

Human Impacts on West Michigan Beach-Dune Systems

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Abstract

The effects of humans upon dunes has long been an issue. For our study, we wanted to find out how humans have affected three specific locations: a popular swimming beach, a trail entrance to a beach, and a popular coastal park. We began by taking survey lines on each dune in both a heavily human-impacted area, and a low or medium impacted area, then compared the results. We also used quadrats in each area to measure the effects of human trampling on vegetation. We used GPS to map each point we measured, as well as any notable features of the dune which might affect our results. We found out that humans caused a drastic increase in dune erosion, and a significant decrease in vegetation height and ground cover.

Introduction

Humans impact sand dunes in countless ways [1, 2]. Realizing our harmful effects on the environment is crucial if we want to fix the problems of vegetation loss, wildlife extinction, and climate change. For our study, our goal was to find out what impacts humans have on coastal dunes in Michigan.

Objectives

- Measure and compare the characteristics of human-impacted beach-dune locations with nearby less-visited locations
- Measure human effects on vegetation patterns
- GPS map the topography of our sites and anything else of note that we found, such as human litter.

Study Area

We studied at Hoffmaster State Park and North Beach Park (Ottawa County). We specifically researched at Dunes 4 (trail entrance) and 6 and 7 (swimming beach) at Hoffmaster and the beach and foredune areas of North Beach Park (Figure 1).

