Wetland Vegetation Reestablishment Following Large Sedimentation (Burial) Events

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Introduction

Threesquare bulrush (*Schoenoplectus pungens*) is a perennial herbaceous emergent plant common to high energy open-water freshwater and brackish wetlands throughout the continental United States, where it is important for wave attenuation, erosion control, and sediment stability. In major coastal storms, stems, roots and rhizomes of threesquare bulrush stands may be buried by large amounts of sediment, resulting in mortality or decreased reestablishment, thereby reducing ecosystem services. We find that reestablishment of threesquare bulrush is likely to occur, within a single growing season, with sedimentation events up to 20cm. Sedimentation greater than 20cm is likely to require active restoration. No vegetation emergence was observed at sediment burial depths of 80cm within a single growing season.

Objectives

1. To evaluate the potential for survival of threesquare bulrush following burial due to sedimentation on the scale of recent tsunami depositions (10cm to 80cm) (Turner et al. 2006, Paris et al. 2007).

2. Quantify differences in the amount, type (stem, root/rhizome), and location of biomass within the sediment column produced during a single growing season (March – October) with different amounts of sedimentation.

Methods

A total of six planters at the O.H. Hinsdale Wave Research Laboratory were divided into five treatments of equal area separated with plywood. Each treatment represented a different amount of sediment deposition: control (0cm), 10cm, 20cm, 40cm, or 80cm (Figure 1).

Fig. 1. Experimental setup. The five experimental units for two of the six planters are visible. Note the lack of above ground vegetation in winter 2011 (left) and presence in summer 2011 (right).

Each month, a 10 cm-diameter soil auger was used to collect stem and root/rhizome samples (Figure 2) within a randomly selected column of sediment for each treatment. For each sample, fresh weight, volume, and dry weight of stems and roots/rhizomes were measured.

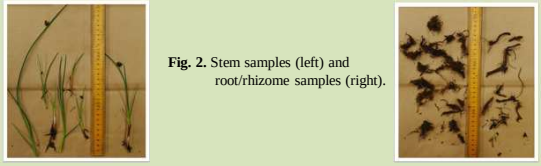


Fig. 2. Stem samples (left) and root/rhizome samples (right).

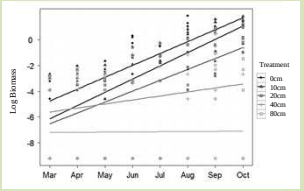
Results

- Total biomass produced in the control was not statistically different from the 10cm and 20cm treatments but was significantly different from the 40cm and 80cm treatments (ANOVA, Tukey HSD Adjustment, Table 1).

Table. 1 P-Values. Comparisons between the total biomass produced of the control and treatments and the rate of biomass production.

Comparison	p-value (Total Biomass Produced)	p-value (Rate of Biomass Production)
0cm-10cm	0.99	0.67
0cm-20cm	0.93	0.76
0cm-40cm	**0.03**	**0.02**
0cm-80cm	**<0.01**	**<0.01**

Fig. 3 Log of Stem biomass production through time for each treatment. The lowest two lines had significantly different biomass production rates compared to the control. See Table 1 for p-values.



- The rate of biomass production was significantly different between the control and the 40cm and 80cm treatments (Multiple Regression with Interaction Terms, Table 1, Figure 3).
- There was no observed difference in the total amount of root/rhizome biomass produced between treatments.
- Root/Rhizome biomass showed evidence of vertical movement through the sediment column (Figure 5).
- Median above-ground stem height and number decreased with increasing sediment burial (Figure 6).

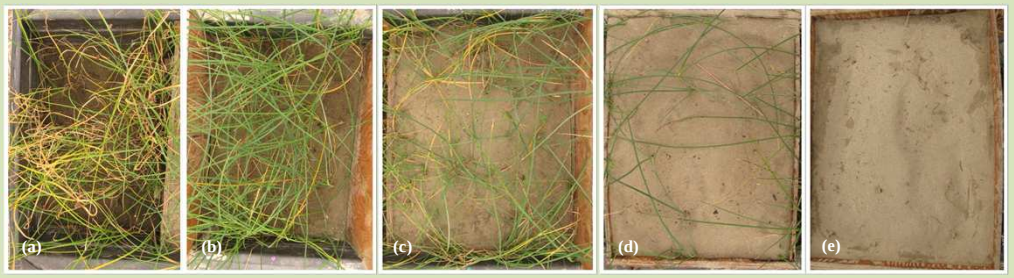


Fig. 4 (a-e). Bulrush growth following sand burial. Amount of burial: (a) 0cm; (b) 10cm; (c) 20cm; (d) 40cm; (e) 80cm. Stem biomass inverse to depth of burial, with the most biomass produced with no burial (a) and least with 80cm of burial (e). Photo October 2011. One of six replicates is shown.

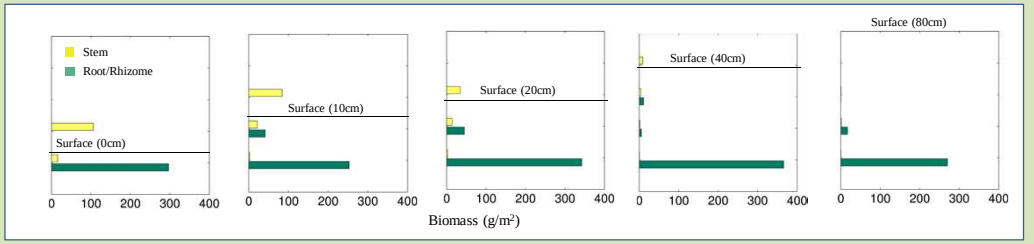


Fig. 5 Total stem and root/rhizome biomass production during a single growing season by sediment treatment depth The surface location for each treatment is marked with a horizontal line. Colored horizontal bars represent the amount and location of biomass within the sediment column. Stem biomass is similar between the control (0cm) and the 10cm treatment. While there is no statistical difference between the 20cm and control, there is a reduction in the amount of stem biomass produced. The 40cm and 80cm treatments had significantly less stem biomass than the control (See Table 1).

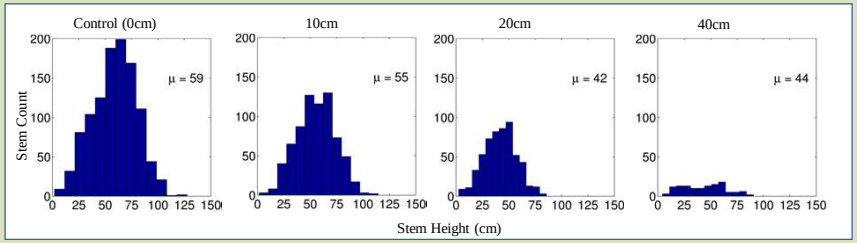


Fig. 6 Distribution of emergent stem heights by sediment treatment depth. Note the progressive decrease in stem count and stem height with increasing sediment. There were no emergent stems in the treatments with 80 cm of added sediment.

Discussion

The results indicate that threesquare bulrush will successfully reestablish following sedimentation up to 20cm in a single growing season. Although there was no statistical difference between 20cm and the control, the total amount of biomass does appear reduced.

Root/rhizome biomass moved vertically through the sediment column to just below the surface level indicating a change in biomass distribution for the 2nd growing season that may aid in sediment retention and erosion control.

The decrease in stem height and number of stems, that is associated with increasing sediment depth, may adversely effect the amount of wave attenuation and erosion control provided by vegetation beds. In instances of 20cm to 40cm of sedimentation, active restoration techniques may mitigate this effect.

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