

# Trees Affected by Pathogens on Coastal Dunes in PJ Hoffmaster State Park

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## Abstract

Invasive pathogens located throughout the United States, and more regionally, within the Midwest threaten both hardwood and softwood forests. In Michigan, these pathogens have been identified as threats to the trees in PJ Hoffmaster State Park. The current study focuses on three parabolic dune systems in the park. The collection of field data included tree girth, visual pathogenic impact, root observation, and tree height. Data collected from the field was recorded concurrent with GPS positional data. Initial observations have shown that a high percentage of red oak and sugar maple are present within the study area but do not exhibit visible signs of infection or infestation. Through collection of data we concluded that there was minimal pathogenic effect happening on the dunes. However this may be due to the data being recorded in the fall when conditions are not optimal for detecting pathogens.

## Introduction

Research into pathogens such as disease and insects that affect the Midwestern United States is necessary [1] because they have the ability to cause damage that may take decades and hundreds of thousands of dollars to repair [2]. Our study focuses on the impacts these pathogens are having on the dunes of southwest Mi, specifically in PJ Hoffmaster State Park, in an attempt to aid the preventative measures being taken to avoid destruction of coastal ecosystems.

## Study Area

This study took place at PJ Hoffmaster State Park in Muskegon Michigan (Figure 1). It was focused on Dune 1, Dune 2, and Dune 3, which are located along the lakeshore in the south end of the park.