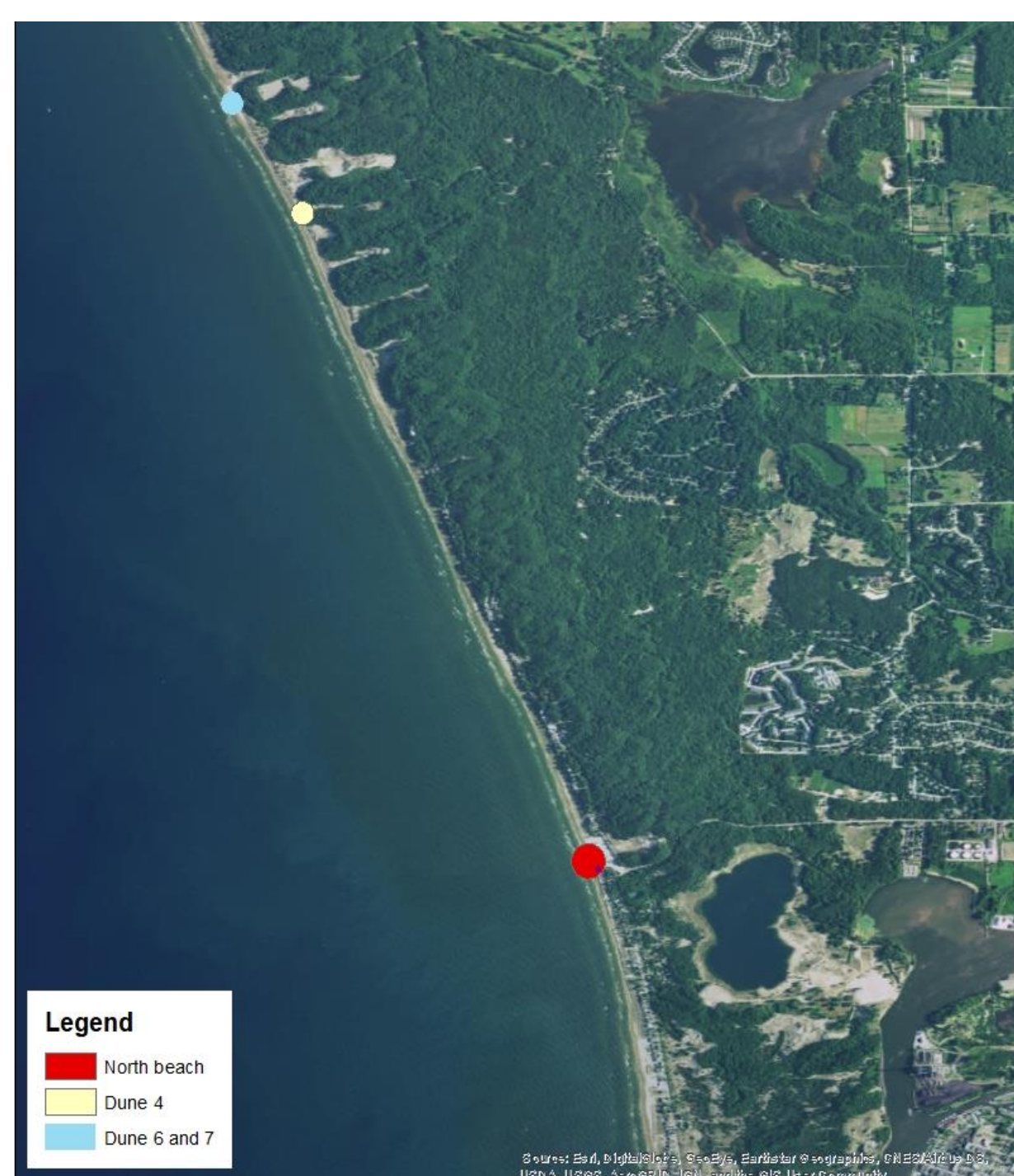


Figure 1. Study sites on the Lake Michigan coast in Ottawa County.

Methods

At each site, we set up transects in the heavily-impacted area and a less-impacted area nearby (Figure 2). For each transect we measured

- A straight-line survey of the topography using stadia rod and hand level
 - We used surveys to compare erosion caused by humans)
- The transect location with GPS.
- Vegetation characteristics at 3 locations along the transect.
 - We picked the locations by throwing a quadrat.
 - For each quadrat, we measured the vegetation density, number of species and vegetation height. We recorded the location of each quadrat with the GPS.

