2024

Factors Determining the Success of Recently Planted Spartina alterniflora on a Living Shoreline in Jamaica Bay, NY

Abby K. Bressette
Virginia Commonwealth University, bressettea@vcu.edu

Shakira Thomas
CUNY Brooklyn College, shakirathomas493@gmail.com

Brett F. Branco
bbranco@brooklyn.cuny.edu

Factors Determining the Success of Recently Planted *Spartina alterniflora* on a Living Shoreline in Jamaica Bay, NY

Abby Bressette[1], Shakira Thomas[2], Brett Branco[2,3]

1. Center for Environmental Studies, Virginia Commonwealth University
2. Department of Earth and Environmental Sciences, Brooklyn College
3. Science and Resilience Institute at Jamaica Bay, Brooklyn College

Introduction

Living shorelines can provide similar ecosystem services to natural marshes while protecting critical infrastructure. The West Pond living shoreline, completed in 2021, included a variety of native marsh plants such as *Spartina alterniflora*, and three types of structures to minimize erosion. Monitoring of the site in 2022 found that *S. alterniflora* plant density was lower than expected after one year of growth. In spring 2023, more *S. alterniflora* was planted to increase density.

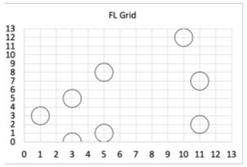
Figure 1. Uneven *S. alterniflora* growth on West Pond living shoreline. Photograph taken June 14, 2023.

Figure 2. Map of Jamaica Bay, NY. The West Pond living shoreline, located in Broad Channel, is indicated by a star.

Our aim is to evaluate how elevation, planting method, and protection from erosion impacted the success of recently planted *S. alterniflora*, as measured by stem height, stem density, and percent coverage.

Methods

3a.



Data collected from 8 randomly selected 1 m² quadrats within 12 cells representing a range of conditions (Fig 3a & Fig 4).

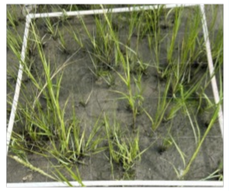
Percent cover determined using the point intercept method within gridded cell (Fig 3b).

Stem density determined by counting stems within 0.25 m² quadrat (Fig 3c).

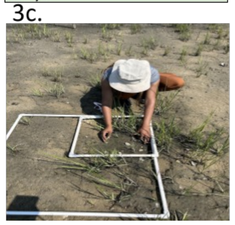
Measured 15 tallest stems with tailors tape within 0.25 m² quadrat (Fig 3d).

Analysis of Variance was run in Excel and R-Studio.

3b.



3c.



3d.

Methods

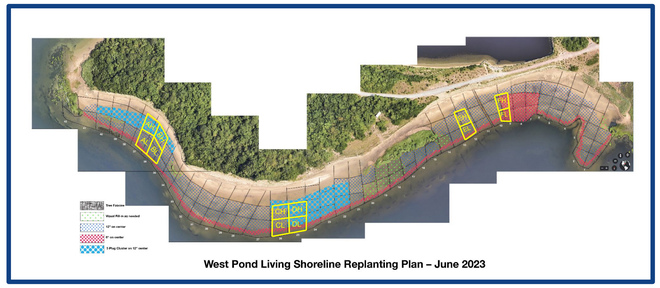


Figure 4. Cell locations labeled alphabetically from west to east, with 'H' representing relative "high" elevation and 'L' representing "low" elevation. Replanting plan map created and provided by Jamaica Bay Rockaway Parks Conservancy.

Results

- Mean values for percent cover, stem density, and stem height significantly different amongst cells as determined by ANOVA.

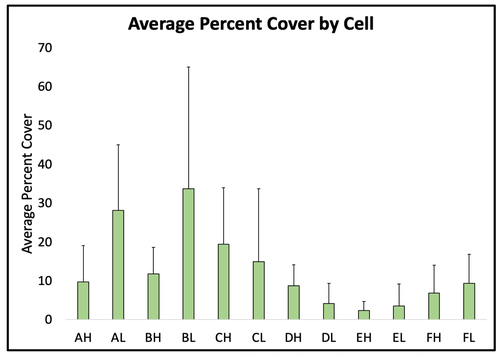


Figure 5. Average percent cover for *S. alterniflora* at twelve cells. ANOVA, p= 0.0004.

