Research Project Summary

Experimental and Computational Studies on the Reinforcement Effect of Smooth Cord Grass (Spartina alterniflora) on Erosion in Louisiana Coastal Marsh Creation Project

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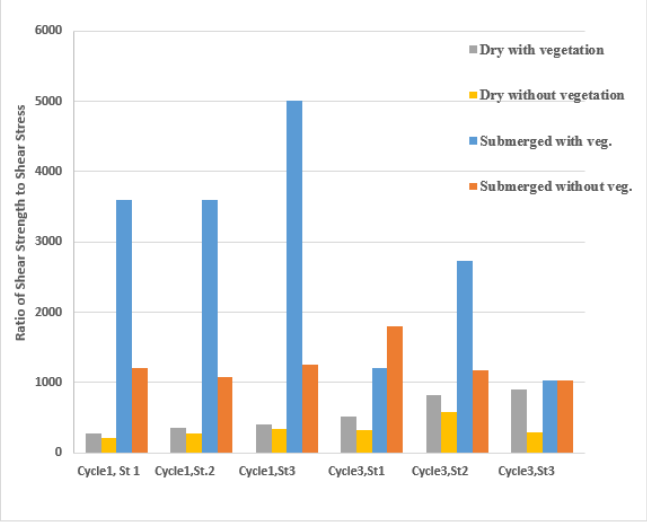
The overall goal of this project was to study the soil binding ability of *Spartina alterniflora*. Through the implementation of geotechnical field and laboratory procedures, combined with the execution of computational storm surge modelling methods, a thorough assessment was performed on the reinforcement capabilities of the aboveground and belowground components of coastal vegetation against coastal erosion processes. Specifically, this study included *in-situ* vane shear tests to measure undrained shear strength of newly vegetated hydraulically dredged fill in the Sabine Refuge Marsh Creation (CS-28) project, and laboratory direct shear tests and tensile strength tests using soil and root samples from the same field site. This study also included the use of analytical models to quantify net soil reinforcement, and the evaluation of erosion resistance using a Delft3D WAVE-FLOW model simulating Hurricane Ike wave conditions in Lake Calcasieu.

Direct shear tests on rooted and unvegetated soils found that reinforcement provided by the roots of *Spartina alterniflora* increased cohesion of the soil by up to 130% for the upper 8 cm of the soil profile, up to 124% for the 8-16 cm layer, and up to 12.5% for the 17-24 cm layer. The analytical models were found to overestimate cohesion due to incorrect assumptions such as assuming that roots all failed at the same time and treating plant roots as stretched cables and not considering bending and compression of the roots. Results from running the Delft3D WAVE-FLOW model found that the ratio of shear strength to shear stress was always higher in the presence of vegetation versus that of unvegetated soils, which indicated that the aboveground biomass helped increase erosion resistance by attenuating wave energy. The results of the *in-situ* tests, lab tests, and model tests conducted in this study confirmed that the enhancement of soil strength and reduction of wave erosion provided by the presence of *Spartina alterniflora* creates a more sustainable and resilient marsh.



Ratio of shear strength to shear stress for six sampling locations for four different grid conditions using Delft 3D analysis.