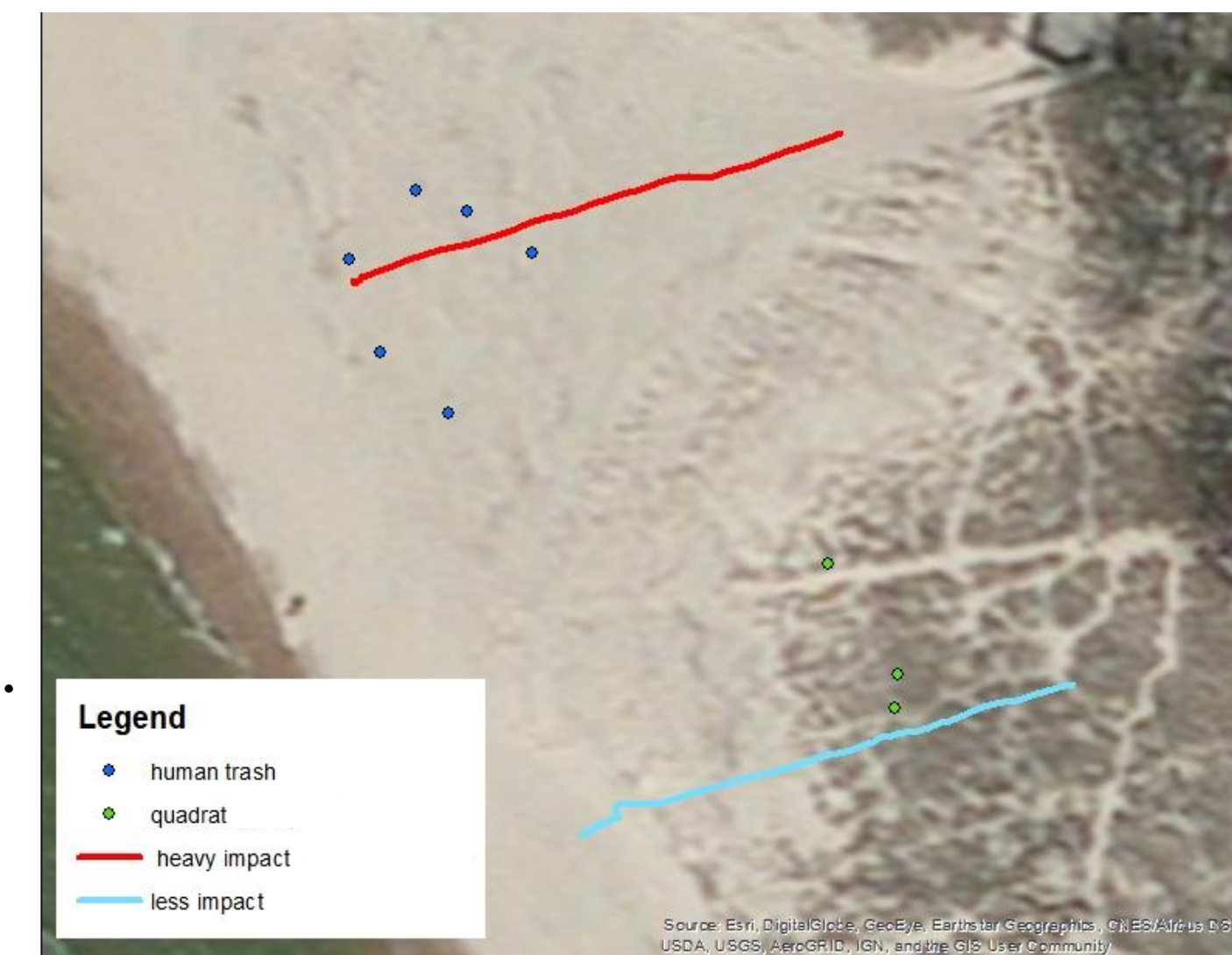


Figure 2. Locations of comparison transects and vegetation quadrats are shown for one of the study sites.

We also recorded human impacts with GPS: litter, structures, parking lots, unmanaged trails, etc.

Results

The vegetation height differs drastically between the various levels of human impacts (Figure 3). In fact, the high impact area contains no vegetation at all.

