

Success of Planted Vegetation

McKinley Anderson, Amy Bristol, Janay Faulkner, Joshua Polanski

Abstract

Planting vegetation is an accepted dune management practice, but there are few studies of the plantings ten years later. Vegetation was planted at North Beach dune ten years ago to stabilize the dune. Our research project investigated the success of the planted vegetation compared to the natural vegetation on the dune. We created a grid of the dune and randomly chose places on the windward slope and slipface where we collected vegetation samples using transects and quadrats. We used the variables of vegetation height, health, density, and the soil moisture content to determine the effects of the vegetation on the now stable dune. Results show that the dune has significantly increased in its vegetation density, allowing stabilization of the dune. The edges of the dune, near the sand fences, are more vegetated. There is a negative correlation between soil moisture content and the height and density of the vegetation. As we compared the naturally vegetated zones of the dune to the restored zones of the dune, we found that the planted zones lack diversity, but maintained similar characteristics in plant health, density, and height.

Introduction

Vegetation is planted on a dune to slow dune advance. The most common vegetation type is *Ammophila breviligulata* (Figs. A and B). Ten years ago *A. breviligulata* was planted on North Beach dune for the purpose of stabilizing the dune. We studied North Beach dune to see how the planted *A. breviligulata* compare to the vegetation that has grown naturally on the dune.



Figure A (left) and Figure B (above): *Ammophila breviligulata* was the most common plant found on North Beach dune. It was the only species planted for vegetation restoration.

Study Objectives

The main objectives of the study were to:

- 1) Collect data on the vegetation of North Beach dune on the windward slope and slipface.
- 2) Compare the characteristics of planted vegetation to the areas with natural vegetation.
- 3) Collect sand moisture and utilize sand traps to learn about the dune characteristics and note how they affect vegetation growth.
- 4) Determine the effectiveness of the planted vegetation techniques.

Study Area

The vegetation on the North Beach dune, located on the eastern shore of Lake Michigan, was planted on the upper windward slope approximately 10 years ago as part of management strategies to slow down the dune's advance. Figure C shows the location of North Beach dune relative to Lake Michigan.

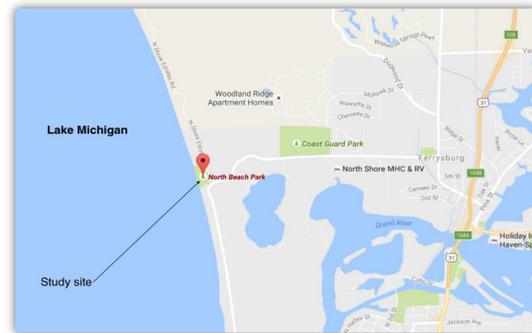


Figure C: Map of dune location

There is a boardwalk encircling North Beach dune and two sand fences are located on the dune. Though the dune has vegetation cover consisting mostly of *A. breviligulata*, there are also many trees on the slipface of the dune and around the dune itself.

Methods

We studied the vegetation on North Beach dune to compare the planted vegetation to the natural vegetation using methods that have been used in other studies [1]. We created a numbered grid for the dune which we used to split the dune into equal sections in which to conduct our studies (Fig. D).



Figure D: GPS of North Beach dune, grid, and transect and quadrats

We chose random numbers to determine which sections of the dune in which to conduct our research. In conducting our research we used the methods in Table A.

Method Used	Data Type Collected
Transects and Quadrats	Number, health, height, and density of vegetation.
Folding Ruler	Height of species (Maximum and minimum)
Moisture Tins	Soil moisture content.
Sand Traps	Measure sand movement
Vegetation Health Scale	0-5 scale. 0 being withered and 5 being flourishing with no dead plants.
Vegetation Density Scale	0-5 scale. 0 being bare sand and 5 being full vegetation coverage.

