

## PROJECT SUMMARY

**Intellectual Merit** – The Georgia Coastal Ecosystems (GCE) LTER is located along three adjacent sounds on the Atlantic coast and includes both intertidal marshes and estuaries. Long-term drivers of climate change, sea level rise and human alterations of the landscape will cause transitions in dominant habitat types (state changes) within the GCE domain by changing the amounts and patterns of water delivery across the landscape. These changes in water delivery can be conceptualized as presses and pulses in river inflow, local runoff, groundwater input, and tidal inundation, which will in turn manifest themselves as changes in salinity and inundation patterns in the domain. ***The research proposed for GCE-III is designed to address how variations in salinity and inundation, driven by climate change and anthropogenic factors, affect biotic and ecosystem responses at different spatial and temporal scales, and to predict the consequences of these changes for habitat provisioning and carbon (C) sequestration across the coastal landscape.*** The goals for this next funding cycle are to:

- 1) Track long-term changes in climate and human actions in the watershed and adjacent uplands, and evaluate the effects of these drivers on domain boundary conditions (riverine input, runoff and infiltration from adjacent uplands, sea surface height). We will accomplish this through long-term measurements of climate, water chemistry, oceanic exchange, and human activities on the landscape.
- 2) Describe temporal and spatial variability in physical (e.g. stratification, estuarine salt intrusion, residence time), chemical (e.g. salinity, nutrients, organic matter lability), geological (e.g. accretion) and biological (e.g. organism abundance and productivity) properties in the domain, and to evaluate how they are affected by variations in river inflow and other boundary conditions. We will accomplish this by tracking both water and marsh conditions at our core monitoring sites, remote sensing, and hydrodynamic modeling.
- 3) Characterize the responses of three dominant habitats in the domain (Spartina marsh, fresh/brackish marsh, high marsh) to pulses and presses in salinity and inundation. We will accomplish this through monitoring, large-scale field manipulations, and modeling designed to evaluate system responses to changes in inundation in the Spartina marsh, increased salinity in the fresh/brackish marsh, and changes in hydrologic connectivity in the high marsh. We are particularly interested in determining thresholds that cause habitat transitions (state changes), and in identifying signals of these changes.
- 4) Describe patterns of habitat provisioning and C sequestration and export in the GCE domain, and to evaluate how these might be affected by changes in salinity and inundation. We will accomplish this by using modeling and field observations to evaluate habitat provision and C flow under different scenarios of sea level rise, freshwater inflow, and coastal development that describe both the pre-colonial past conditions of the system and its likely future over the next 100 years.

These efforts will be synthesized into a synoptic understanding of both biotic and ecosystem responses to variations in salinity and inundation driven by climate change and human activities, which will be used to assess thresholds between habitats and the potential for state changes in the domain.

**Broader Impacts** – The goal of GCE outreach is to enhance scientific understanding of coastal ecosystems by teachers and students, coastal managers, and the general public. The GCE Schoolyard program, run in partnership with the UGA Marine Extension Service, is built around long-term contact and mentoring of educators. The Schoolyard program is developing activities and distribution plans for the forthcoming GCE children's book, *As the Tide Comes In*. A partnership with the GCE Peach LSAMP program will provide research opportunities for minority undergraduates, and a cross-site interdisciplinary course will provide interdisciplinary training for graduate students. GCE postdoctoral opportunities will advance the early careers of several scientists. We partner with the Georgia Coastal Research Council to promote science-based management of coastal resources. GCE scientists routinely participate in a variety of public outreach forums. GCE information is also broadly accessed via our website, which uses a state-of-the art information system to manage and display information about study sites, research, taxonomy, data sets, publications, and project administration.