St. Catherines Island RESEARCH AND CONSERVATION

No Wake Zone

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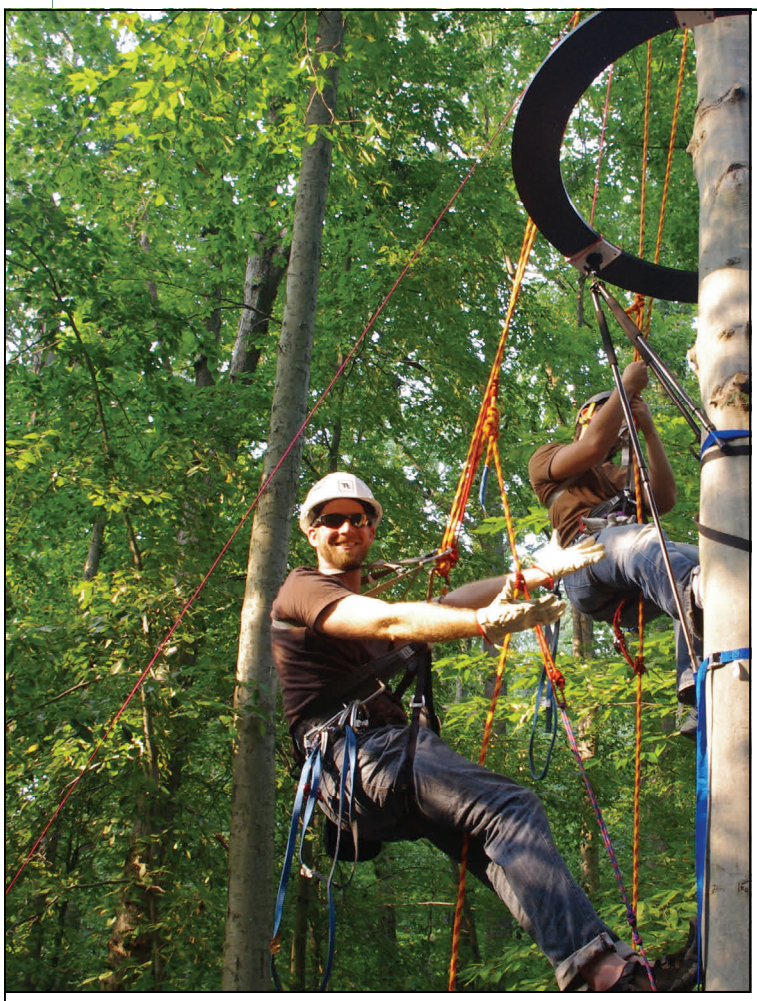

Throughfall and Stemflow in the Forest Canopy By Dr. John Van Stan

Forests provide many known ecosystem services— they clean our air, sequester our carbon emissions, protect our soils from erosion, provide habitat for species on which we rely for sport and ecotourism, and much more. While the list goes on, there are likely even more ecosystem services which have yet to be discovered. What other amazing services do forests provide to our ecosystem? That's the question at the heart of Dr. John Van Stan's (Fig. 1) research on St. Catherines Island. To begin answering this question, Dr. Van Stan is currently installing monitoring equipment that will allow him and his colleagues at Georgia Southern University, Skidaway Institute of Oceanography, and the Helmholtz Centre for Environmental Research (in Leipzig, Germany) to track water and nutrients as they move from the canopy into the soils and freshwater lens and, ultimately, out to the ocean. They expect to find new forest influences over each of these ecosystem components critical to barrier islands as a whole.

For example, the magnitude, timing and spatial delivery of water and nutrient resources to soils beneath forest canopies during rainfall may play a role in the patterning of moisture and nutrient availability. Where organic and surface soils are thin (like on barrier islands) they could control, in part, which plants, microbes and arthropods can inhabit them and at what abundance. Dr. Van Stan will examine how the forest canopy captures rainfall and nutrients from the air, then re-routes these resources to soils along two pathways: throughfall and stemflow. Throughfall consists of the rainfall that "drips" through the canopy, whereas stemflow is rainfall that has been captured by the canopy and funneled down the stem. Throughfall will be monitored using troughs connected to tipping buckets (Fig. 2a) and stemflow with gutter-like collars connected to sampling bins (Fig. 2b).

Throughfall and stemflow enter and move through soils differently, as throughfall is more diffusely spread across the forest floor and stemflow is a concentrated input at the very base of the tree trunk. The different infiltration processes between throughfall and stemflow are expected to control, in part, the recharge and nutrient content of St. Catherine Island's freshwater lens.

Fig. 2a Troughs connected to tipping buckets for throughfall collection

Editor-in-Chief Jenifer Hilburn

Canopies continued..

Throughfall and stemflow influences over recharge could alter freshwater lens characteristics (thickness and depth) on barrier islands which affect a forest's resistance to fire and drought stresses. This, in turn, has implications for pine beetle infestation as it is related to drought severity. If freshwater lens chemistry is closely tied to throughfall or stemflow, it could impact nutrient outputs from the freshwater lens to the near-shore ocean.

Fig. 2b Stemflow collection with gutter-like collars connected to sampling bins

Dr. Van Stan is working closely with Dr. Jacque Kelly (also at Georgia Southern University), an expert on groundwater outputs to coastal waters, to examine whether forest canopy type can account for variability in groundwater outputs from the freshwater lens. It is known that contrasting forest types cycle nutrients differently and, therefore, respond to human alteration differently. If these differences can alter water and nutrient discharges to coastal waters, forests may exert control over near-shore ecosystem processes like the concentration of nutrients limiting phytoplankton and algal growth or even the exchange of greenhouse gasses!

These are but a few of the potential ecosystem services barrier island forests may provide (in excess of the ones we know). We are just scratching the surface of barrier island forests, since accessibility and infrastructure issues have prevented fine scale, long term research. Thanks to the St. Catherine's Island Foundation, scientists across the spectrum of forest sciences will now have the opportunity to peer into barrier island forests at a resolution previously unattained.

Horizontal lighting

Photo by: Lisa Rodriguez