Kitchel-Lindquist-Hartger: Natural Blowout

Rachel Commons, Noah DenBleyker, Josh DeVries, Jake Mulder, Kyra Schofield, Abby Voskuil

Calvin COLLEGE 1876

Abstract

Saucer blowouts provide a unique dune layout to study the wind speed and vegetational changes throughout the dune system. Our study of the north blowout of the Kitchel-Lindquist-Hartger Dunes Preserve in Grand Haven, MI, investigates the correlation between wind and vegetation and how they, in turn, affect the sand movement and shape of the blowout. From October through November 2018, we utilized a stadia rod survey to study the overall shape. We studied the vegetation of the blowout to understand the stability of the blowout. GPS mapping techniques utilizing GIS software were used to map features of the dune and give insight into the composition of the blowout area. The dune system is an active dune with a windward slope composed of mostly bare sand. We found that the vegetational patterns and erosion pin data indicate some deposition occurring within the dune system. The results of this study show how the interactions between wind and vegetation influence the shape of the dune along with sand transport patterns.

Introduction

Aeolian activity and vegetation are two variables that directly affect the transformation and advance of a dune system [1]. Our study investigates the effects of wind speed and vegetation on the movement of sand and the shape of dune.

Our study objectives were to:

- Investigate blowout characteristics.
- Measure wind and sand movement.
- Record vegetation patterns.

Study Area

This study took place at Kitchel-Lindquist-Hartger Dunes Preserve in Ferrysburg, Michigan (Figure 1). The focus was on one of the main blowouts (Figure 2) located east of Lake Michigan which sits behind a road in front of a development of beach-front houses, adjacent to North Shore Marina.

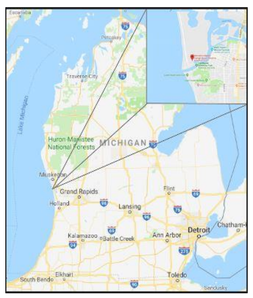

Figure 1: *A map view of where the north Kitchel-Lindquist-Hartger blowout is in western Michigan.*

Figure 2: *The windward slope of the north Kitchel-Lindquist-Hartger blowout.*

Methods

We studied blowout characteristics, measured wind and sand movement and recorded vegetation patterns (Table 1).

Study Objectives	Measured Variables	Methods	Comments
Investigate blowout characteristics	Elevation	Stadia rod survey	Multiple points to make the profile graphs.
Investigate blowout characteristics	Blowout boundaries and features	GPS mapping and photography	Features included signs, tree distances from the bottom of the slip face, and other vegetation.
Measure wind and sand movement	Deposition	Erosion pins	Five pins placed in different areas of the dune.
Measure wind and sand movement.	Wind movement	Hand-held anemometer	A handheld instrument used to measure the wind speeds at the blowout.
Measure wind and sand movement	Sand movement	Sand traps	4 sand traps spread out over the dune area.
Record vegetation patterns	Species types, heights, and health	Quadrats and measurements	Ten different quadrat throws to find the sampling locations.

Table 1: Methods for our objectives.

Results

Blowout Characteristics: Our two transects provided a topographical representation for the dune and dune shape reference for future studies (Figure 3 and 4).

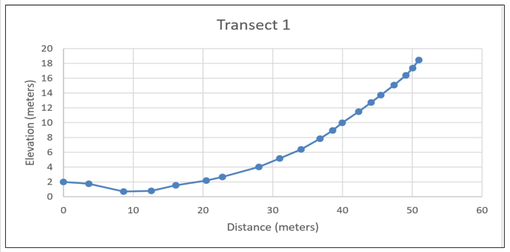

Figure 3: *Profile from the floor of the blowout to the dune crest.*

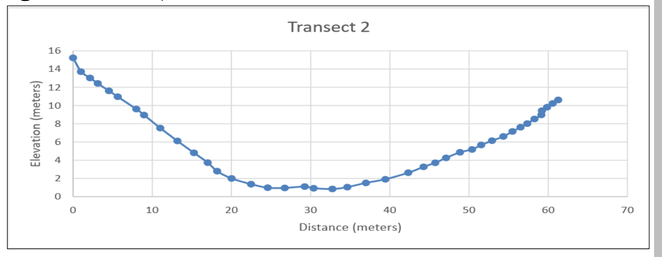

Figure 4: *Profile from the ridge of the north arm to the ridge of the south arm.*