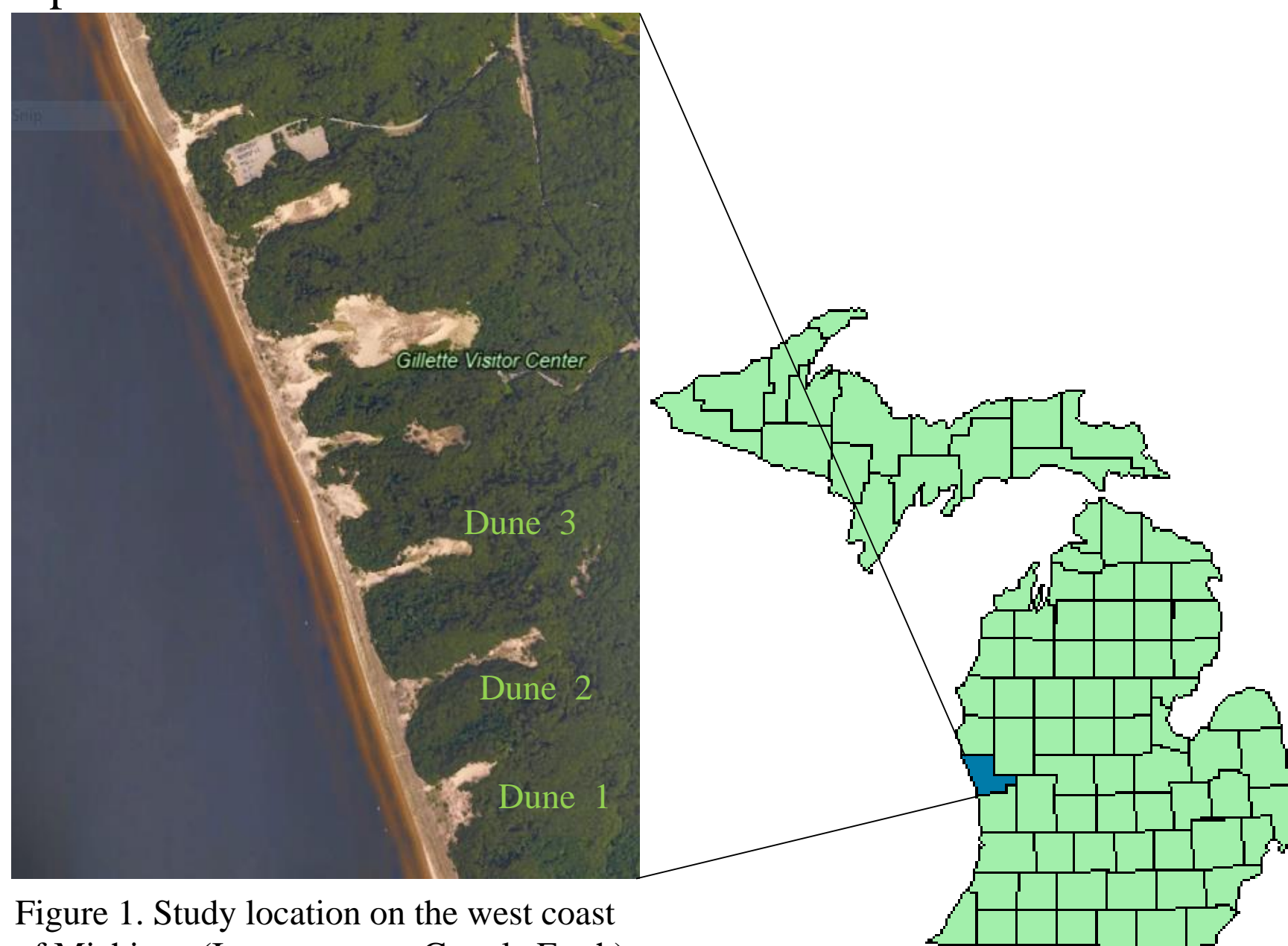


Figure 1. Study location on the west coast of Michigan (Image source: Google Earth).

[http://www.michigan.gov/images/mdu/MDOT\\_PTD\\_providers\\_Muskegon\\_186694\\_7.gif](http://www.michigan.gov/images/mdu/MDOT_PTD_providers_Muskegon_186694_7.gif)

## Objectives

The objective of this study is to identify trees with pathogenic infections in Hoffmaster State park. This study will show what species have been affected by pathogens in the past, what species are currently under attack, and what species are vulnerable in the near future.

## Methods

Methods utilized to collect data for this study were transect lines and mega quadrats. Transects consisted of walking a 25m line and taking measurements of four trees using the point-quarter method (Figure 2). The four trees were categorized by species, measured for height and girth, and examined for pathogens.

The mega quadrats consisted of a 10x10m square placed randomly in the center section of the dunes. The trees inside the square were also identified, measured for height and girth, and examined for pathogens (Figure 3). Pathogen examinations consisted of close observations of tree trunks and canopies. Any notable damage was recorded for study.