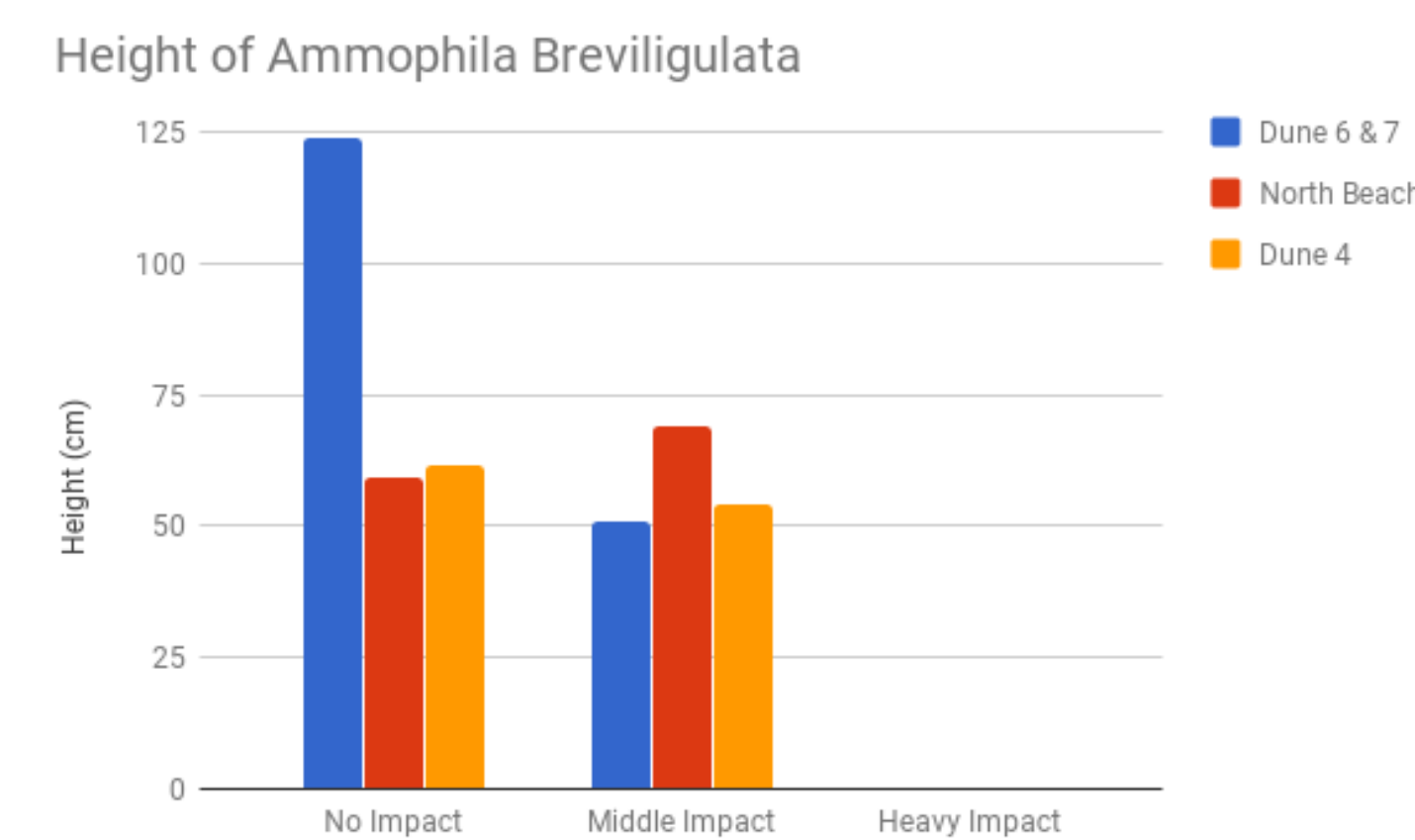


Figure 3. Beach grass vegetation height measured in study areas.

The vegetation densities varied greatly between each of the three study areas: extremely low density in the heavily impacted area, moderate density in the moderately impacted area, and very high density in the low impact area (Figure 4.)

