Viability of Salt Marsh Plants and Composition Change Over Time

Lily Zufall, WATERS Intern

NEW YORK STATE Department of Environmental Conservation | Hudson River Estuary Program

Randall's Island Park Alliance

Introduction

Salt marshes are a key part of a coastal ecosystem. The low marsh area floods twice a day at high tide while the high marsh area almost never floods, and the difference between the two can be a matter of centimeters in some marshes (New Hampshire Department of Environmental Conservation, 2004). High and low marsh are characterized by different species of plant that can be found there; low marsh plants are highly salt tolerant and able to handle routine flooding. High marsh species are less salt tolerant.

Climate change and human behavior bring about risks for salt marshes; primarily, being flooded by high waters. They can mitigate this flooding in two different ways; accumulating more sediment and migrating further inland. Marshes trap sediments that wash over them and use them to build higher. Rates of accumulation have in many cases kept pace with rates of sea level rise (Currin, 2021), successfully keeping marshes from drowning. In other instances, marshes migrate backwards. Low marsh species begin to grow in places that had been previously high marsh only, and high marsh species spread into the surrounding forests and ecosystems. As the water levels rise and encroached on the marsh, the marsh essentially backs up away from the water's edge to survive.

To understand the future of a salt marsh, it is also important to examine its current composition. The Little Hell Gate Salt Marsh (LHGSM) on Randall's Island was constructed in 2006. Records exist of the species originally planted in the marsh, but marsh composition has potentially changed.

Objectives

- Determine the present composition and viability of the marsh's plant life by looking for and counting seedheads and flowers on these plants
- Compare it to the marsh's original plantings with the ones found in the marsh to see how marsh composition has changed over time

Methods

- The transect (10m) was walked and all plant species within a meter of it were noted. For each species, the number of plants in bloom was tallied. An estimate was then made for what percentage of each species was currently flowering
- Air temperature, wind speed, soil pH, and nutrient levels were measured at the 0-meter mark of all three transects.

Results

Table 1. Species recorded at each site with number and percentage of plants flowering.

Location	Plant	Flowering number	Percent flowering
Low	*Spartina alterniflora*	52	60%
Low	*Atriplex prostrata*	0	0%
Low	*Iva frutescens*	4	66%
Low	*Limonium carolinianum*	0	0%
Mid	*Spartina alterniflora*	1	1%
Mid	*Iva frutescens*	5	70%
Mid	*Limonium carolinianum*	0	0%
High	*Phragmites*	0	0%
High	*Solidago sempervirens*	0	0%
High	*Iva frutescens*	5	100%
High	*Sporobolis alterniflorus*	0	0%
High	*Solidago mexicana*	0	0%

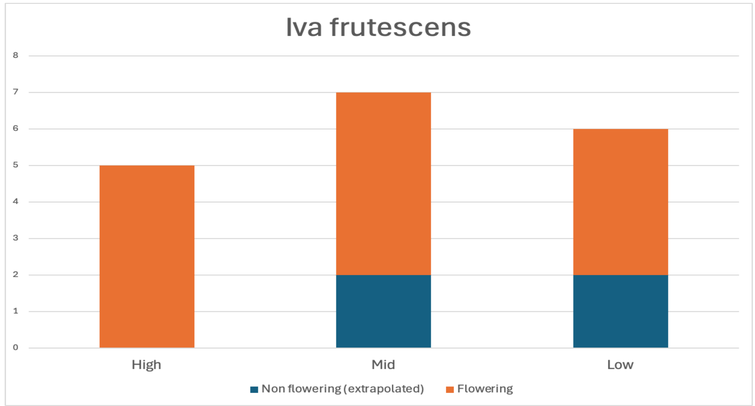

Figure 1. *Iva frutescens* was the only species found at all three sites. At high marsh, all five plants were in bloom. Five of seven were blooming at mid marsh, and four of six at low marsh.

