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Vegetation and Hydrology of Land-Margin Ecosystems:

The Mangroves of South Florida in Relation to Disturbance, Global Change and Response to Restoration

The USGS Florida Caribbean Science Center's Restoration Ecology Branch at Florida International University is conducting research on disturbance, global change and restoration of land margin ecosystems of South Florida. Critical research for the restoration of these systems involves understanding the responses of mangrove forests to changes in the quality, quantity, timing and distribution of freshwater inflows, response to global change (e.g., sea level rise) and catastrophic disturbances such as hurricanes.

An aerial view of young and old mangrove stands along Broad Creek in Everglades National Park.

Land-margin ecosystems (mangroves, brackish marshes and coastal lakes/back bays) comprise some 40% of Everglades National Park (ENP). Primary productivity in these systems fuels the detrital food webs which support sport and commercial fishes and numerous endangered species (e.g., wood stork, manatee, roseate spoonbill). Freshwater inflow from managed, upstream sources is critical in regulating salinity and nutrient regimes of mangrove ecosystems and thus their productivity.

In August 1992 the land margin systems of ENP were severely damaged by Hurricane Andrew. Recovery from hurricane damage may be affected by water management and regulation of freshwater inflows. Our research is asking several key ecological questions including:

1. How does freshwater inflow regulate primary productivity in the various land-margin ecosystems?
2. How does freshwater inflow interact with other factors (nutrients, soil type) to influence primary productivity?
3. Is there an effect of freshwater inflow on recovery from disturbance in these ecosystems?
4. Does freshwater inflow affect below ground production, peat formation and soil accretion in mangroves?
5. Will the position of the mangrove marsh ecotone respond to upstream water management?
6. What non-hydrological factors (e.g., soil type and depth, nutrients, fire) influence the position of the mangrove/marsh ecotone?

The ecological research is closely tied to hydrological studies conducted at the same sites. We have combined study sites for measuring both mangrove forests and hydrology along upstream - downstream gradients on three tidal rivers on the southwest coast of Everglades National Park, where both surface and groundwater flows are measured.

These studies will provide the means to evaluate the effects of the various hydrological restoration scenarios on the land-margin system. Furthermore, the data will prove valuable to other scientists, in particular the Across Trophic Level System Simulation (ATLSS) modeling group. The ATLSS team plans to expand the coverage of their model to include mangrove forests.

Ongoing Research and Collaborations

Vegetation Dynamics of Land Margin Ecosystems: The Mangroves of South Florida

T.J.Smith III, USGS-BRD.

Understanding and Predicting Global Climate Change Impacts on the Vegetation and Fauna of Mangrove Forested Ecosystems in Florida

T.J.Smith III and Carole C. McIvor, USGS-BRD.

Wood Decomposition and Nutrient Dynamics in the Mangroves of south Florida

James Fourqurean, Department

Department of the Interior
U.S. Geological Survey
Florida Caribbean Science Center
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Hydrologic Variation and Ecological Processes in the Mangroves of South Florida

James Saiers, School of the Environment, Yale University, and T. J. Smith III, USGS-BRD.

Sediment Elevation and Accretion in Coastal Everglades wetlands in Relation to Hydrologic Restoration

Donald Cahoon, National Wetlands Research Center, and T.J. Smith III, USGS-BRD.

Interrelation of Everglades Hydrology and Florida Bay Dynamics to Ecosystem Processes and Restoration in South Florida

Raymond Schaffrannek, USGS-WRD; Charles Holmes, USGS-GD; and T.J. Smith III, USGS-BRD.

Mangrove Die-off in Florida Bay

T.J. Smith III, USGS-BRD and Paul Carlson, Florida Marine Research Institute, Florida Department of Environmental Protection; Tom Armentano, USNPS, Everglades NP.

Vegetation and Faunal Studies in the Mangroves of Micronesia

Kathy Ewel, USDA and T. J. Smith III, USGS-BRD.