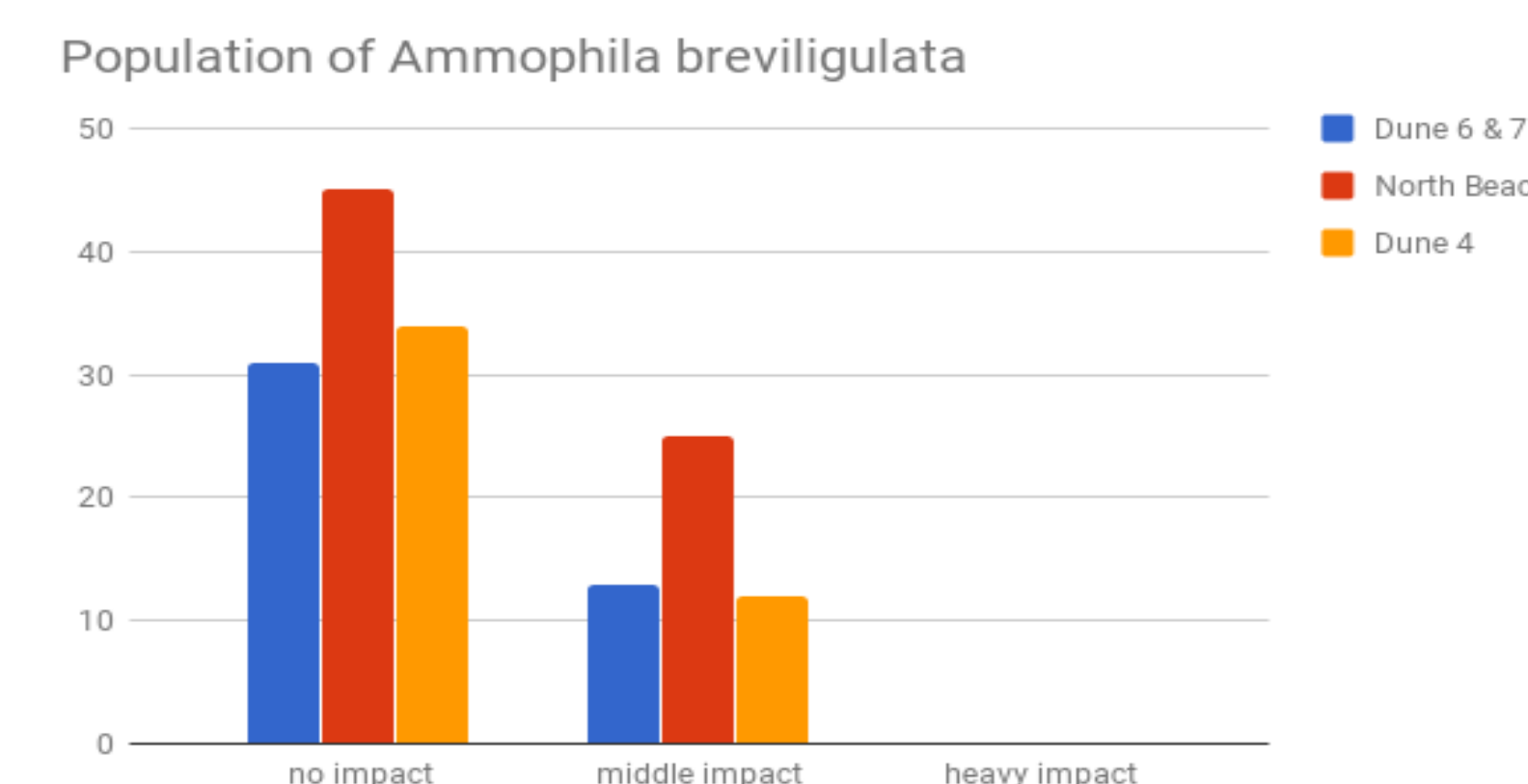


Figure 4. Beach grass density which was the number of stocks counted per square meter.

Our survey lines showed that the change in elevation (slope) was more gradual in areas with more human impacts compared to areas with less human impacts (Figures 5 and 6).

