

Investigating a Boardwalk's Effects on a Lake Michigan Dune

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Abstract

Boardwalks are often used to prevent negative human impact in natural areas. However, the boardwalks themselves can also have an effect on the ecosystem. The "Dune Climb" stair portion of the boardwalk at P.J. Hoffmaster State Park has recently been rebuilt, offering the opportunity to study the effects of construction on the dune and provide data on the newly built section, as well as the current conditions of the old boardwalk. We measured health, height, and density of vegetation at various locations along the boardwalk. The boardwalk and unmanaged trails were mapped, and we interviewed the park naturalist to get more information on the boardwalk. Our results showed that while the boardwalk can have some negative impact, such as decreased vegetation growth and health next to the boardwalk and development of unmanaged trails, boardwalks are overall effective at their purpose in protecting vegetation and directing visitors to points of interest.

Introduction

On coastal dunes, high rates of trampling decrease species diversity and vegetation cover (Fig. 1) [1, 2]. Building boardwalks to minimize trampling on the dune surface, while allowing people to access points of interest on the dune, has proved to be an effective management technique [3, 4]. However, little research has been done to document the possible negative effects of boardwalks, including their construction, on surrounding vegetation.

Study Objectives:

- Map a boardwalk and its characteristics
- Measure vegetation characteristics
- Map any unmanaged trails near the boardwalk
- Determine the impact of the boardwalk on surrounding vegetation



Fig. 1 Unmanaged Trail Stemming from the Boardwalk

Study Area

Our research site is located at the boardwalk near the Visitor Center at P.J. Hoffmaster State Park in Muskegon, Michigan (Fig. 2). The boardwalk has undergone recent construction as the "Dune Climb" stair portion was rebuilt in 2015 (Fig. 3 and 4).



Fig. 3 Recently-Constructed Stairs



Fig. 4 Older Section of Boardwalk

Methods

Boardwalk Characteristics: The entire boardwalk was mapped using a Trimble Juno GPS. Additionally, unusual characteristics of the boardwalk, such as unmanaged trails stemming off it, boards left over from construction, and other evidence of human impacts were documented.

Vegetation Characteristics: Transect lines and quadrats placed perpendicular to the boardwalk were used to gather vegetation data at intervals of 0m, 1m, and 5m along the transect lines. Examples of data collected at quadrat locations includes:

- health
- height
- percentage of plant cover
- sand samples

Park Staff Interview: On November 10, 2016, we interviewed a park naturalist regarding her personal observations on characteristics related to the boardwalk, including observations on the effects of the construction on the boardwalk and the development of unmanaged trails.

