Effect of *Spartina alterniflora* Harvest Intensity on Recovery in Donor Marsh

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Introduction

Shoreline erosion is a major contributor to the decline of health in estuarine marshes. Measures that prevent or reduce the impacts of erosion along the marsh edge are essential to ensuring the resiliency of the estuary. One option to stabilize eroding shorelines is the transplantation of *Spartina alterniflora* (saltmarsh cordgrass) plugs along vulnerable margins. The root and rhizomatous structures of Spartina bind sediments, preserving soil structure and reducing soil washout. The vegetative portion of the plant acts a wave break, attenuating wave energy and thus reducing the overall impact of kinetic forces on the marsh.

Spartina plugs can be harvested easily, but care must be taken to ensure the integrity of the donor marsh. Thus, there is need to determine at what intensity plugs can be harvested without long-term negative impacts to the donor marsh. This project seeks to understand the effect of varying Spartina harvest intensity on the rate of recovery in healthy donor saltmarsh.

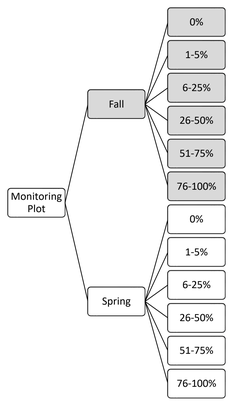
Site Location

The study site is in St. John's county in northeast Florida. The experimental plot is located in pristine low saltmarsh along the Guana River within the Guana Tolomato Matanzas National Estuarine Research Reserve .

Fig 1 Map of A) Study site and B) Plot layout

Design

Fig. 2 Treatment diagram



The experimental area was divided into two plots, fall and spring harvest, each measuring 33 m x 21 m. These plots were each divided into 77 subplots measuring 3 m x 3 m. Using a random number generator, 18 grid locations were identified within each plot. For both seasons, three replicates of six harvest intensities (T1-T6) were applied, totaling 36 treatment quadrats. Harvest intensity ranges were based on the Braun-Blanquet vegetative cover classes used for estimation of percent cover in field conditions. Using stem densities from pre-treatment measures, the appropriate range of stems to be harvested was determined for each plot and plugs were harvested until the target treatment stem densities were reached.

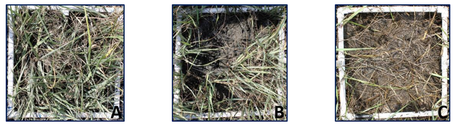


Fig 3 Post-harvest quadrats with different treatments applied: A) 0% harvest, B) 26-50% harvest, and C) 75-100% harvest.

Methods

Plots were monitored at monthly intervals for a period of six months. Three indices for Spartina recovery were measured: stem density, percent cover, and average culm height. Stem density was a count of all stems within the sample quadrat, including new rhizomatous growth. Percent cover was determined through analysis of a digital photo of the sample quadrat taken from a height of 1m. Random points within a 10 x 10 grid overlay were analyzed using Sample Point software . Each point was assigned a value of Spartina or bare, and a percent cover was generated for each quadrat. Average culm height was determined by measuring the five tallest culms within the quadrat and then taking their average.

Because treatment quadrats had differing initial composition due to natural variation, raw data were transformed to a relative term so treatments were comparable regardless of different pre-treatment compositions. Therefore, Relative Stem Density = Experimental Stem Density / Initial Stem Density

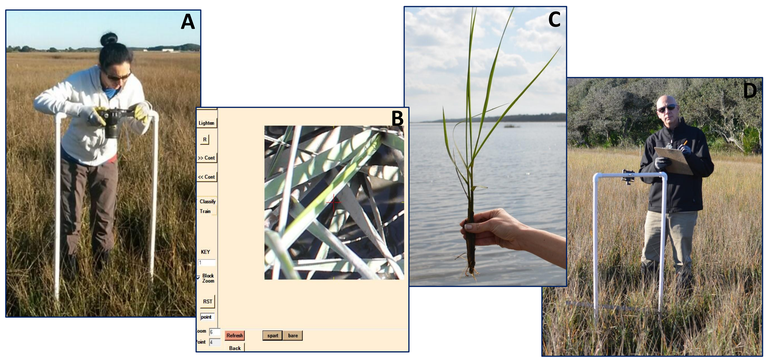


Fig 4 A) Camera stand setup, B) Screenshot of Sample Point analysis, C) Harvested Spartina plug, and D) Data recording in field

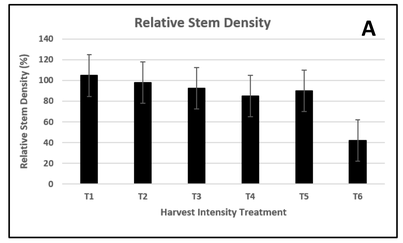
Results

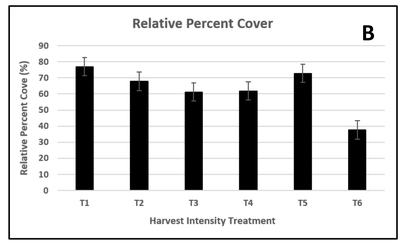
Data for all three measurement variables passed the Shapiro-Wilkes test of normality, thus the assumptions for parametric analysis were met. Multi-way analysis of variance showed no significant interaction between season and treatment for any measured variable and there was no significant difference between fall and spring treatments. Accordingly, one-way analysis of variance was conducted to examine the effect of treatment on each of the three variables measured.

Relative stem density means were similar across treatments with the exception of treatment six, which was significantly different from all other treatment means.

Relative percent cover showed a similar trend with the mean of treatment six proving to be significantly different from all other treatment means.

Relative average culm height again showed treatment six being significantly different from the means of treatments one and two, but not significantly different from treatments three, four, and five.





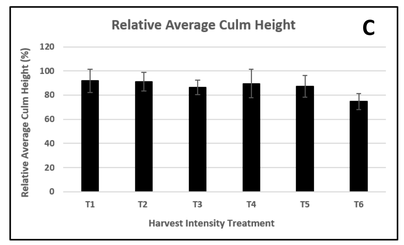


Fig 5 Treatment means for: A)Relative stem density, B) Relative percent cover, and C) Relative average culm height.

Discussion

The season of harvest did not exert a strong influence on recovery rate within the time frame of this study. This study was initiated in Oct. 2014 and final monitoring will conclude Apr. 2016. To fully understand the impact of seasonality on recovery rate, the study should continue for an entire year to capture the full growth cycle of the Spartina.

The influence of treatment on recovery was most prominent at the greatest harvest intensity. Stem density means reflected the most complete recovery of the three measured metrics with five of the six treatments approaching pre-treatment levels. The percent cover measure showed the most sensitivity to treatment with recovery from the most intense harvest being significantly lower than all other treatments. Average culm height showed the least sensitivity to treatment, with very similar treatment means with the exception of the highest intensity treatment.

Before these data can be used to advise Best Management Practices (BMPs) for *Spartina alterniflora* harvest, studies should be conducted on a larger scale to determine if the trends in harvest intensity and recovery are consistent at the landscape level. Final conclusions will be available in summer of 2016.

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