Georgia Coastal Ecosystems Long Term Ecological Research Project
Marsh Hammock Research – 2007

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The physical and biological processes associated with coastal marsh hammocks are a major focus of the Georgia Coastal Ecosystems (GCE) Long Term Ecological Research (LTER) project (http://gce-lter.marsci.uga.edu/). Marsh hammocks are small islands surrounded by marshlands or tidal creeks and nested between the mainland and larger barrier islands. There are approximately 1,670 marsh hammocks in coastal Georgia, ranging in size from less than a hectare to tens of hectares. Most are remnants of high ground of either Pleistocene (1,110 hammocks) or Holocene (294) age, but there are also man-made hammocks that have developed from dredge spoil or ballast stones (265). We hypothesize that uplands of different size (ranging from small to large hammocks to mainlands) will support a different extent of upland marsh, and that hammocks of different elevation will have different associated marsh plant and invertebrate communities.

The hammock project began in summer 2007. A team of technicians, graduate and undergraduate students conducted a broad survey of hammocks representing a range of sizes (Table 1) and origin (20 each of Pleistocene and Holocene origin; 9 dredge spoil islands; 6 ballast stone islands; 4 mainland transects; see Figure 1). They used GIS and field methods to characterize each site in terms of its geomorphology, stratigraphy, water table characteristics, flora and fauna (Table 2). Field surveys at each hammock involved circumnavigating the hammock with a real-time sub-meter GPS to delineate the extent of the upper marsh. Transects were conducted at six locations around the perimeter of each hammock to determine the slope and profile (e.g., relative elevation) using traditional surveying techniques (i.e., rod and level). Surficial sediment was sampled along each transect to characterize trends in grain size (i.e., for permeability) and carbon content of soils. At each of the six transect locations, flora and fauna were surveyed using standardized GCE protocols in 0.5 m^2 quadrats set up 2.5 m from the upland edge. Plant species, shoot height (to the nearest cm) and flowering status were recorded; epifauna were counted and measured for size frequency information. Stratigraphy and water table height were determined at the top of one of the transects (n = 1 per hammock) using a 25-cm throw hand auger. Water was sampled for salinity and nutrient analysis (dissolved organic carbon, total dissolved nitrogen).

Table 1. Size classes of hammocks sampled in the GCE domain, 2007.

Size Class	Area (ha)	Number Sampled
I	< 1	28
II	1-3	13
III	3-6	6
IV	6-10	4
V	10-15	2
VI	15-20	0
VII	> 20	2

The data collected from this effort are now being input into both GIS and Access to develop a synchronized database. The data will be used to characterize hammocks and explore relationships among a series of independent (i.e. upland physical characteristics) and dependent (i.e. marsh biodiversity, plant and animal distributions) variables.

Table 2. Variables, methodology and sampling strategy for hammock survey.

