# Dune Advance and Vegetation on an Active Blowout: a Study at Kitchel-Lindquist-Hartger Dunes Preserve

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## Abstract

Active dune landscapes with unique vegetation define the Great Lakes region. Our research investigated how the advance of the Kitchel-Lindquist-Hartger (KHL) dune is affected by the vegetation communities surrounding it. By utilizing erosion pins, GPS mapping, Leatherman sand traps, and quadrats, our group mapped the features and measured the movement of the dune landscape from late October to early November. Results show little blowout movement or dune advance within our research period. The correlation between sand movement and vegetation was high, with high vegetation density resulting in lower rates of sand movement. These measurements revealed the slow advancement of the KLH dune in a direction that would not interfere with their learning center. Our research will help to further understanding in the relationships between rates of advance and vegetation and will help to promote further research in this topic of interest.

## Introduction and Objectives

Jerry S. Olson demonstrates the effects of different plants on an active dune system [1]. Due to the concern of managers at Kitchel-Lindquist-Hartger Dunes Preserve regarding the dune's advancement toward a nearby outdoor education center, our research team was able to observe the role of vegetation, wind movement and sand transport in connection with dune advance.

Our objectives for research were to:

- Calculate rate and direction of dune advance.
- Record vegetation patterns on the dune.
- Draw connections between vegetation and dune advance data.

## Study Area

The study area is the Kitchel-Lindquist-Hartger Dunes Preserve in Ferrysburg, Michigan (Figure 1). The specific dune of interest is a blowout (Figure 2) with emphasis on the crest, slipface, and leeward slope of the dune.


**Figure 1:** Aerial photo and location of study area. The structure pictured is the outdoor learning center.

**Figure 2:** Photo looking up towards blowout crest.

A previous study by the FYRES program concluded that there is activity in the dune system at Kitchel-Lindquist-Hartger Dunes Preserve [2].

## Methods

| Study objectives | Measured variables | Methods | Comments |
|---|---|---|---|
| Measuring dune activity | -Sand movement<br>-Deposition and erosion<br><br>- Wind speed and directional movement | -Sand traps<br>-Erosion pins<br><br>-Wind analysis tower | -Traps placed on crest of dune.<br>-Sixteen pins placed within blowout, on crest, on slip face, and at the bottom of leeward slope.<br>-Wind tower located south of site at P.J. Hoffmaster. |
| Recording vegetation patterns | -Density, diversity, and max. height | -Random quadrat sampling | -In total, forty quadrat samples were collected. |
| Drawing connections between dune and vegetation | -Features of dune and location of instruments placed by research team (inclusive of quadrats) | -GPS mapping (Juno Trimble Device) | -Features of dune: vegetation communities, areas of deposition and deflation, and water. |

**Table 1:** The methods we used while carrying out our data collection.

**Figure 3**: An example of our quadrat sampling.

## Results

Various weather conditions (high wind speeds, snow, rain) occurred during the research period. Winds moved sand in different directions than suggested by the bare sand areas on the leeward slope of the dune (Figure 4). The area around Sand Trap 3 was the most active (Figures 4-6). Vegetation species and density varied by location, with higher densities occurring on the leeward slope (Figure 7).

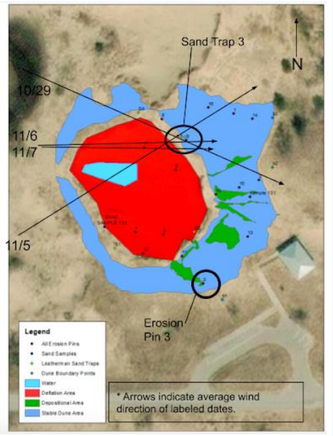


**Figure 4:** Wind direction over research period.

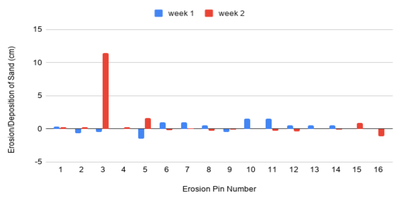


**Figure 5:** Change in erosion levels.

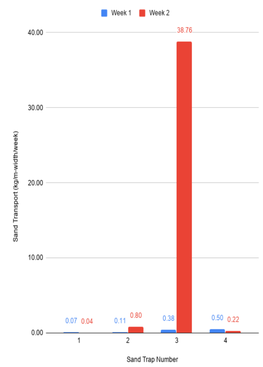


**Figure 6:** Sand transport rates.

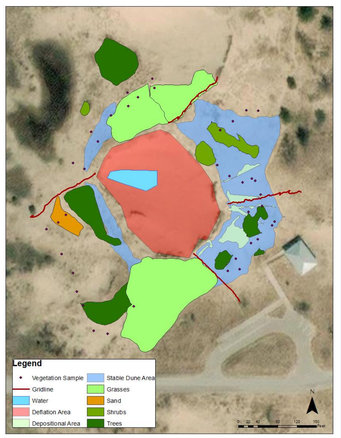


**Figure 7:** Vegetation communities and depositional features. Highest densities of vegetation occurred on the leeward slope and "grasses" area (see legend).

## Discussion

Our data revealed that minimal sand movement occurred over the course of the two weeks, apart from sand trap three, during the second week, which was discovered to be completely full of sand. This was clearly a result of strong aeolian movement in an estimated northeast direction between the dates of October 31 and November 7, which would suggest movement away from the outdoor education center.

We also investigated various vegetation communities and discovered segregation in which one of four dune segments was comprised solely of *Ammophila Breviligulata*. Jerry Olson discusses in his paper that "dune-building shrubs and grasses may be vigorous pioneers" [1]. From our results, we recognize a stability in this region, which further validates the importance of Olson's interpretation.

## Conclusions

Because of the deposition on southeastern slip-face, it can be concluded that there is sand movement in that direction. However, during our two weeks of data collection, erosion pin and Leatherman sand trap data show that there is sand movement in a northeasterly direction in correlation with the wind. After researching the vegetation at Kitchel-Lindquist-Hartger Dunes Preserve, we concluded that vegetation is essential in preventing sand movement.

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## Works Cited

[1] Olson, Jerry S. 1958, "Rates of Succession and Soil Changes on Southern Lake Michigan Sand Dunes." *Botanical Gazette* 119, no. 3: 125-70.

[2] Duimstra, Peter, Christopher H. Anderson, Katherine C. Benedict, Haleigh I. Bos, Kees VanDerAa, Lesley Vargas, and April Volzer. 2019. "Considering Management for a Blowout in Kitchel-Lindquist-Hartger Dunes Preserve." FYRES: Dunes Research Report #35. Grand Rapids: Department of Geology, Geography and Environmental Studies, Calvin College: 16 p.