METHODS OF ACCELERATING RE-VEGETATION AT BAY OF FUNDY SALT MARSH RESTORATION SITES: A PRACTICAL COMPARISON

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BACKGROUND

Salt marshes are an essential part of coastal landscapes but have been lost in large quantities due to human manipulation. Salt marshes provide important ecosystem services, including coastal protection, carbon sequestration, and habitat. Interest in their restoration is growing in response to climate change. In Atlantic Canada, tidal wetland restoration has focused on restoring tidal flow without planting vegetation. However, the vegetation communities on unplanted restoration sites in Atlantic Canada and elsewhere do not always mimic natural salt marsh vegetation.

RESEARCH

The main objective of this research was to determine whether active re-vegetation accelerated the recovery of plant communities at two new salt marsh restoration sites in the Bay of Fundy, Nova Scotia. I evaluated five methods of growing eight native species at Bay of Fundy restoration sites by comparing the growth and health of plants over two years.

RESULTS & APPLICATION

Of the tested methods, only planting a mixture of species as potted seedlings and field transplants (plants transplanted from adjacent sites) successfully established a higher abundance of plant cover and species richness of target species (perennial halophytes) than unplanted areas. Interestingly, at the Belcher site, the total abundance of plant cover considering all species was similar between planted and unplanted areas due to extensive colonization of non-target species (mainly annuals). More research is required to understand the role of these non-target plants in salt marsh vegetation restoration.

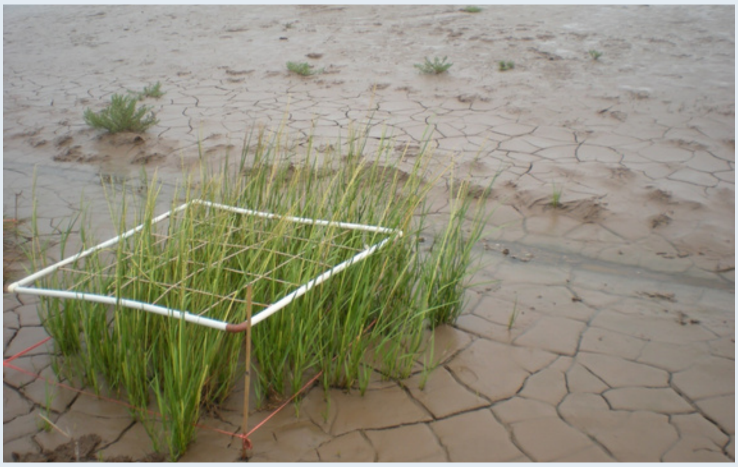

Figure 1. A field transplant plot at Converse showing contrast in vegetation abundance between planted plot and the unplanted marsh surface.

While potted seedlings and field transplants had similar relative growth rates (RGR), potted seedlings were twice as likely to survive over the first summer (survival ≈ 75%), while field transplants had higher mortality (survival ≈ 40%), likely due to trauma caused by digging transplants. Higher survival may also be achieved by transplanting larger clumps, as opposed to single plants used in this study.

The remaining plant restoration methods—adding a propagule source (sowing seed and planting wrack) and encouraging seed deposition (tilling)—did not increase the abundance or richness of the target species. Unfortunately, in this study, seeds were planted deeper than planned due to miscommunication, which may have contributed to meagre germination rates, particularly at Belcher, where seeds were planted 10 cm deep. Wrack and tilling treatments were unsuccessful in this study for establishing vegetation. Planting wrack has been unsuccessful in the past and may not be a reliable source of propagules for planting. However, wrack may be helpful when partnered with another method of planting or seeding to act as mulch, secure seeds, or protect plantings.

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Plant performance measures other than abundance and species richness showed that the planting site was a more critical determinant of performance than treatment. RGR, health scores (assigned using a visual assessment), and over-winter survival (survival to the second summer) were higher at the Belcher site than at the Converse site. Differing conditions (soil salinity, soil nutrient content, surface elevation, and characteristics of tidal flooding) between sites may have been responsible for these differences. Notably, higher elevations, less saline soil, and less frequent flooding at Belcher made it a less stressful site overall for plants.

Interestingly, elevation, which mediates flooding and salinity in salt marshes, was positively related to health and RGR at Converse but negatively associated with those variables at Belcher. This finding is likely explained by higher overall elevations at Belcher, which caused plants high in the elevation range at Belcher to experience excessive stress from drought. In contrast, plants low in the elevation range at Converse experienced excessive stress from frequent flooding.

Additionally, plant performance may be associated with soil nutrients, including phosphorus, potassium, and calcium. However, more research is needed to determine causal relationships between soil nutrients and the performance of plantings. A confound to results of this study is that Belcher had approximately 30 cm of freshly deposited sediment at the time of planting. In contrast, Converse had experienced little sedimentation and soils were compacted from previous agricultural land use.

CONCLUSION

The planting techniques used in this study show promise for accelerating re-vegetation at recovering salt marsh restoration sites. Particularly, planting live plants grown in the greenhouse and directly from adjacent sites yielded healthy plants that survived over two years to kick-start plant colonization. This study has revealed several interesting avenues for future research, including investigating the role of early annual salt marsh colonizers in plant succession and the role of soil nutrients in the performance of plantings in salt marshes. In addition, modifications of the methods used here may be interesting to investigate, such as digging and planting large clumps of transplants from adjacent sites instead of individual plants, planting younger potted seedings, or mixing methods together (e.g., seeding amongst potted seedlings or using wrack as mulch around seeds or plantings). My results also highlight the need to understand site conditions to inform planting schemes and provide information for weighing budget and logistical considerations of different planting methods.

Figure 2. Photograph of Tasha during vegetation surveys at Belcher in August 2020

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