

Long-Term Effects of Planted *Ammophila Breviligulata* on North Beach Dune

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Abstract

Ammophila breviligulata is a beach grass commonly planted for dune management because of its burial tolerance and effectiveness in sand stabilization. The long term effect of planted beachgrass is not fully understood. This study investigated the vegetation health, distribution, and density of planted *A. breviligulata* in relation to site characteristics. The study location is North Beach dune, which has been moving towards the only access road for many shoreline homes. To stabilize the dune, Ottawa County Park staff and volunteers have been planting *A. breviligulata* periodically over the past ten years. Our investigation included comparing photographs from 2004 to 2014 and using GPS to map vegetated areas. We divided the study area into 9 sections to measure plant health, maximum height, and density within randomly selected quadrats. The photographs showed that the planted beach grass has spread across much of the windward slope of the dune. Grass near sand fences was taller and healthier than grasses in transition areas between bare sand and full vegetation. Areas with steeper slopes had generally taller, healthier plants than areas with gentle slopes. Our results suggest that 5-10 years after planting, *A. breviligulata* was moderately healthy and offering greater protection to the dune surface.

Introduction

Ammophila breviligulata is a commonly used beachgrass for management and stabilization purposes (Figure 1) because of its tolerance for burial [1,2]. This study focused on planted *A. breviligulata* and its establishment on a Lake Michigan dune 5-10 years after planting.

Objectives

1. Determine condition of planted *A. breviligulata*
2. Assess distribution of beachgrass over the dune
3. Investigate relationship between plant characteristics and environmental conditions



Figure 1: The windward slope of this dune is covered with planted *A. breviligulata*.

Study Site

The study took place on the upper windward face and crest of North Beach dune, a large parabolic dune in Ferrysburg, Michigan (Figure 2). Ottawa County Parks initiated plantings of *A. breviligulata* between 2004 and 2014 to mitigate dune movement caused by human disturbances.



Figure 2: Location and aerial photograph of North Beach dune.

Methods

We divided the study area into 9 zones (Figure 3) and sampled vegetation characteristics with 7 randomly placed quadrats in each zone (Figure 4). In each quadrat, we measured *A. breviligulata* height and health (Table 1) and observed other species. For each zone, we measured zone dimensions, estimated vegetation cover, and calculated dune slope. We compared photographs of the study site throughout the past 10 years to see how *A. breviligulata* had spread.



Figure 3: Study site with zones superimposed over the map.

Number	Category	Description
1	Poor	Complete discoloration, damage to leaves or stalk noticed, dying or dead grass
2	Below Average	Significant discoloration, some damage to leaves or stalk
3	Average	Some discoloration, trace damage to leaves or stalk
4	Above Average	Very little discoloration, no damage noted
5	Excellent	No discoloration or damage, perfect condition

Table 1: Classification of plant health.



Figure 4: Researcher using .5 m x .5 m quadrat for sampling vegetation.

Results

In 2004, the study area was mostly bare sand with some *A. breviligulata* present in small patches around the perimeter (Figure 5). In 2014, the vegetation cover on the dune was mostly planted *A. breviligulata* from periodic volunteer events (Table 2). New species were present on the dune and vegetation had spread over much of the dune surface.



2004



2014

Figure 5: Photographs of North Beach dune from 2004 to 2014 showing vegetation growth.

In 2014, *A. breviligulata* had an average height of 72.7 centimeters (Table 3). Overall, plant health was slightly below average with a health ranking of 2.57.

The upper zones were densely vegetated, almost exclusively with *A. breviligulata*, and the lower zones were very sparsely vegetated, but with higher diversity including a rare species (Figure 6). Zone 9 had no specimens in any quadrats. Zone 9 had the steepest slope and zone 5 had the most gentle slope.

Our results show a weak positive relationship between dune slope angle and height of *A. breviligulata* (Figure 7). Grass near sand fences was taller and healthier than grasses in transition areas between bare sand and full vegetation.



Figure 6: *Cirsium pitcheri* (Pitcher's Thistle) is a federally threatened species that was found in zone 5.

Date	Activity	Source
9 Oct 2004	Volunteer dune grass planting	E-mail records
Sept/Oct 2007	Volunteer dune grass planting	Park Manager's Report
19 April 2008	20 Volunteers planted 1,500-2,000 sq. feet	Park Manager's Report
18 April 2009	Volunteer dune grass planting	Outdoors Ottawa County (Spring 2009)

Table 2: Compilation of known plantings at North Beach dune. Conversations have suggested more plantings, but the record is incomplete.

Zone	Avg Height	Avg Health	# of Bare Sand Quadrats	Vegetation Cover	Other Species Present	Zone Slope
1	71.86	2	0	Dense	0	0.45
2	71.71	2.7	0	Dense	0	0.46
3	65.33	2.9	1	Dense	0	0.44
4	56.67	1	3	Moderately Dense	0	0.38
5	68.40	2.9	2	Moderately Dense	1	0.33
6	75.00	3.4	4	Moderately Dense	0	0.39
7	84.67	3.3	4	Sparse	1	0.69
8	88.23	2.35	4	Sparse	1	0.43
9	N/A	N/A	7	Sparse	1	0.69
Average	72.73	2.57				

Table 3: Plant characteristics (from quadrats) and environmental measurements taken in each zone.

