes for some part of their lives.

Westport River marshes have declined by nearly 50% during the past 80 years. A recent study suggests that this rate of decline has increased dramatically over the past 15 years. However, the underlying cause of this accelerated loss is not fully understood. A number of changes along the Westport River, including nitrogen pollution, sea level rise, dredging projects, coastal development, erosion from large storms, and grazing from crabs, are all potential drivers of marsh loss.

An experimental approach is necessary to identify the mechanisms driving Westport River marsh loss. Scientists from Brown University, Providence College, and UCONN are currently conducting a series of descriptive and manipulative experiments in both branches of the River, which are experiencing different rates of vegetation loss. These experiments are designed to test specific hypotheses. Implementing sound conservation and management strategies require that we understand the underlying ecological processes that *are* and *are not* contributing to accelerated marsh loss in the Westport River.

Hypothesis I – Differing flow and sediment dynamics drive differences in vegetation and marsh loss between the branches of the Westport River.

Hypothesis ll – Differing nitrogen loading and eutrophication drive vegetation and marsh loss differences between the branches of the Westport River.

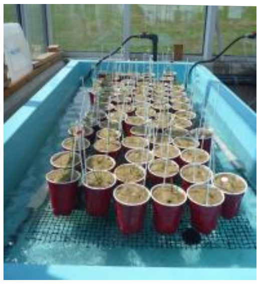
Methodology
To provide the context for the above manipulative experiments and to fully understand the physical differences between the sites we will collect data on a number of marshes in both branches of the Westport River. A total of **14** field sites on both the East and West Branches of the River have been selected by scientists. At each site, scientists established 15 experimental plots (50 x 50cm) marked with small flags. Experimental treatments are applied to some of the plots, while others remain unmanipulated as experimental controls. Plots are monitored about every 2 weeks from June through September, 2018.

Experiment 1: Nutrient Effects
To investigate the effect of elevated nutrients on cordgrass production, we will conduct a nutrient addition experiment. Plots established as above will receive nutrient delivery tubes in the sediments that are filled with fertilizer (elevated nutrient levels) or inert gravel (ambient nutrient levels). These two nutrient treatments are fully crossed with a sediment aeration treatment to simultaneously test whether plant growth is limited by environmental nutrient availability or their ability to take up nutrients through their roots. If environmental nutrient levels are limiting, fertilizer additions will enhance plant growth. If nutrient uptake by roots is limiting, aerating the sediment should also enhance plant growth, especially with additional fertilizer.

Experiment 2: Transplant/Local Adaptation
To test effects of adaptation by plants to localized environmental conditions, scientists are conducting a reciprocal transplant experiment. Plants are collected from and transplanted to a relatively healthy site and a relatively degraded site. If plant growth is the same at collection and transplant sites, then plant growth is a product of the plant's genetics. Alternatively, if all plants do better at the healthy site, then plant growth is a product of the environment.

Experiment 3: Sediment Effects
To explicitly examine the influence of sediment compaction on plant growth scientists are conducting a greenhouse experiment to investigate seedling survivorship and growth on sediments that are firmly or loosely packed.

Measurements
Plants and sediment cores will be collected at the end of all experiments and returned to the laboratory for analysis. Scientists will measure above- and below-ground biomass, plant morphology, and sediment characteristics (density, percolation, grain sizes, etc.). Surveys at all field sites will examine the plant and invertebrate communities and how they might also differ between the branches.



Descriptive Context Data:
Finally, to put our findings into a historical conservation context, scientists will investigate the historical changes in coastal land development, shoreline hardening and channel dredging along both branches of the Westport River. Historical reconstructions of both branches of the Westport River will be made using archived aerial photographs and historical images of shorelines provided by local citizens.

The Science Team:

Mark D. Bertness, Ph.D.
Robert P. Brown Professor of Biology, Department of Ecology and Evolutionary Biology, Brown University**.**
Research interests: Marine coastal ecology and conservation. His research focuses on understanding the processes that structure natural communities and applying this knowledge to informing coastal conservation. He is also interested in the role of positive interactions in community organization and gaining themechanistic understanding of community assembly rules necessary to predict and remediate the consequences of human disturbances. Mark works with coastal communities in New England, but is also interested in marine biogeography, tropical ecosystems and has worked extensively on South American shorelines.

BROWN

Patrick J. Ewanchuk, Ph.D.
Associate Professor of Biology, Providence College
Research Interests: How recruitment, intraspecific interactions, and predation control species borders in a tidal estuary; Clonal Integration and the Expansion of Phragmites australis; Anthropogenic modification of New England salt marsh landscapes; Latitudinal and Climate-Driven Variation in the Strength and Nature of Biological Interactions in New England Salt Marshes.

PROVIDENCE COLLEGE

Catherine M. Matassa, Ph.D.
Assistant Professor of Marine Sciences, University of Connecticut
Research interests: The behavioral and evolutionary ecology of species interactions and how these interactions scale up to shape community dynamics and ecosystem function. Catherine's research approach utilizes manipulative field and laboratory experiments to address theory and to understand the mechanisms underlying the ecological and evolutionary outcomes of changing species interactions. Trained as a benthic marine ecologist, she primarily conducts her research in the shallow subtidal and intertidal communities of coastal New England.

University of Connecticut