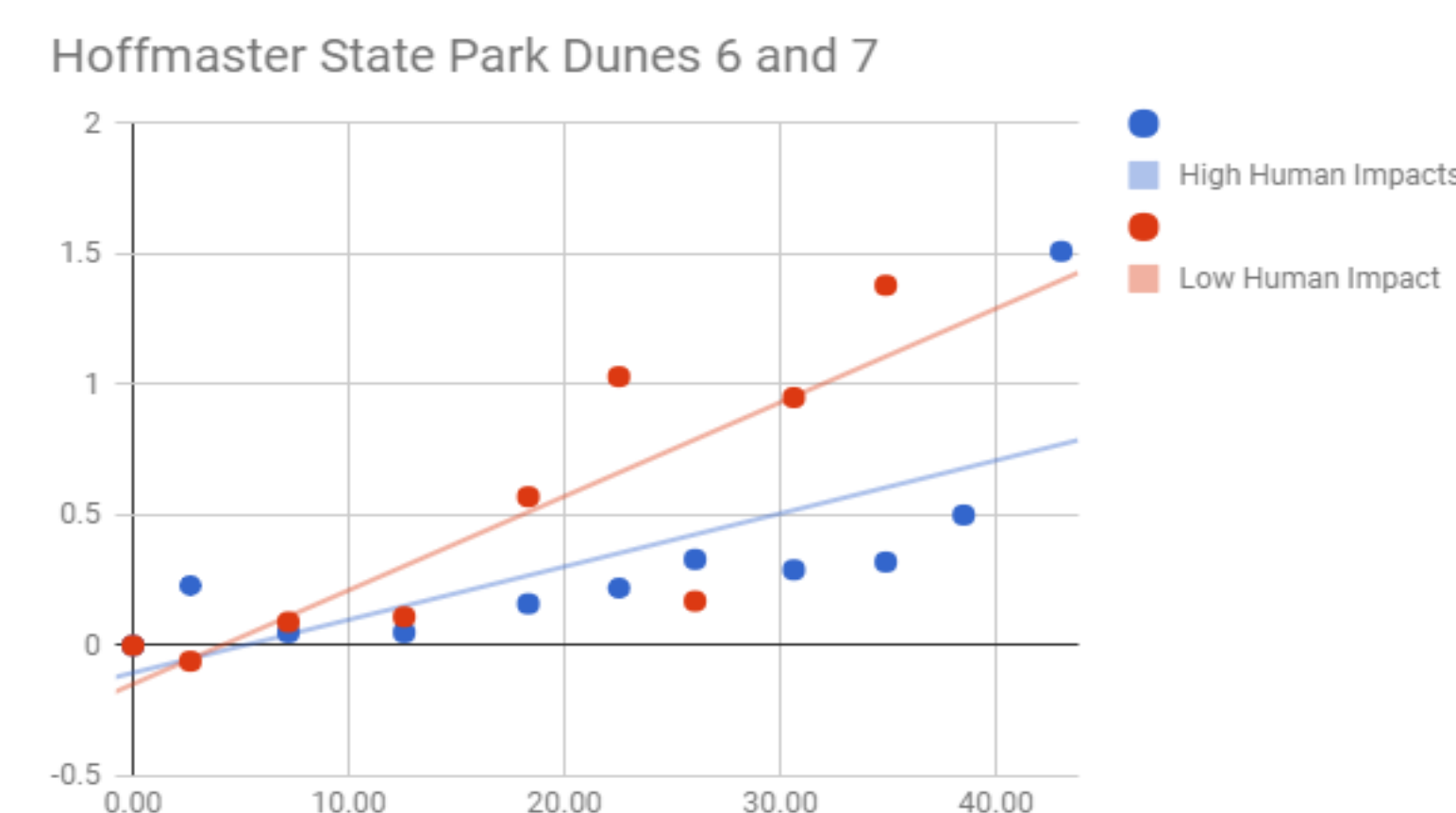


Figure 5. Changes in elevation and distances between survey points at the swimming beach in Hoffmaster State Park.