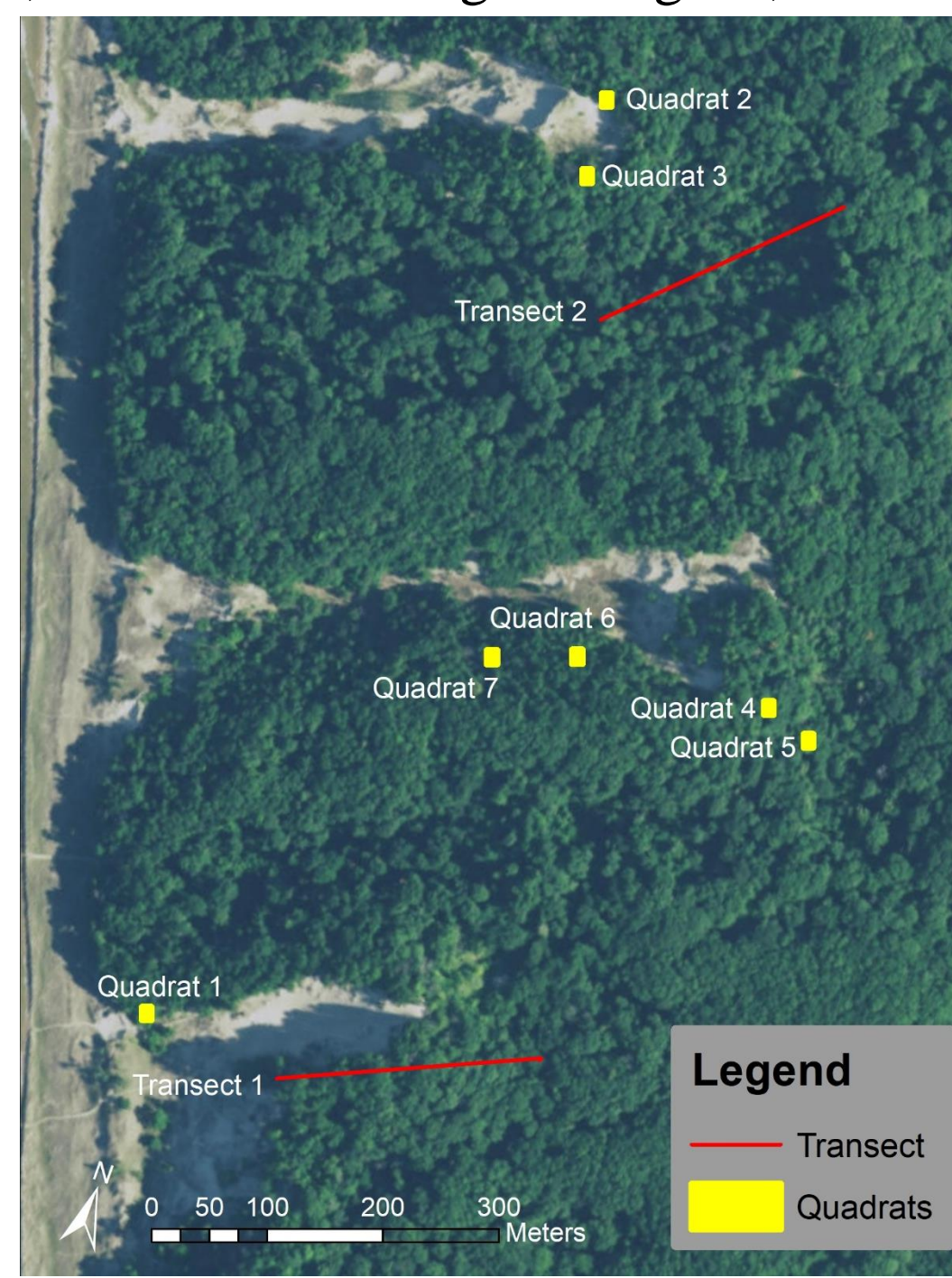


Figure 2. Map of the studies that were performed over 2 weeks.

