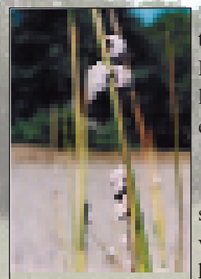
Georgia Coastal Ecosystems

Long Term Ecological Research



The marsh periwinkle, *Littoraria irrorata*, shreds dead leaves, increasing the rate of decomposition and nutrient cycling in the marsh. Periwinkles are an important link in the marsh food chain from plants to predators like blue crabs. Photo:Dale Bishop

The Georgia Coastal Ecosystems Long-Term Ecological Research (GCE) program is headquartered at the School of Marine Programs at the University of Georgia, and is part of the National Science Foundation's Network of LTER sites. NSF established the LTER program in 1980 to support research on long-term ecological processes that cannot be properly studied in the 3-5 year time-frame typical of most ecological research programs.

The general organizing principle of the study is that variability in the physical environment of coastal systems results from variation in the amount of salt water in the system. This in term is determined by variation in the strength of tides, rainfall and groundwater input. The goal of the project is to understand how this spatial and temporal variation in the physical environment affects the chemical and biological processes in the marshes and tidal creeks.

Research, Education and Outreach

The Georgia Coastal Ecosystems LTER program began in 2000. It continues a strong history, dating back to the 1950's, of scientific study of Georgia's estuaries by scientists at the University of Georgia and the Sapelo Island National Estuarine Research Reserve. Field work for the program is based at the University of Georgia Marine Institute on Sapelo Island. Researchers from a variety of U.S. and international institutions collaborate in the work.

K-12 educators gain a hands-on understanding of scientific research by participating in our schoolyard program. Photo: Patricia Hembree.

Education takes place through a variety of mechanisms. Graduate and undergraduate students learn by direct participation in research programs and through coursework. Our schoolyard program exposes K-12 educators to current research in the study system through long-term partnerships with the GCE. Our outreach efforts include providing scientific information on topics of current interest to coastal managers through the Georgia Coastal Research Council (http://www.marsci.uga.edu/coastalcouncil/). We invite inquiries from scientists, educators and managers interested in collaborating on our activities. GCE data sets are publicly available at the web site.

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http://gce-lter.marsci.uga.edu/lter/index.htm

The Georgia Coastal Ecosystem LTER is part of a coordinated network of research sites. For more information see:

http://www.lternet.edu

Background photos: this page, Steve Pennings, front cover, Steve Pennings; inside, Chuan Kai Ho.

LTER Georgia Coastal Ecosystems

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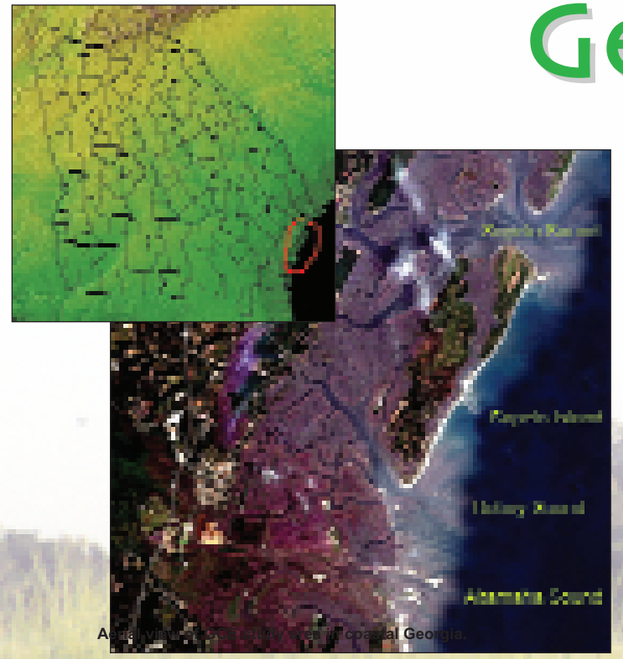


Aerial view of the coast of Georgia.

Project Overview

The focus of the GCE LTER is on the marsh ecosystems that line the coast of Georgia and adjacent states. Salt marshes are the most common type of habitat along the Atlantic and Gulf coasts of the United States. They are among the world's most productive habitats. Marshes are vital to coastal economies. They protect coastal habitats from erosion, filter nutrients and pollutants from the water, support commercial and recreational fisheries, and provide opportunities for a range of recreational activities. Coastal systems face threats from sea level rise and human activity (nutrient inputs, pollution, fresh water withdrawal, overfishing), but these threats are difficult to identify against a background of natural spatial and temporal changes. A long-term and large-scale perspective on natural variation is needed to allow coastal managers to protect these habitats and the services that they provide for future generations. The GCE LTER is helping to fill this gap by studying the effects of oceanic and terrestrial influences on the ecology of coastal marshes.