Acknowledgments

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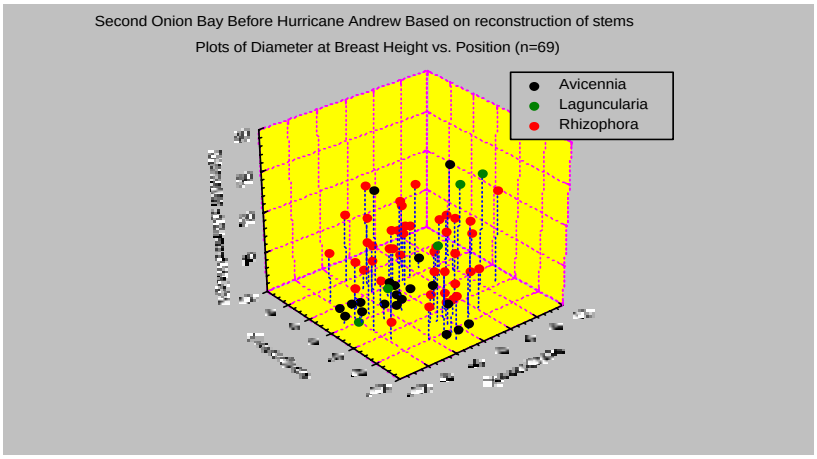
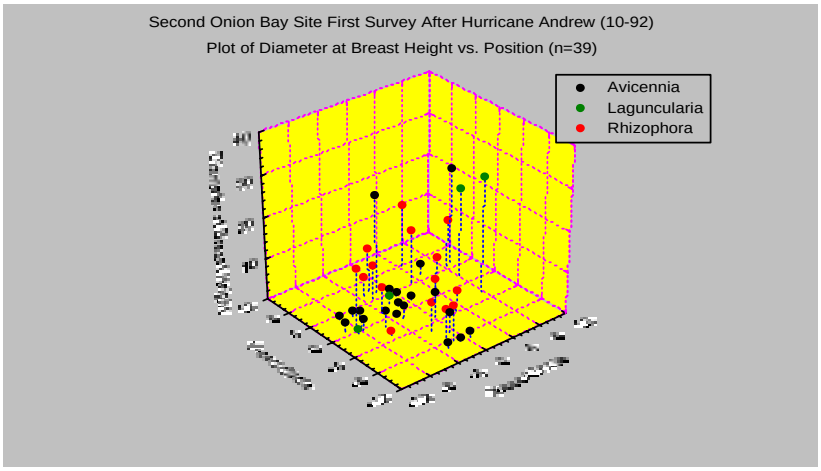
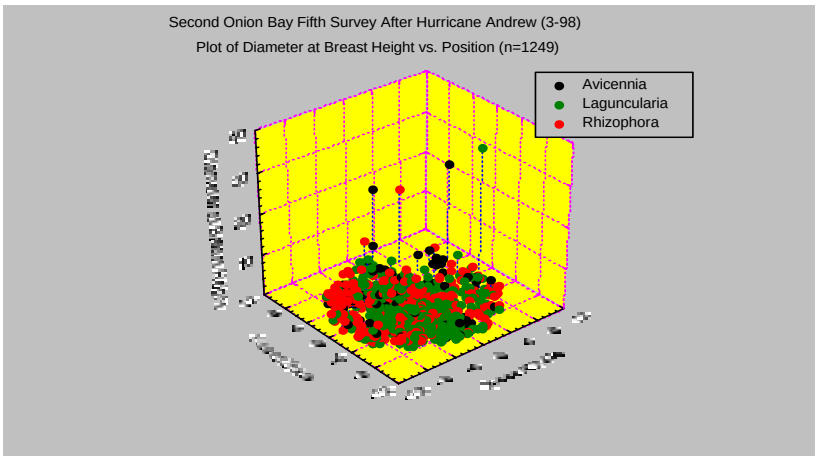


A) Species and size composition of the mangrove forest before the passage of Hurricane Andrew



B) The same forest two months after Hurricane Andrew's passage



C) The plot six years after Hurricane Andrew with more than 1,000 recruits.

Figures A-C. Mangrove forest structural changes through time as recorded in a permanent sampling plot at Second Onion Bay in Everglades National Park.