Discussion

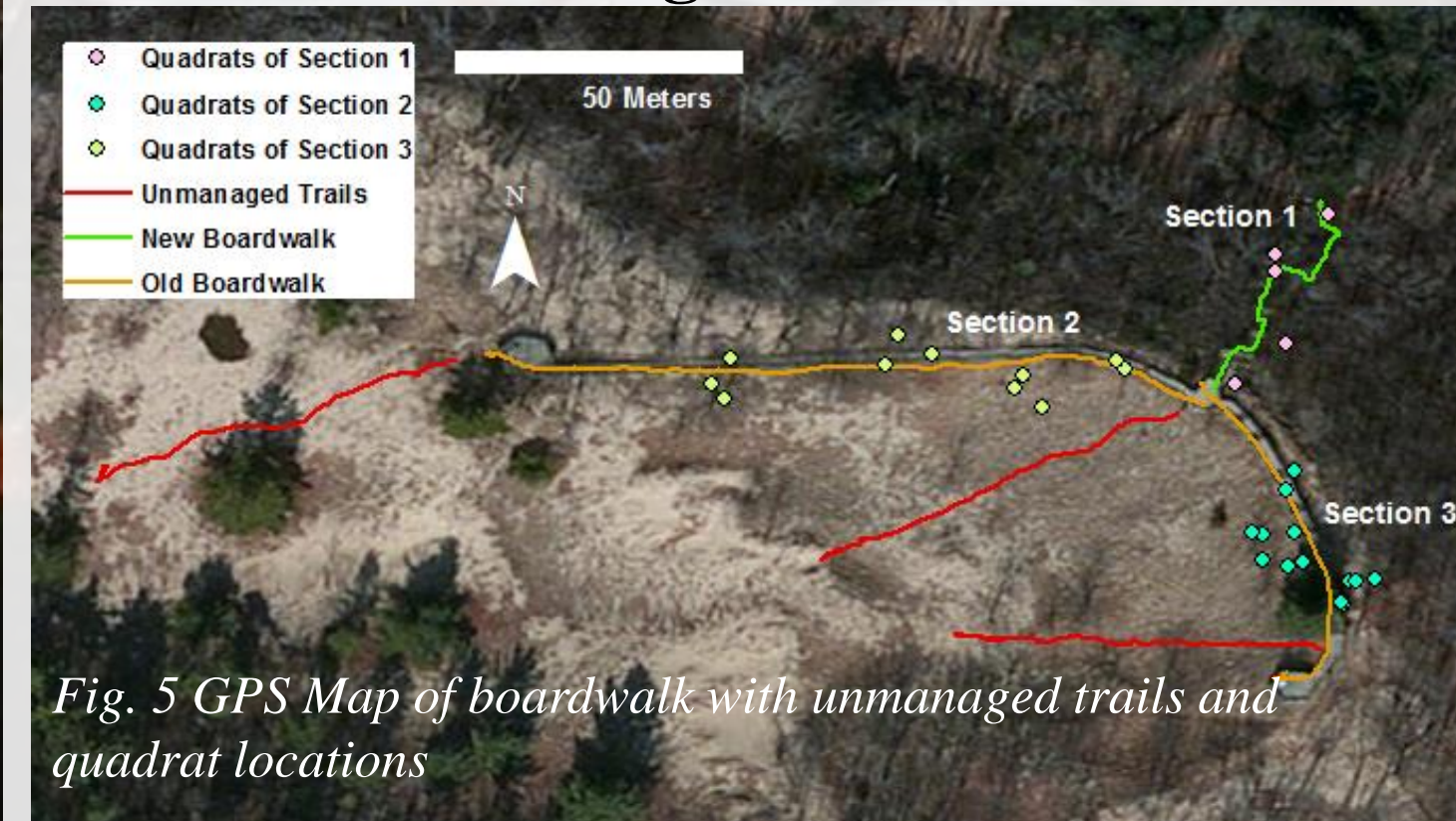
These results demonstrate that there is a decrease in the overall abundance of vegetation near or directly under the boardwalk. This suggests that the construction of the boardwalk and several unmanaged trails stemming off of the boardwalk have had some negative effect on the amount and health of the surrounding vegetation. One possible solution to decrease the boardwalk's effect on vegetation would be to add spaces in between the boards of the boardwalk to allow light and water to reach vegetation under the boardwalk. Educational signs discussing how human traffic affects dune health also may help reduce unmanaged trails and other negative impacts such as litter.

Conclusion

Our research shows that boardwalks have minimal negative impacts. Vegetation growth and cover underneath and next to the boardwalk is less than vegetation growth and cover further away. Additionally, the boardwalk can provide an origin point for unmanaged trails, however, the effect on vegetation would be greater if the boardwalk was not present. Overall the boardwalk is an effective management tool for protecting vegetation and encouraging visitor enjoyment of the park.

Results

Boardwalk and Vegetation Characteristics:



-Plant cover was mostly *Ammophila breviligulata* in Section 2 and forest in Section 3 (Fig. 7). Section 2 of the boardwalk is raised, allowing for sand movement which encourages growth of *A. brev.* Vegetation did not grow under the boardwalk (0m) but grew plentifully 1m away. The boardwalk perhaps provides shelter from the elements, explaining large growth 1m away, but less growth 5m away. Section 3 is forested; low vegetation levels are a result of leaf litter that covers the ground during autumn when the research was done. Additionally, Section 3 is closer to the ground, not allowing as much vegetation growth next to or under the boardwalk, thus, vegetation thrives further away from Section 3.

