Hurricane Impacts on Structure and Functioning of U.S. Coastal Forests

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The primary goals of this project are to: (***i***) Develop empirical relationships between wind-field parameters and species-specific tree mortality rates for Major (Saffir-Simpson Category 3-5) hurricanes striking the U.S. Coastal Region, (***ii***) Modify an ecosystem model (Ecosystem Demography – ED) to allow simulation of catastrophic hurricane-driven tree mortality dynamics; (***iii***) Develop a set of hurricane scenarios based on historical records and possible future trends driven by natural cycles and anthropogenic climate change, and employ ED to predict forest carbon balance from these scenarios; and (***iv***) Utilize hurricane events that are likely to strike the U.S. Coastal Region during the course of this study to further expand and test empirical relationships and model predictions.

Research activities will be conducted in the NICCR Coastal Region, and initially focus on hurricane Katrina. Tulane University's location in New Orleans is uniquely suited to facilitate local hurricane impact studies. During hurricane seasons of 2006 -2008, priority will be given to carry out field investigations on new Major hurricanes that strike in Louisiana, Mississippi, Alabama, East Texas and the pan-handle of Florida. Second priority will be given to Georgia, South Carolina, North Carolina, and then other States.

The overall working hypothesis is that disturbance related to hurricane activity in the U.S. Coastal Region has significant negative impacts on forest carbon balance and the regional carbon sink, and that expected future changes in the hurricane disturbance regime will further degrade the carbon sink of U.S. coastal forests.

This project will employ a synthetic approach combining field-based tree mortality and damage investigations, remote sensing image analyses, and an ecosystem simulation model. Forest inventory analysis methods will be employed to estimate biomass loss from damage and tree mortality. Spatial variability in mortality rates will be correlated to hurricane wind-field parameters using regression methods. Remote sensing investigations using spectral mixture analysis on non-photosynthetic vegetation endmembers will provide maps of disturbance variability within wind-field classes, and allow further development of tree mortality probability distribution functions. A modified ED model will allow integration of results, and be used to explore historical and future hurricane scenarios on forest carbon balance of U.S. coastal forests.

Expected deliverables include: (***i***) A network of forest inventory plots for Major hurricanes striking the U.S. Coastal Region. (***ii***) Atmospherically corrected remote sensing images (e.g. ALI, Hyperion, Landsat) and relative abundance maps of disturbed areas within footprints of Major hurricanes. (***iii***) A modified ED model allowing simulation of past hurricane events and future scenarios.