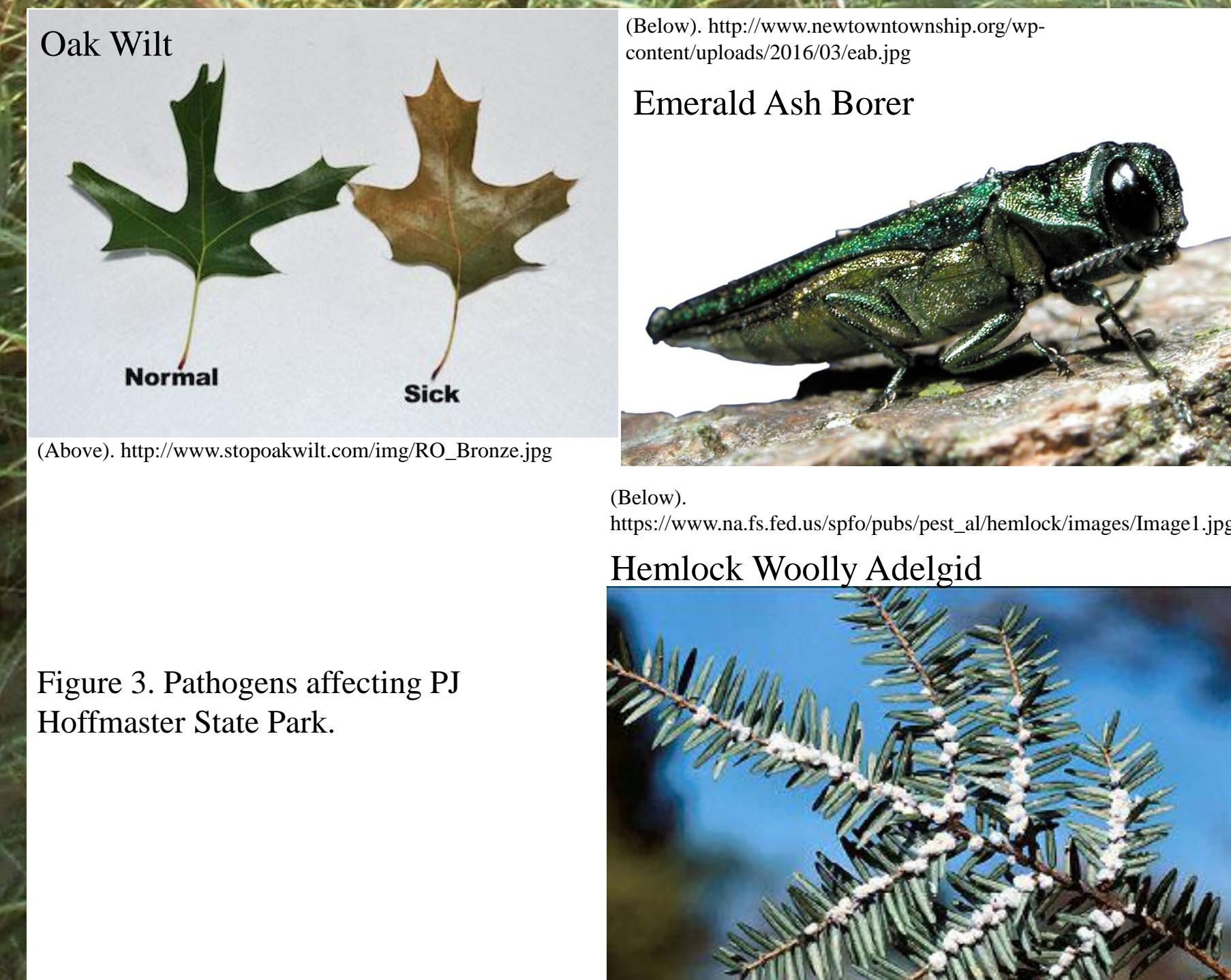


Figure 3. Pathogens affecting PJ Hoffmaster State Park.

## Results

Across all of our study areas in PJ Hoffmaster, the density (Figure 5) remained consistent and the variety of species (Figure 6) suggested a relatively healthy forest ecosystem. There were some notable trees, like Ash, missing from our observable data, but the species like Red Oak, Sugar Maple, and American Beech were dominating as would be expected.