Table A. Methods used in the study of North Beach dune

Results

We divided North Beach dune into nine different zones (Fig. E). The vegetation was naturally grown on the slipface and at the base of the dune in zones 1, 4, and 7. The vegetation was mixed, both planted and natural, in the middle of the dune around the blowout in zones 2, 5, and 8. The species *A. breviligulata* was completely planted in zones 3, 6, and 9 at the top in order to help stabilize the dune.



Figure E: Numbered grid on dune

The vegetation was more dense on the sides rather than the center of the dune. *Ammophila breviligulata* was the only species found on the planted parts of the dune. The highest average plants were found in planted zones. The lowest average plants were found in natural zones (Fig. F).

	# of Species Found	Average Highest Plant	Average Lowest Plant	Average Density	Average Health	Zones
Planted	1	31.12in	13.25in	2.71	2.46	Windward:3, 6, 9
Natural	3	29.06in	8.81in	2.19	2.69	Windward:1, 4, 7; Slipface: 2, 6
Mixed	1	33.59in	16.94in	2.88	1.94	Windward: 2, 5, 8

Figure F. Chart with data regarding the various types of vegetation.

Zones that contained natural vegetation had the highest moisture content in the sand as compared to planted and mixed zones which were more consistent (Fig. G). The area of the dune with natural *A. breviligulata* seems to have the most sand movement. (Fig. G)

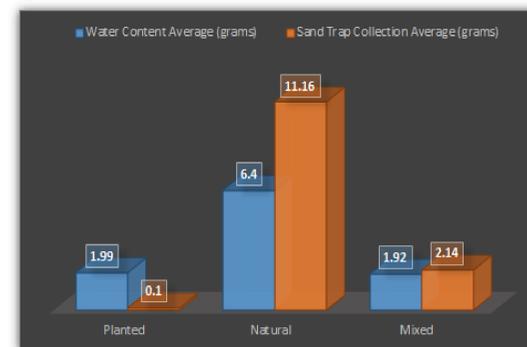


Figure G: Graph of water content and sand collected

Discussion

Our results, similar to other studies, reveal that the restored parts of North Beach dune lack the diversity that natural parts have [2]. The natural sections of the dune contained more moisture in the sand samples, produced more sand in their sand traps (Fig. H), and contained less height and density, but the vegetation was healthier.



Figure H: Two team members collecting sand from sand traps

The natural vegetation sections had a higher sand transport rate because the sections were located at the base of the dune. The vegetation in the naturally planted sections were healthier because *A. breviligulata* thrives with sand burial [3]. The restoration project of dune vegetation at North Beach was successful because of the planted *A. breviligulata*. This strategy should be implemented at other dunes because of its success.

Conclusions

Planted and natural vegetation at North Beach dune are similar in their height, density, and health, but differ in their water content and sand movement. Even though planted vegetation was an overall success, a weakness was the lack of diversity compared to the natural locations.

Acknowledgments

We would like to thank Professor Deanna van Dijk for her guidance and our mentor, Isaac Jacques. The study could not have been completed without Ottawa County Parks and Melanie Manion's cooperation. The Geology Department at Calvin College enabled the project by allowing us to use the necessary equipment to complete our studies, the Michigan Space Grant Consortium provided funding, and finally Calvin College made the FYRES program possible.

References

- [1] Françoise, R. and S. Lemauiel. 2004. "Sand Dune Restoration in North Brittany, France: A 10-year Monitoring Study" *Restoration Ecology* 12 (1): 29-35.
- [2] D. H. Slaymaker, M. S. Peek, J. Wresilo, D. C. Zeltner, and Y. F. Saleh. 2015. "Genetic Structure of Native and Restored Populations of American Beachgrass (*Ammophila breviligulata* Fern.) along the New Jersey Coast" *Journal of Coastal Research* 31 (6): 1334-1343.
- [3] Maun, M. and J. Lapierre. 1984. "The Effects of Burial by Sand on *Ammophila Breviligulata*" *Journal of Ecology* 72: 827-839.