Turtle Cove Experimental Marsh: Effects of disturbance and fertility upon the vegetation of a Louisiana coastal marsh.
T. Mcfalls, P. Keddy, G. Shaffer and D. Campbell

Project Overview

The future of Louisiana’s coastal marshes is threatened by a multitude of factors including: relative sea level rise, saltwater intrusion, altered hydrology (e.g. canal construction), exotic species, wave erosion, and the elimination of riverine inputs by artificial levees built along the Mississippi River. All of these factors combined result in some of the highest land loss rates in the world. Fire, herbivory, nutrients, and sedimentation are major factors controlling marsh structure and composition; this study examines some of these factors.

There are two main objectives for the project:

1. to explore the effects of multiple disturbance and fertility regimes upon plant community structure, and
2. to set targets and provide guidelines for restoration.

The ranked disturbance treatments are control, prescribed fire (a common management tool), single herbicide, and double herbicide. Initial results show that nutria, the principal vertebrate herbivore of the marsh, may limit biomass production and increase species richness. Prescribed fire seems to promote heavy, localized herbivory in burned areas thereby, reducing the amount of organic matter incorporated in the soil. The sediment + fertilizer treatment, which simulates a proposed freshwater diversion, significantly increases biomass production with no reduction in species diversity.

Introduction

Fire, herbivory, nutrients, and sedimentation are major factors controlling marsh structure and composition. These factors are not routinely manipulated in long-term robust replicated factorial design experiments. A large experimental facility, Turtle Cove Experimental Marsh, was constructed in the wetlands behind the Turtle Cove Environmental Research Station through a collaborative effort managed by Tiffany Mcfalls between the research laboratories of Dr. Paul Keddy (Edward G. Schlieder Endowed Chair for Environmental Studies) and Dr. Gary Shaffer (Southeastern Wetlands Restoration Laboratory). The study site is a marsh on the Manchac landbridge, a narrow strip of land that separates Lakes Pontchartrain and Maurepas. This landmass is very important in maintaining salinity gradients within the basin, and the landbridge’s long-term stability is imperative to the health of the entire eastern portion of the basin. The future of these marshes is threatened by a multitude of factors including: relative sea level rise (eustatic sea level rise + steric sea level rise + subsidence), saltwater intrusion, altered hydrology (e.g. canal construction for petrochemical exploration & logging), exotic species, wave erosion, and the elimination of riverine inputs by artificial levees built along the Mississippi River. All of these factors combined result, regionally, in some of the

(continued on page 2)
highest and loss rates in the world (Boesch et al. 1994). The study site is part of one of the nation’s largest coastal oligohaline systems—one of the most complex and least understood types of wetland.

Experimental Design
There are two main objectives for the project:
1. to explore the effects of disturbance and fertility upon plant communities
2. to set targets and provide guidelines for restoration.

Three main plots exclude mammalian herbivores such as nutria, and three main plots paired with the herbivore exclosures are open to grazing.

The ranked disturbance treatments are:
- control
- prescribed fire (a management tool in many marsh areas of Louisiana, but it has not been studied in the Manchac area)
- single herbicide (examines the role of the buried propagules in marsh recovery)
- double herbicide (increases the intensity of the disturbance and shows the role of dispersed propagules in marsh recovery from disturbance)

A freshwater diversion into the general area has been proposed to help slow land loss rates in this rapidly submerging coastal area. The nutrients and sediment deposition that would accompany the riverine inputs provided ideal fertility treatments for the experiment. The ranked fertility treatments include:
- control
- fertilizer addition (acts as the nutrients that a marsh would receive from overland sheet flow from a diversion project)
- sediment addition (1 cm; attempts to mimic the sediment deposition that would occur if a diversion were in place)
- sediment + fertilizer addition (emulates the proposed freshwater diversion since it combines the increased nutrient levels with increased elevation).

The factorial nature of the experiment allows the research team to examine the interaction between herbivory, disturbance treatments, and fertility treatments.

Initial Results and Technology Transfer
Initial results show that nutria, the principal vertebrate herbivore of the marsh, may control biomass and increase species richness. Prescribed fire does not appear to have a place in management of the area - it seems to promote heavy, localized herbivory in burned areas thereby, reducing the amount of organic matter incorporated in the soil. The sediment + fertilizer treatment, which simulated a proposed freshwater diversion, significantly increased biomass production with no reduction in species diversity. Preliminary results have been presented during oral sessions at the 24th annual Society of Wetland Scientists’ meeting on June 13, 2003 and the Louisiana Association of Professional Biologists’ symposium on August 21, 2003. The longterm work on fire, sediment, fertilizer, grazing, and disturbance in the Turtle Cove Experimental Marsh will be continued. In addition, we will be increasing the emphasis upon biological diversity, including seeds buried in the soil of the experimental marsh.