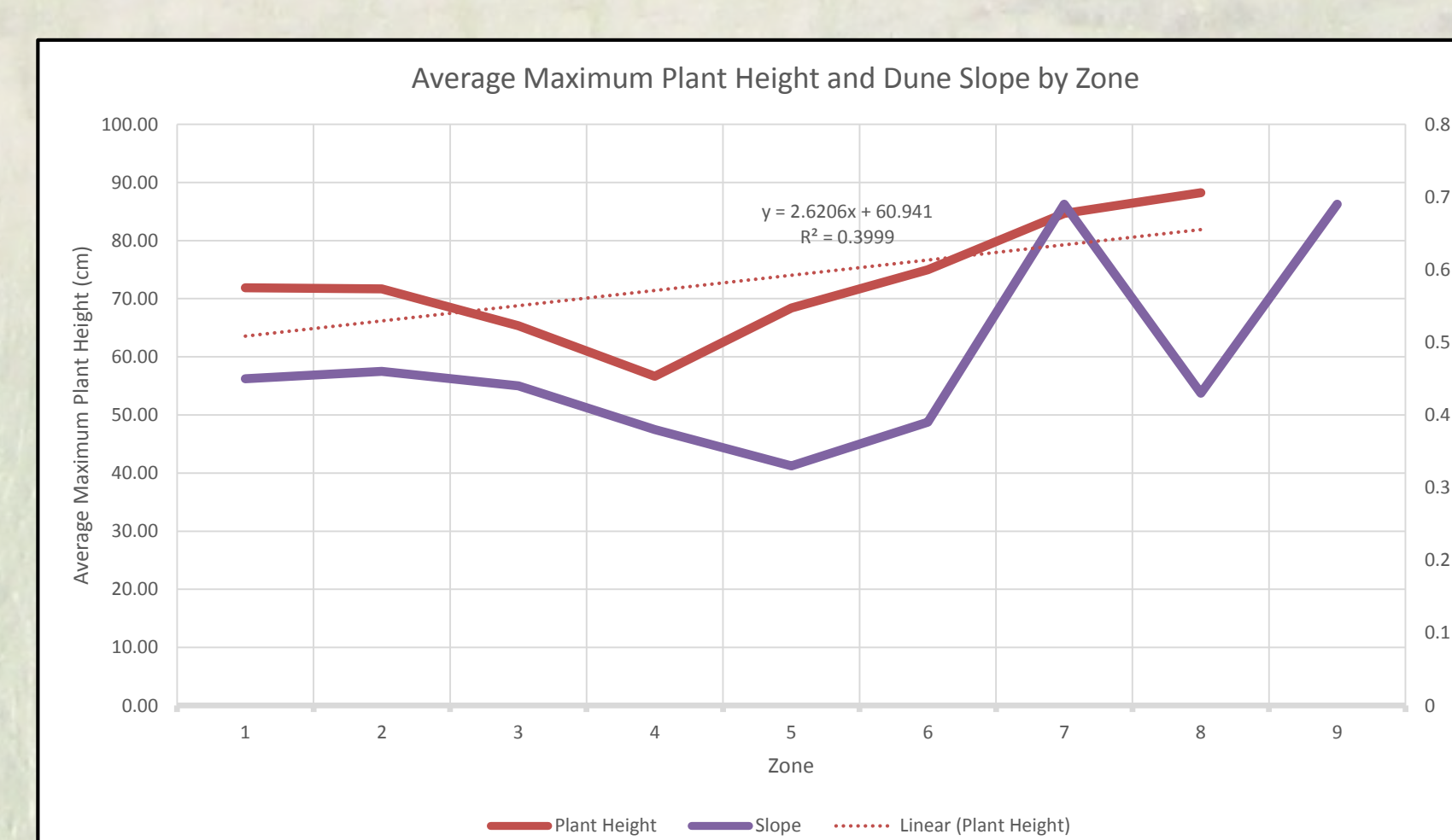


Figure 7: Chart showing relationship between height and of *A. breviligulata* and dune slope. Relationship between the two characteristics is a direct one.

Discussion

Photographs show a spread of *A. breviligulata*, suggesting that the plantings have been successful in re-establishing vegetation on the upper windward slope (Figure 8). A sign of recovering ecological health is the presence of additional species [3] such as *Cirsium pitcheri*, a federally threatened plant endemic to the Great Lakes.

Less than excellent plant health values suggest that the plants lose vigor after a certain period of time, as also noted by previous studies [1].

Areas with steeper slopes have greater instability which enhances levels of disturbance from gravity or animal activity. The observed increase in *A. breviligulata* height on the steeper slopes may result from *A. breviligulata* thriving in areas of disturbance.



Figure 8: The vegetated upper slope of North Beach dune. The non-vegetated lower zones can be seen in the background.

Conclusions

In 2014, *A. breviligulata* was found to be well established across the upper windward slope of the North Beach dune. Increased species presence and decreased *A. breviligulata* vigor suggest that the ecological community is in transition.

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