Park Naturalist Observations: Our interview with the park naturalist revealed that during the construction, the crew was not careful and trampled much of the vegetation. They left many unused wood boards on the dune next to the boardwalk, which could be contributing to the loss of vegetation. She also discussed how several unmanaged trails were formed, mainly from dogs off their leashes and hiking groups.

-Fig. 5 shows the boardwalk at Hoffmaster State Park. Built on a parabolic dune, the boardwalk includes a recently rebuilt stair section and two older sections that span along the arms of the dune. The map shows locations where unmanaged trails have formed due to people leaving the boardwalk to explore the dune.

-Fig. 6 shows the height of vegetation for Section 3 on the boardwalk at quadrats 0, 1, and 5 meters from the boardwalk. Vegetation height generally increased with distance from the boardwalk.

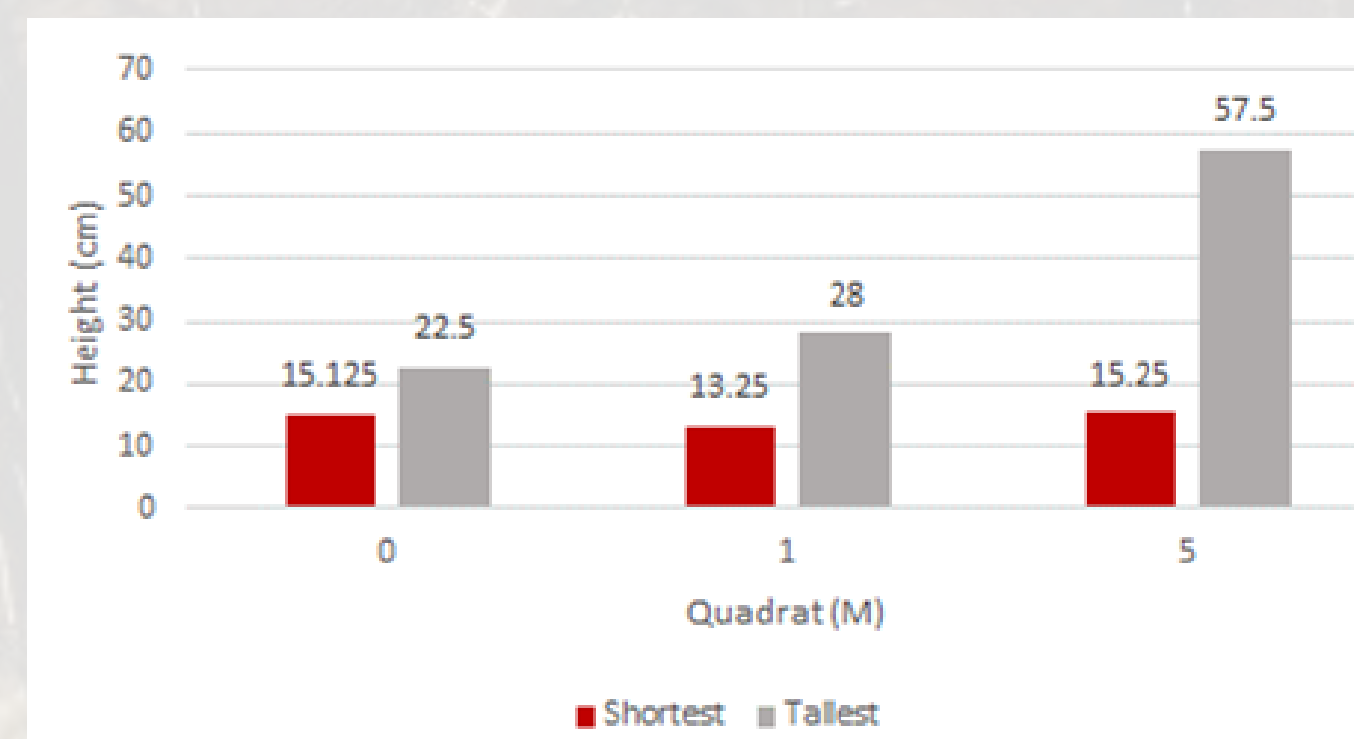


