Integrative Approach to Understanding the Causes of Salt Marsh Dieback: Coupled Hydrologic/Ecological Models of Marsh Dieback Processes (Task II.6)

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Study Site Location(s): Lake Felicity and Barataria Bay, Louisiana

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Project Outline:

Ecological modeling is a powerful tool that can be used to describe, quantify, and forecast the response of wetland ecosystems to different coastal management strategies (Twilley et al. 1999). While there are a few ecological models that describe vegetation patterns in wetland ecosystems, there are very few that describe their hydrology, particularly subsurface water budgets. Coupled models of both vegetation dynamics and

hydrology are critically needed given the increasing pressure of human activities and land use changes on distribution of freshwater resources. In addition, models must be at the appropriate scale to capture the drivers that are responsible for specific patterns of ecosystem damage. We propose to develop and apply coupled ecological/hydrologic models to help in understanding the causes and remediation associated with brown marsh event in coastal Louisiana.

The goal of this proposed program is to integrate modeling efforts with existing landscape monitoring plots of water levels and elevation in marshes of the Mississippi River Deltaic Plain. Field monitoring and manipulative greenhouse experiments will be used to develop parameters that are needed to develop the HYMAR model that describes hydrology in coastal marsh wetlands to simulate the impacts of changes in river flow and precipitation on marsh die back. We will examine selected soil biogeochemical processes and their responses to changes in marsh hydrology. The implications of these impacts to marsh elevation and long-term stability will be evaluated relative to rehabilitation efforts.

The proposed science program in wetland diagnostics and rehabilitation will test the relative significance of several hydrologic and biogeochemical processes in the study of brown marsh phenomenon. The UL Lafayette Center for Ecology and Environmental Technology, the LSU Wetland Biogeochemistry Institute, and USGS centers in Lafayette (BRD) and Baton Rouge (WRD) provide excellent personnel and facilities to pursue the objectives of these studies integrating both field and mesocosm research programs with ecological modeling (Fig 7). Mesocosm and field studies will be used to optimize for both controllability and realism to distinguish between the complex interactions of hydroperiod (soil water deficits) and soil biogeochemical changes on marsh productivity (above and below ground) and stability (marsh elevation).

Publications, reports, or web-accessible materials

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