Wind and Sand Movement: Wind and sand trap data collected during site visits show negligible deposition, but erosion pin data shows that substantial amounts of deposition occurred between our site visits (Figure 5). During the first week, there was deposition at all erosion pins. During the second week, there was deposition at three pins but erosion at the other two pins.

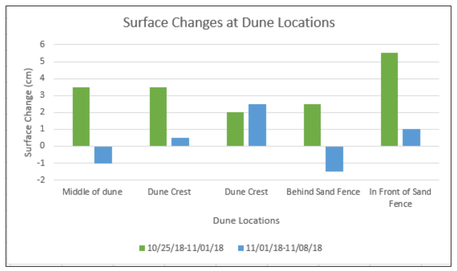

Figure 5: Surface changes at erosion pins over two weeks of research.

Vegetation Patterns*: Ammophila breviligulata* was found in many areas of the dune (Figure 6), including clumps of *Ammophila* behind the sand fences. The health of the *Ammophila* was low, indicating minimal amounts of sand burial. A variety of shrub-related types of vegetation are present on the leeward slope, including *Myrica gale*. Near the base of the dune, we found multiple species of pine trees.

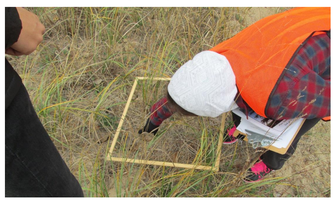

Figure 6: Quadrat with a healthy section of vegetation.

Figure 7: Erosion pin placement near a sand fence.

Discussion

Our erosion pin and wind data suggest that deposition is occurring from week to week over the crest of the dune. Negligible sand trap data and the data collected by the erosion pins supports, however, that deposition is not occurring at a high frequency.

The poorer health of the *Ammophila breviligulata* throughout the dune indicates surface stability or low amounts of sand movement. *Myrica gale* is commonly found in saturated habitats which may indicate that the leeward slope of the dune was once a wetland. Pine trees on the leeward slope are indicators of stability over a longer period of time for this part of the dune

This information is intended to help dune managers make informed decisions about possible management strategies. There are few indicators of human presence on the dune, so managers need not act at this point in time. Vegetation prevents expansion of the blowout in certain directions, and it impedes wind flow and sand transport paths.

Conclusions

Presence and health of the *Ammophila breviligulata* indicates moderate sand deposition. Based on stadia rod, vegetation, and erosion pin studies we have concluded that this dune has high elevation differences, minimal vegetation coverage and moderate rates of deposition.

Acknowledgements

We would like to thank Kitchel-Lindquist-Hartger Dunes Preserve for allowing our group to obtain research in this area, as well as Hans Leisman and Professor Deanna van Dijk for directing us. We would also like to thank Calvin College, the Department of Geology, Geography, and Environmental Studies, and the Michigan Space Grant Consortium for their support.

References

[1] Fraser, G.S., S. W. Bennett, G. A. Olyphant, N. J. Bauch, V. Ferguson, C. A. Gellasch, C. L. Millard, B. Mueller, P. J. O'Malley, J. N. Way, and M. C. Woodfield. 1998. "Windflow Circulation Patterns in a Coastal Dune Blowout, South Coast of Lake Michigan." *Journal of Coastal Research* 14, no. 2: 451-60.

[2] Jungerius, P. D., and F. Van Der Meulen. 1997. "Aeolian Dynamics in Relation to Wind in a Blowout Complex in the Meijendel Dunes, the Netherlands." *Journal of Coastal Conservation* 3, no. 1: 63-70.