

TWO MARSH CREATION/RESTORATION METHODS USING DREDGE MATERIAL FROM SHIP CHANNEL MAINTENANCE AND EARTHEN TERRACES IN SOUTHWEST LOUISIANA

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INTRODUCTION

Thousands of hectares of coastal Louisiana have been negatively impacted in the last century, resulting in a significant loss of marsh habitat. The frequency at which Louisiana's marshes are converted to open water has been accelerating over the past fifty years (Gosselink 1984) and widespread deterioration continues (Turner and Cahoon 1987; Britsch and Kemp 1990). Net land lost along the Louisiana coast from 1978-90 was 1,085 km² and was even greater from 1956-78 when 2,234 km² of marsh was lost (Barras et al. 1994). This rate of loss is alarming since an estimated 69 percent of marshes adjacent to the Gulf of Mexico occur in Louisiana (West 1977). Several factors, which function exclusively or mutually, are known to directly or indirectly contribute to the deterioration of coastal marshes. Factors such as furbearer herbivory, global sea level rise, hurricanes, hydrological modifications, saltwater intrusion, sediment deprivation, and subsidence accelerate marsh erosion (Turner and Cahoon 1987). Acceleration rates vary within each component but massive and irreparable damage may rapidly occur when a hurricane invades a vulnerable and fragile coastline.

During the early part of the 1900's, numerous man-made canals were dredged for navigation and access to oil and gas drilling sites (Cahoon and Holmes 1989). These canals increased tidal exchange of saline water from main basins into interior marshes. This intrusion of saltwater is reported to have caused substantial degradation of freshwater marshes in Louisiana (Chabreck 1981; DeLaune et al. 1983). Inundation results in a net effect of sublethal salt stress and a reduction in vegetative growth (Waisel 1972) which can subsequently impact the survival of wetland species from various habitats (Pezeshki et al. 1989). Salt concentrations greater than 10‰ is known to cause leaf death in freshwater plants resulting in weaker plants with reduced survival rates and decreased productivity, thus creating the potential for long-term habitat changes (Pezeshki et al. 1989). Not only does increased salinity adversely affect freshwater and intermediate vegetation, but widely fluctuating salinity is suspected to inhibit vegetative reestablishment and intensity plant die-off. If low salinity macrophytes die and salt-tolerant species do not quickly establish, then underlying peat will erode leaving open expanses of water. These open expanses of water (henceforth referred to as "blow-outs"), which were once viable marshes subsequently support less biomass. Wave action and tidal amplitude typically erode the contiguous marsh and resuspend sediments so that

growth of submerged aquatic vegetation is precluded. The resulting turbid, open water thus provides poor habitat for the propagation and survival of an abundance of estuarine dependent species.

BACKGROUND

Sabine National Wildlife Refuge (NWR) encompasses approximately 50,832 ha of interspersed fresh, intermediate, brackish, and saline marshes in southwest Louisiana that support diverse vegetative and wildlife communities. The refuge is variably affected by saltwater influences from the Gulf of Mexico via the Calcasieu Lake/Ship Channel to the east, the Gulf Intracoastal Waterway to the north, and the Sabine Lake/Sabine-Neches Waterway to the west. Because the refuge is proximate to the Gulf of Mexico, portions of the landscape have been severely fragmented by damage from excessive saltwater intrusion, hurricanes, and other degradative forces. Since the primary purpose of the refuge is to serve as a sanctuary and breeding ground for migratory birds and other wildlife, considerable emphasis has been directed to restore areas of blow-outs to viable marshes through methods that foster emergent and submergent vegetation.

METHODS

The first restorative method involves the construction of multiple earthen dikes in a boomerang configuration (305 meters in length with each half at 30 degree angles, 31 m apart horizontally and 153 m apart vertically) using an amphibious track-hoe. Terrace configuration is angled toward the prevailing southerly winds to maximize the amount of calm water on the dormant wind side. Reduced wave action induces sediment precipitation, thereby producing an environment more conducive for submerged aquatic vegetation. All terraces are created with endemic soils and are borrowed from each side of the terrace. A cross-sectional view comprise a 4.6 m crown and 4:1 slope with a targeted crown height above the mean water line of 0.5 m. In an attempt to stabilize the newly constructed terrace, smooth cordgrass *Spartina alterniflora* is planted in 0.6 to 0.9 m intervals at the terrace/water interface at an amplitude relevant to normal tidal conditions. *S. alterniflora* is selected because it proliferates in brackish marshes where salinities range above 10‰, occupies the transition zone between dry ground and water, and is durable once established.

The second method employed is the beneficial use of dredge material from adjacent navigation channels. The U.S. Army Corps of Engineers (USACOE) is responsible for maintaining the Calcasieu Ship Channel from the Gulf of Mexico to the Port of Lake Charles. Maintenance dredging results in a need to discharge channel sediments into an environmentally acceptable location. Collaboration between the two agencies has resulted in benefits for both parties. The refuge receives the dredge material to restore blow-out areas and the USACOE is able to dispose of unwanted material. The dredge material/water “slurry” is diluted to a consistency dependant upon pumping distance.

The slurry is then pumped through a 76.2 cm pipe into a strategic containment levee built in a blow-out area until a target elevation is achieved. Once the slurry de-waters and the material becomes stable, the containment levees are then removed to allow maximum tidal ebb and flow. A new variation of this method has been to include a low elevation delta built by free-flowing the slurry into open water. This delta component provides increased habitat diversity within the restored estuaries.

RESULTS

Preliminary findings proximate to the terraces indicate diminished wave energy, improved water clarity, rapid expansion of *S. alterniflora*, and initial colonization by submerged aquatic vegetation such as widgeon grass *Ruppia maritima*. The integrity of the terraces has remained intact with buffering from the *S. alterniflora* plantings.

Approximately

360 ha have been treated to date and it has now become a standard mitigation method.

The dredge material marsh creation sites have been left to colonize naturally with vegetation. Multiple creation sites illustrate that a site generally becomes predominately vegetated with glasswort *Salicornia* spp. and wiregrass *S. patens* within five to six years. It appears that initial post-project rainfall amounts play a significant role in vegetation response and establishment. Approximately 650 ha of blow-out areas have been restored since 1993 on the refuge. Evaluation of the habitat quality continues by U.S. Geological Survey, Louisiana State University, and McNeese State U. researchers. Cooperation from federal and state agencies as well as funding through the Coastal Wetlands, Planning, Protection, and Restoration Act (CWPPRA) has ensured that dredge pumping will occur annually on the refuge for the next five to ten years.

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