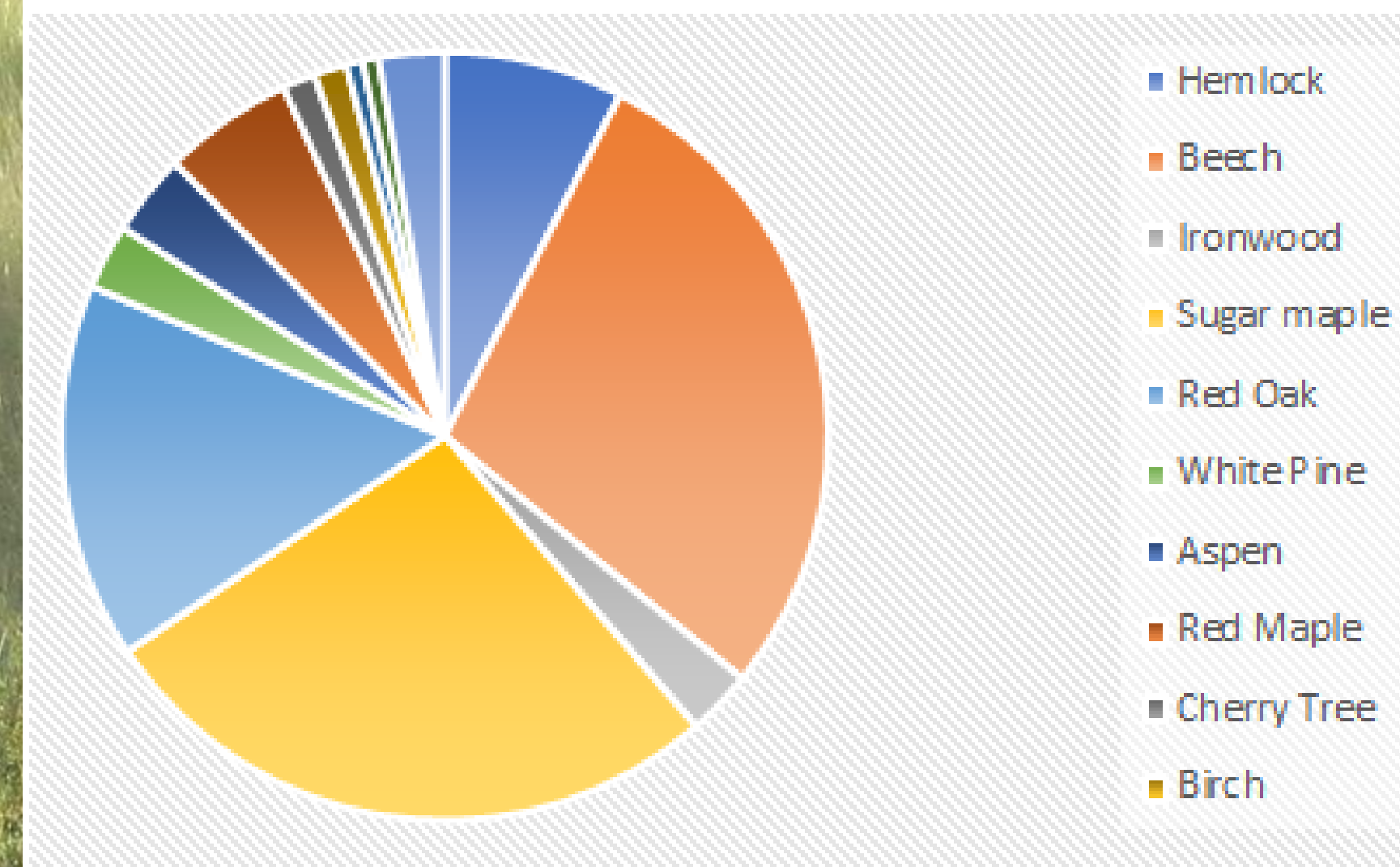


Figure 5. Total tree species encountered across all study areas.

In Table 1, it can be observed that there were no visible pathogens affecting any species found our study areas. This lack of observation could have been caused by a few things mentioned in the discussion.

Table 1. Visible pathogens in all study areas.