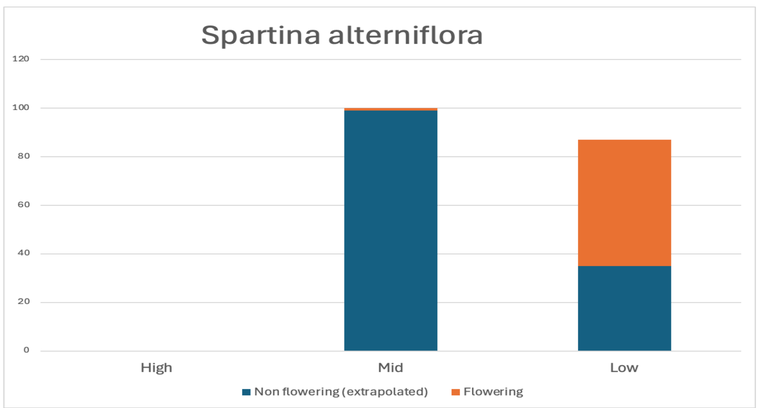

Figure 2. *Spartina alterniflora* was found in the mid and low marsh. The vast majority of the plants in the mid marsh were not in bloom, whereas a little more than half in the low marsh were. No *spartina* was found along the high marsh transect.

Summary

The low marsh soil was acidic with a pH of 3.5 and the nutrient level was 8 (sufficient). Here we found *spartina alterniflora*, *atriplex prostata*, *iva frutescens*, and *limonium carolinianum.* Of these plants, neither the *atriplex prostata* and *limonium carolinianum* were flowering. 60% of the *spartina alterniflora* was flowering, and 66% of the *iva frutescens* was in bloom.

Only three species were found in the mid marsh: *iva frutescens*, *limonium carolinium*, and *spartina alterniflora.* The majority of the *iva frutescens* was flowering along this transect, but only one stalk of *spartina alterniflora* was in bloom (making about 1% of the total for the plant). Soil was acidic, with a pH of 3 and the nutrient level was 7, which while slightly lower than in the low marsh, is still plenty sufficient for most plant growth.

Five species were found in the high marsh. This included *iva frutescens* like the other two transects. In this location, all five *iva frutescens* plants were in bloom but none of the other species were. These four were *phragmites, solidago sempervirens, sporobolis alterniflorus,* and *solidago mexicana*. The pH level was 6 nutrient level was 7.

Discussion/ Conclusions

Of the species found along our transects, only the *spartina alterniflora* was originally intended to be planted in the marsh. The *spartina alterniflora* found along the low and mid marsh transects was originally planted at marsh elevations between 0 and 1.15 feet, where it remains. It may be worth noting that much more *spartina* was blooming in the low marsh than in the mid marsh. *Spartina alterniflora* is a plant that characterizes low marsh and tends to grow in water and along coasts (NC Common Wetland Plants Guide: Spartina Alterniflora, 2018). This suggests that while mid marsh is an acceptable location for it to grow, low marsh is more suitable and it will grow better there. This could be part of why so much more of the *spartina alterniflora* was in bloom in the low marsh. In the case of sea level rise, the mid and high marsh regions will become more suitable for *spartina* and it will likely grow in larger numbers there, potentially even blooming more and/or earlier in the season.

Iva frutescens was present in all three levels of the marsh, indicating that it will likely be able to weather rising sea levels and potential marsh flooding. In its low and mid marsh locations, it was incredibly close to the waters edge at low tide and partially submerged at high tide. If sea level rise causes higher tides in this salt marsh and high marsh areas begin to experience wetter conditions, the *iva frutescens* in the high marsh will be able to handle it.

Acknowledgements

I would like to thank the New York Department of Conservation Hudson Estuary Program for funding my research. I would like to thank Olivia Smith and Chris Girgenti for support and mentorship throughout the internship.

References

What is a Salt Marsh? (2004). New Hampshire Department of Environmental Services. https://www.hamptonnh.gov/DocumentCenter/View/405/What-is-a-Salt-Marsh-PDF

Davis, J., Currin, C., & Morris, J. T. (2017). Impacts of Fertilization and Tidal Inundation on Elevation Change in Microtidal, Low Relief Salt Marshes. *Estuaries and Coasts*, *40*(6), 1677–1687. https://doi.org/10.1007/s12237-017-0251-0