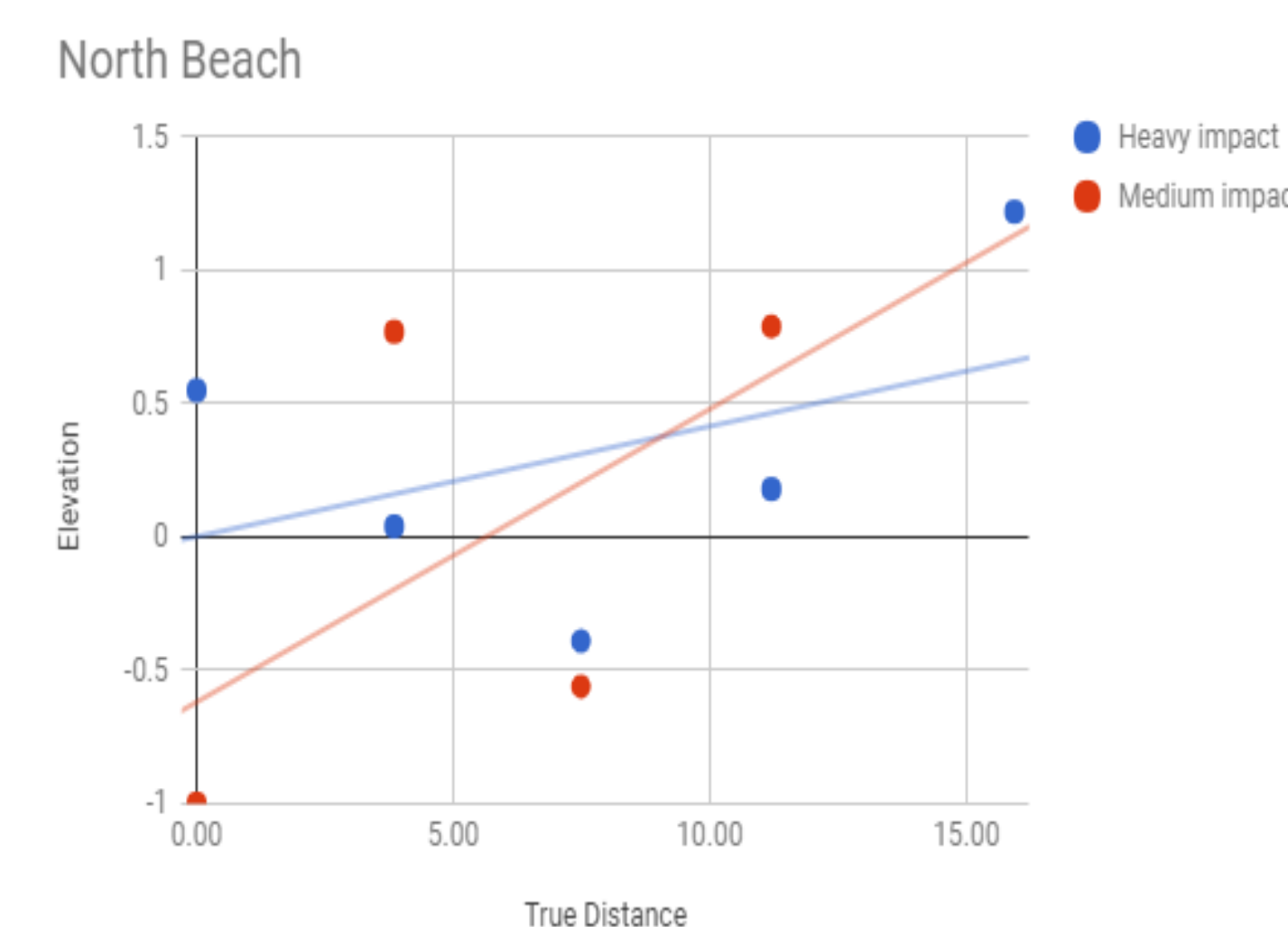


Figure 6. Changes in elevation and distances between survey points at a popular coastal park.

Discussion

Humans have had a very heavy impact on dune and beach systems of our study sites. Litter, which affects all general health areas of the dune system, was all over our study areas.

Trampling has created unmanaged trails in the vegetation which leads to damaged and sparse vegetation areas which do not grow back quickly. When vegetation gets destroyed, erosion on the beaches happens much faster because there are no roots to hold sand down.

In the heavily impacted area, the foredune was much more eroded than the non-impacted area. The health of these natural areas is in danger because of people's unawareness in their activities on dunes. Also roads, pollution and litter, beach 'cleaning', off-roading, and other activities add to the disturbances [1].

Conclusions

The density of the vegetation was greatly affected by trampling. There was much less vegetation in areas where people have made many passes over time which creates trails and eroded dunes.

Sediment erosion is heavily impacted by humans. When people trample vegetation, sediments are easily moved by outside conditions. Our group took survey points to compare heavily and little impacted areas.

Acknowledgments

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References

- [1] Davenport, John, and Julia L. Davenport. 2006. "The impact of tourism and personal leisure transport on coastal environments: A review." *Estuarine, Coastal and Shelf Science* 67(1-2): 280-292.
- [2] Defeo, Omar, Anton McLachlan, David S. Schoeman, Thomas A. Schlacher, Jenifer Dugan, Alan Jones, Mariano Lastra, Felicita Scapini. 2009. "Threats to sandy ecosystems: A review." *Estuarine, Coastal and Shelf Science* 81 (1):1-12.