2009 CSREES National Water Conference; St. Louis, MO

Bannockburn Plantation: Defining Pre-Development Targets for Coastal Hydrology and Water Quality

Daniel R. Hitchcock*, Anand D. Jayakaran
Clemson Baruch Institute
* dhitchc@clemson.edu

Abstract:

Coastal headwater streams in undeveloped forested landscapes function as a natural storage and conveyance mechanism for rainfall and groundwater. Stream flows are often driven by groundwater table depth, while soil saturation with a high water table may drive rainfall response. Evapotranspiration also plays a significant role in groundwater levels and influences stream flows both seasonally and diurnally. The dynamics of coastal forested watersheds are complex, and water budgets of these headwater streams are difficult to quantify.

Bannockburn Plantation, located in Georgetown County, SC between Hwy. 17 and the Atlantic Ocean, provides a unique opportunity for spatial and temporal research related to coastal hydrology, ecology, and land use change. The 3500-acre site is currently dominated by forested wetlands and upland pine stands, and the property is slated for development over the next 10-12 years. Bannockburn Plantation is a pilot digital watershed site for a remote data acquisition network and Intelligent Riverâ project.

The importance of understanding these hydrologic dynamics is critical to water resources protection and flooding prevention in coastal landscapes, especially forested areas that are being converted to residential and commercial development. Baseline hydrology must be assessed as a benchmark for sustainable development goals over the course of land use change, and understanding short- and long-term responses from the conversion of forest lands to urban areas can minimize negative effects in terms of water quantity and quality. Toward the goal of quantifying the water budget in a pre-development forested watershed, stream flows, groundwater levels, and rainfall (both open and subcanopy) are being measured in an approximately 800-acre coastal watershed, Upper Debidue Creek, at Bannockburn Plantation. Evapotranspiration rates are also being estimated where photosynthetically active radiation (PAR) is being measured on site. Water quality measurements are also being collected. Water budget estimates, rainfall-runoff relationships, and water quality results from Upper Debidue Creek will be presented.

Impact Statement:

Research and extension programs at Bannockburn Plantation, located in Georgetown County, SC, offer the unique ability to (1) study the predevelopment forested wetland and upland landscape; (2) monitor environmental impacts before, during, and after development, and (3) provide a benchmark for sustainable coastal development and land use change. The importance of understanding these hydrologic dynamics is critical to water resources protection and flooding prevention in coastal landscapes, especially forested areas that are being converted to residential and commercial development. A major challenge in coastal areas is that hydrology is typically dictated by low gradient topography and a shallow water table. The Program of Integrated Study for Coastal Environmental Sustainability (PISCES) is a Clemson research group dedicated to investigating coastal development, potential impacts, and promising solutions.

Category: Watershed Assessment and Restoration
Type of Presentation: Oral Presentation