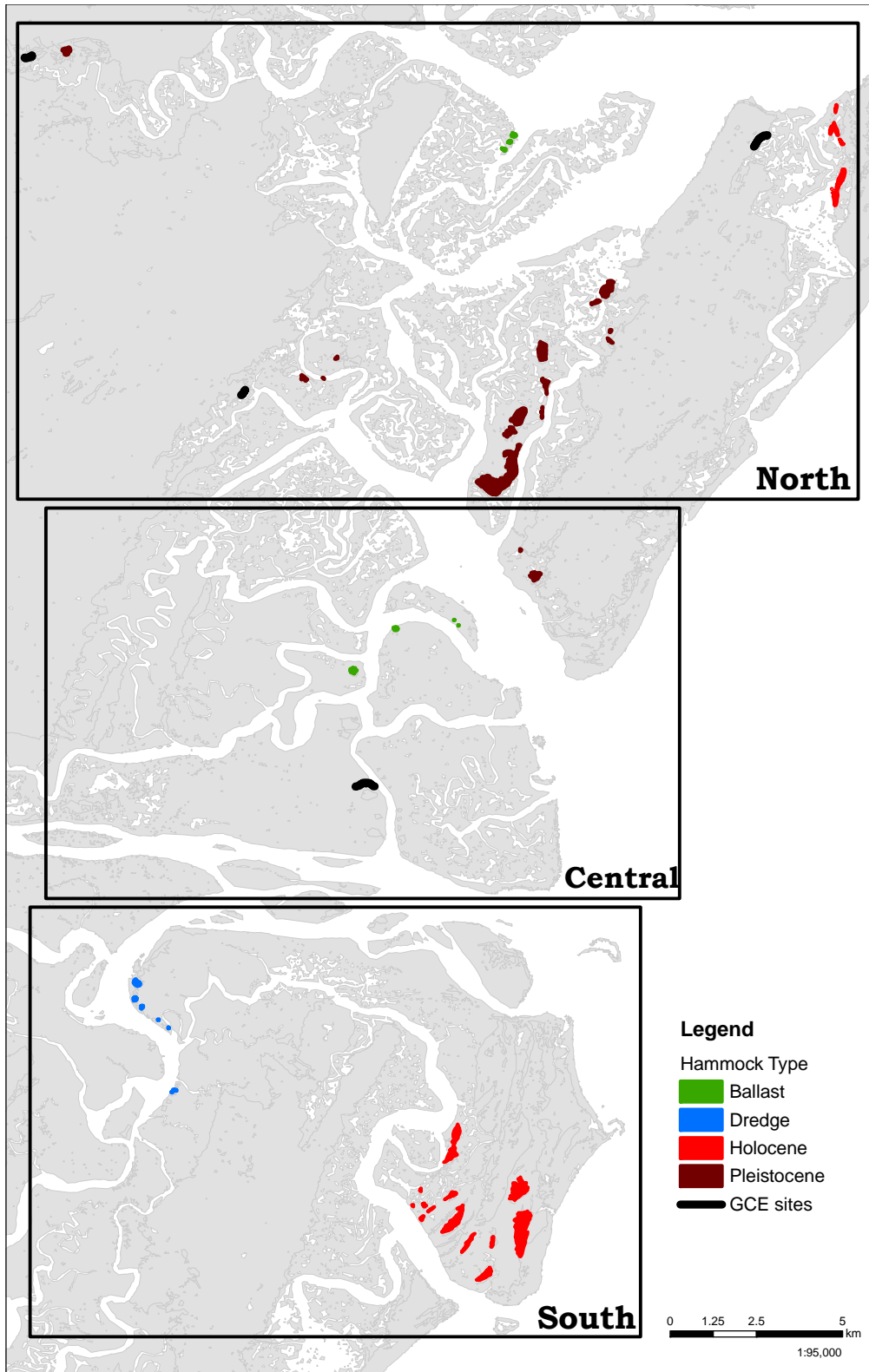| Independent variables	Methodology	Sampling strategy
Upland Area	GIS (ARCGIS 9.1)	Hammocks selected to cover a broad range of size classes and origins
Upland Elevation (Maximum, Average); slope of upland/marsh interface	Standard surveying equipment	Transect from marsh to upland at 6 locations evenly distributed around hammock
Water table height, measurements of surficial aquifer	Soil augur	Augur to water level, water sampled for measurements of salinity, DOC, TDN.
Surficial sediment type across hammock; hammock stratigraphy	Manual surficial sampling and auger core	Transect across hammock into marsh; vertical boring
Dependent variables		
Extent of upland and mid-marsh	Distance to *Spartina* edge	GPS circumnavigation of each site, augmented by 6 transects per hammock and aerial photography/GIS
Vegetation in upland marsh (including relative amounts of *Juncus*, *Borrichia*)	Standard GCE-LTER methods	0.5 m^2 quadrats per hammock, located 2.5 m from upland edge at 6 transect sites
Upland marsh benthic invertebrate diversity and abundance	Standard GCE-LTER methods	Same as above
Terrestrial-dependent herbivores (marsh grasshoppers, deer)	Abundance and damage scores for marsh grasshoppers; direct counts, tracks, and droppings for deer	Visual observations along transect from upland to creek conducted at 6 transect sites
Vertebrate presence Terrestrial-dependent animals (i.e. birds, raccoons, deer)	Observations of tracks, scat, nests, direct counts, other indicators	Same as above

Figure 1. Marsh hammock and mainland sites sampled in summer 2007.