Interactions Between Blowout Formation and Trails on the Dune Ridge

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Abstract

During the fall of 2011, a study was conducted to survey a portion of the dune ridge located in P.J. Hoffmaster State Park. The goal was to determine if blowout formation was in direct correlation to the orientation of trails upon the dune ridge. We surveyed an area measuring 1,253 meters. We took measurements of all blowouts and trails encountered while surveying along the dune ridge. We surveyed 32 blowouts and 32 trails. Results indicate that perpendicular trails cause both saucer blowouts and trough blowouts to form on dune ridges. The importance of this conclusion is that since people and animals cause trails to form and trails cause blowouts to form, when excessive amounts of life pass through a certain area ne ridges become unstable and prone to erosion. Therefore, to stall dune ridge destabilization, controlled access is a precautionary measure that may allow the dune ridge to stabilize itself again.

Van Dijk, Deanna. (2004). “Contemporary Geomorphic Processes and Change of Lake Michigan Coastal Dunes: An Example from Hoffmaster State Park, Michigan.” *Michigan Academician* 35: 425-453.

Introduction

In the past, it has been thought that wind traveling through areas of bare sand, because of human or other disturbances, cause blowout initiation and formation over time (Bate et al. 1996). This study examines the relationship between trails and blowout development of Michigan coastal dunes.

Bate, Guy, Ferguson, Michele. 1996. Blowouts in coastal foredunes. Landscape and Urban Planning 34; 215-224.

Figure 1:
This study focused on a portion of shoreline at P.J. Hoffmaster State Park. We were able to use GIS to map out the study area to visually display blowout and trail locations.

The blue lines represent the trails on the dune ridge, while the tan lobes demarcate identified blowouts.

Objectives

-Document the characteristics of trails and blowouts.
-Investigate the relationships between trails and blowouts.

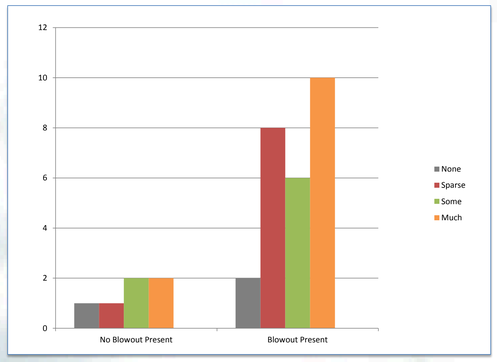

Figure 2:
This chart shows the different amounts of vegetation on paths in which blowouts are present and on paths in which there are no blowouts.

Methods

Materials Used:
- Measuring Tape
- Hand Levels
- Flagging Tape
- Stadia Rod
- Kestral Anemometer
- BFI (Blowout Features Inventory)
- Trimble GPS unit
- Ground Flags
- Suunto Compass

Figure 3: Group delegating methods

The purpose of this investigation was to study the relationship between trails and blowouts. This was accomplished by:
- Measured the width, height and length of each blowout from Dunes 7 to 3.5 using a measuring tape and stadia rod.
- Measured the average width of each trail using measuring tapes
- Determined the orientation of each blowout
- Determined the orientation of each trail
- Mapped the area of each trail and blowout using a Trimble GPS unit
- Documented the vegetation density on trails and blowouts
- Recorded wind speed using a Kestral anemometer
- Determined the classification of the blowout (either saucer or trough blowouts)

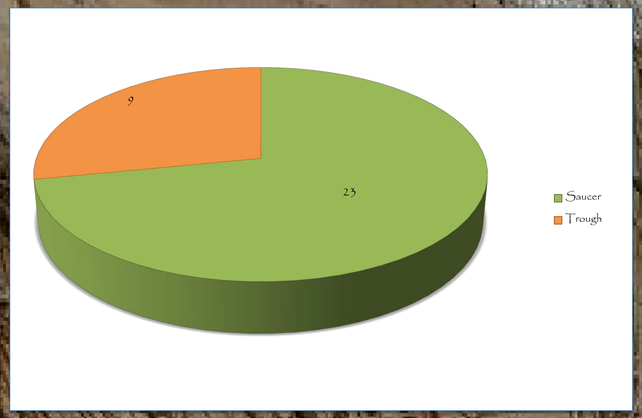

Figure 4:
This graph details the ratio between the number of saucer and trough blowouts in our site.

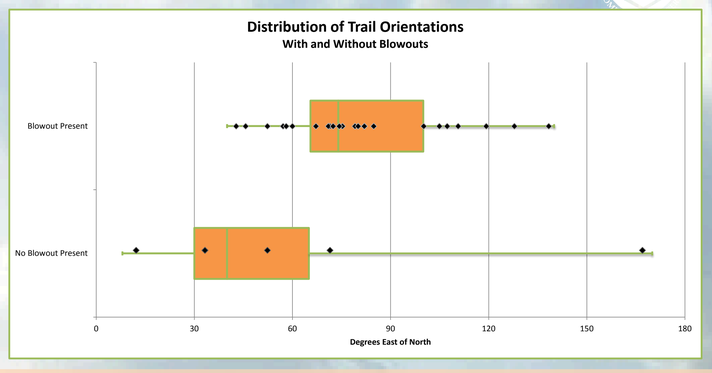

Figure 5:
This graph depicts the trail orientations overlaid by the data points of the orientations themselves The box plots show the minimum, lowest point of the middle fifty percent, median, highest point of the middle fifty percent, and the maximum. The data points overlaid on this graph give a better idea of the concentration of the data.

Results

- High density of blowouts occur when trails occur perpendicular to the shore
- 50% of the trails with blowouts had orientations of 67.5 NE° to 103.75° SE
- Bearing of lakeshore is 70° degrees NE
- Our data shows that blowouts with perpendicular trails are more likely to form at an orientation equal to the perpendicular angle
- This shows that trails perpendicular to the shoreline are more likely to have blowouts.

Hugenholtz, Chris H., Wolfe, Stephen A. (2008). “Form-flow interactions of an aeolian saucer blowout.” *Earth Surf. Process. Landforms* 34: 919-928.

Conclusion

Our results show that trails perpendicular to the shoreline have more blowouts than trails parallel to the shoreline. Most of the blowouts on the ridge connected to trails perpendicular to the shoreline are saucer blowouts, which reveals that trails play an important part in the formation of this type of blowout. This study was one of the first to analyze the relationship between trails and blowout development. This study will act as a reference for future studies as it provides valuable information that will help advise P.J. Hoffmaster State Park of areas where potential blowouts may occur.

Acknowledgements

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Bibliography

Van Dijk, Deanna. (2004). “Contemporary Geomorphic Processes and Change of Lake Michigan Coastal Dunes: An Example from Hoffmaster State Park, Michigan.” *Michigan Academician* 35: 425-453.

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