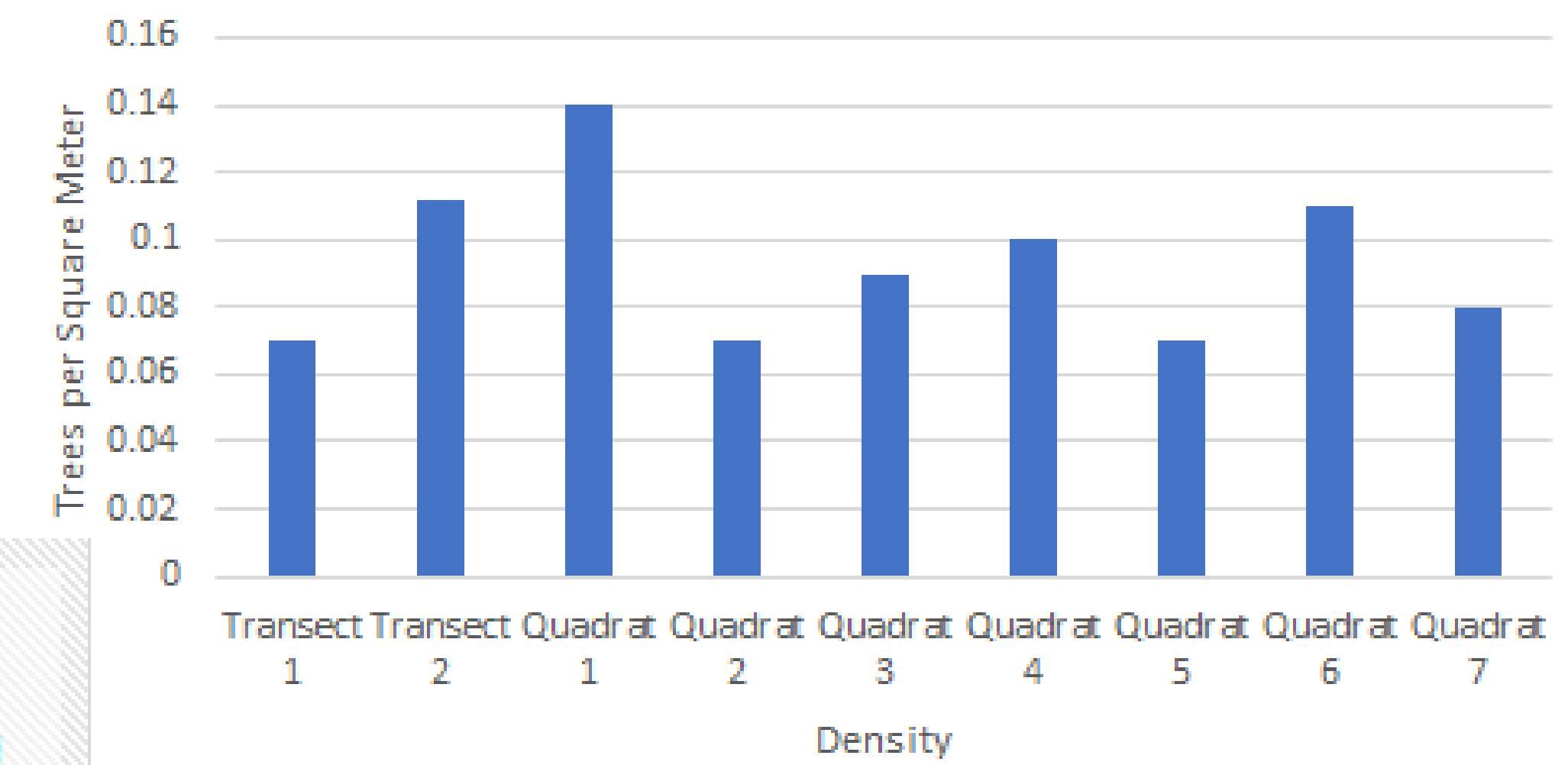


Figure 4. Density by location.

Species Observed	Possible Pathogen	Examples Observed
Hemlock	Hemlock Woolly Adelgid	0
Beech	Beech Bark Disease	0
Ironwood	Gall Wasps	0
Sugar Maple	Asian Longhorned Beetle	0
Red Oak	Oak Wilt	0
White Pine	White Pine Weevil	0
Aspen	Aspen Bark Beetles	0
Red Maple	Asian Longhorned Beetle	0
Cherry	Black Knot	0
Birch	Bronze Birch Borer	0
Basswood	Forest Tent Caterpillar	0
White Oak	Oak Wilt	0
White Cedar	Keithia Blight	0

## Discussion

Lack of observable pathogens suggests that either the diseases and insects have not yet reached the trees near the lakeshore or the pathogens were simply too hard to observe during the fall season. Studying the same areas in the summer or spring would make it easier to tell if a tree was dying or wilting out of season.