- Three highest values for average percent cover and stem height observed in west end cells (A & B; Fig. 5, 7)
- Three lowest values for average percent cover and stem density observed in east end cells (E & F; Fig. 5, 6)
- Low elevation cells have higher average stem densities than their corresponding high elevation cells (excluding cell D; Fig. 6)

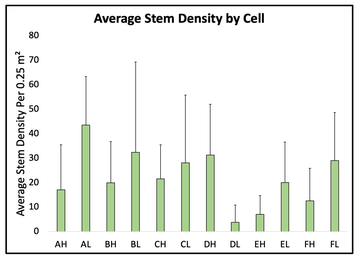


Figure 6. Average stem density for *S. alterniflora* at twelve cells. ANOVA, p= 0.01.

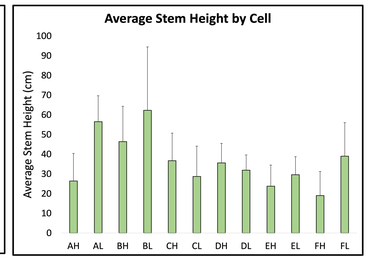


Figure 7. Average stem height for *S. alterniflora* at twelve cells. ANOVA, p= 0.0009.

Results

- Interactive linear model showed a negative relationship between elevation and stem height on the east and west end but a positive relationship in the middle of the shoreline (Fig. 8).
- S. alterniflora is a low marsh plant, so it grows best when inundated for part of the day

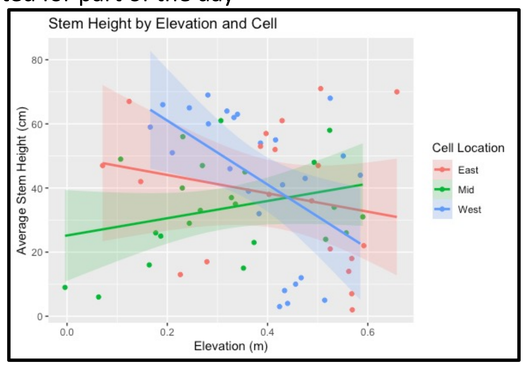


Figure 8. Interactive model with elevation and cell location as predictors of stem height. p = 0.030, R-squared = 0.11

Discussion

- *S. alterniflora* planting has been more successful on the west end of the living shoreline than the east end.
- This could be due to higher erosion rates at east end, as indicated by coarse, rippled substrate (Fig. 10).
- West end may experience lower wave energy and erosion due to its proximity to Yellowbar Island (Fig. 2).
- Impact of planting method on plant growth cannot yet be determined due to variation in planting dates. More years of data collection needed.
- Future studies should measure wave energy and/or erosion at the living shoreline.

Figure 10. Evidence of high wave energy on the east end of the living shoreline. Photograph taken June 14, 2023.

ACKNOWLEDGEMENTS:
We would like thank Natasha Herman, Miles Ramnarace, Caitlin Lynch and Camilo Gaston-Greenberg for assistance with data collection. This material is based upon work supported by the National Science Foundation under Grant DBI-2050828. Disclaimer: Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

REFERENCES

1.Branco et al. (2023). "2022 West Pond Living Shoreline Monitoring", Unpublished report submitted to the Jamaica Bay Rockaway Parks Conservancy
2.Hartig et al. (2002). Anthropogenic and climate-change impacts on salt marshes of Jamaica Bay, New York City. *Wetlands, 22*(1), 71-89. https://doi.org/10.1672/0277-5212(2002)022[0071:AACCIO]2.0.CO;2
3.Martin et al. (2021). The effects of large-scale breakwaters on shoreline vegetation. *Elsevier, 169,* 106319. https://doi.org/10.1016/j.ecoleng.2021.106319
Silliman et al. (2015). Facilitation shifts paradigms and can amplify coastal restoration efforts. *PNAS, 112*(46), 14295-14300. www.pnas.org/cgi/doi/10.1073/pnas.1515297112