Study Area

The GCE study area is a barrier island and marsh complex located on the central Georgia coast. Our study area includes Sapelo Island and the Altamaha River, one of the largest and least-developed rivers on the east coast of the United States. Study sites are located on the Altamaha, Doboy and Sapelo sounds.

The salinity regime in the system results from the interaction of river discharge and ocean tides. Areas adjacent to upland habitats are also influenced by runoff and groundwater seepage. The most southern estuary is Altamaha Sound, which lies at the mouth of the Altamaha River, the largest river in Georgia. The cities of Atlanta, Athens and Macon lie within the Altamaha River watershed, but most of the watershed is agricultural or forested land. Altamaha Sound is strongly river-dominated. Freshwater from the Altamaha River is transported north to the Doboy Sound through marsh channels and through tidal exchange with the Altamaha's plume in the ocean. Sapelo Sound is at the northern edge of the study area and has the least freshwater influence.

Sampling salinity and temperature from the bottom of the sound to the water surface helps us understand the oceanographic processes at work along the coast. Photo:Dale Bishop.

What We Study

We use a variety of approaches to understand the ecology of Georgia's estuaries, including monitoring, laboratory and field experiments, and mathematical modeling. We also compare our findings with those from estuaries in other parts of the U.S. and around the world.

Freshwater and Marine Inputs

We want to know how freshwater inputs (rain, river discharge, groundwater inputs) mix with ocean water to create relatively fresh or relatively marine conditions at different locations in the study area. We use this information to understand how temporal variation in freshwater inputs and tides changes salinity over time at any one site.

Biogeochemistry

Rain, river water, groundwater and seawater differ in their chemical composition and in the amount of nutrients they carry. We are interested in how the chemical composition of each type of water changes over space and time, and in how the chemistry of the water affects the kinds of chemical reactions that take place in the marshes. We study how biological processes affect the distribution of different elements in the environment.

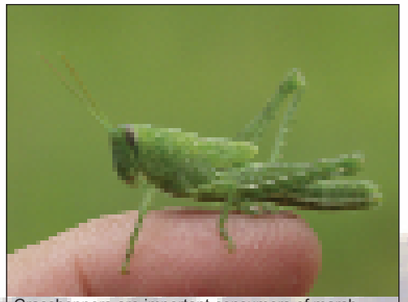
Soils

Marshes build as plant roots grow and sediments settle out of the water, and they shrink as sediments erode, compact or decompose. We are interested in how marsh growth varies across our study site and whether the growth is keeping pace with sea level rise.

Analyzing soil cores reveals the history of marsh growth. Photo: Chris Craft.

Marsh Productivity

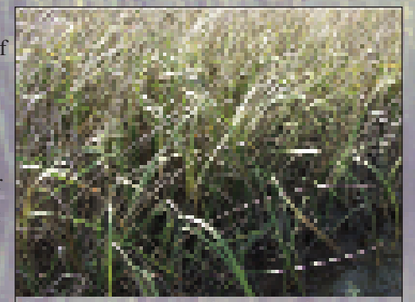
Marshes support vigorous plant growth. Plants in turn support a productive food chain that includes many species such as crabs and shrimp that are eaten by humans. We are interested in why the abundance of marsh plants and animals varies among sites and years.



Grasshoppers are important consumers of marsh plants. We are studying why their numbers vary among sites and years. Photo: Steve Pennings.

Human Impacts

Humans have interacted with Georgia estuaries for thousands of years. These historical activities have left records on the system that can be observed today. Currently, people use estuaries for hunting, fishing, and recreation. Development of coastal areas changes the chemical composition of runoff and groundwater. Changes in land-use as far from the coast as Atlanta can change the chemical composition of river water entering the estuaries. The amount and quality of water that enters estuaries from land may be changed if water is used upstream by municipalities, agriculture or industry. To ensure that these activities do not seriously damage coastal ecosystems, management must be based on a strong scientific understanding of how coastal systems work.



Cordgrass, *Spartina alterniflora*, is one of the most abundant and productive salt marsh plants. Photo: Steve Pennings.