Fig. 6 Vegetation Height

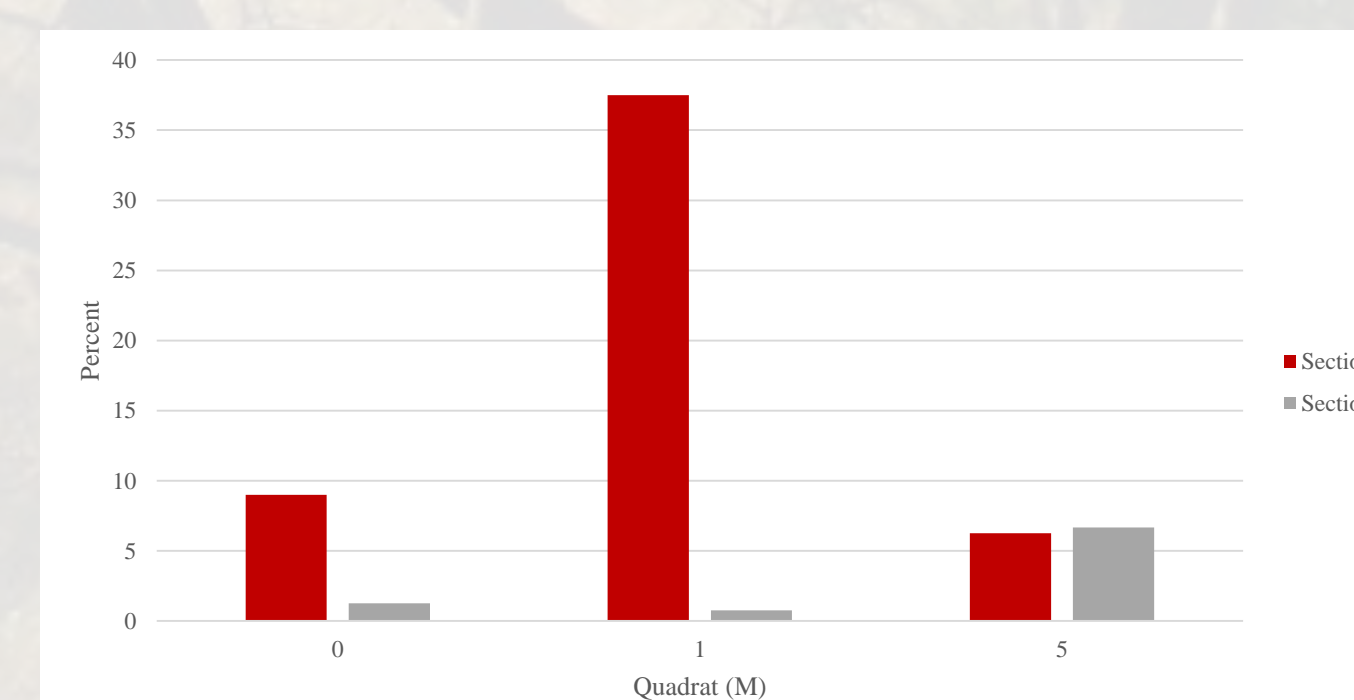


Fig. 7 Percent Cover

Acknowledgments and References

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References:

- [1] Purvis, Kelly G., Gramling, J., and Murren, C. 2015. "Assessment of Beach Access Paths on Dune Vegetation: Diversity, Abundance, and Cover." *Journal of Coastal Research* 31, no. 5: 1222-28.
- [2] Santoro, R., Jucker, T., Prisco, I., Carboni, M., Battisti, C., and Acosta, A. 2012. "Effects of Trampling Limitation on Coastal Dune Plant Communities." *Environmental Management* 49: 534-542.
- [3] Carlson, Lars H., and Godfrey, P. 1989. "Human Impact Management in a Coastal Recreation and Natural Area." *Biological Conservation* 49: 141-156.
- [4] Randall, M., and Newsome, D. 2008. "Assessment, evaluation and a comparison of planned and unplanned walk trails in coastal south-western Australia." *Conservation Science Western Australia* 7(1): 19-34.