The large amount of American Beech, Red Oak (Figure 6), and Sugar Maple, could mean that pathogens who prefer these trees would be especially harmful if they were to spread to the study areas. The absence of certain species, like the Ash, could be a sign that a pathogen like the Emerald Ash Borer [3] has already moved through the area.

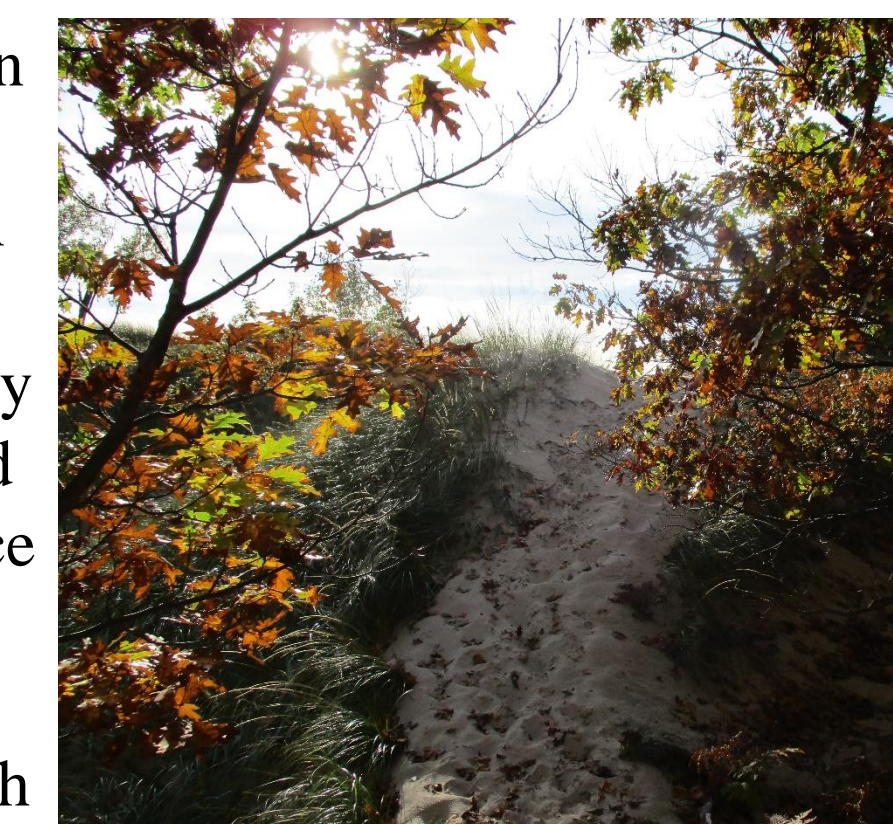


Figure 6. Healthy Red Oak trees near the lakeshore.

## Conclusions

The trees in our study areas on Dune 1, Dune 2, and Dune 3 showed minimal pathogenic pressure. However, this study was conducted in the fall, a time when many pathogenic effects are not easily observed.

## Acknowledgments

We would like to thank the Michigan Department of Natural Resources and PJ Hoffmaster State Park for granting us permission to conduct research in this area, Rileigh Haan for her work during the planning stages of our project, Professor Deanna Van Dijk and Matt Wierenga for their knowledge and assistance in our study, and Calvin College GEO department as well as the Michigan Space Grant Consortium for their funding.

### References:

- [1] Moser, W., E. Barnard, R. Billings, S. Crocker, M. Dix, A. Gray, G. Ice, M. Kim, R. Reid, S. Rodman, and W. McWilliams. 2009. "Impacts of nonnative invasive species on US forests and recommendations for policy and management." *Journal of Forestry*: 320-27.
- [2] Poland, T., and D. McCullough. 2006. "Emerald Ash Borer: Invasion of the urban forest and the threat to North America's ash resource." *Journal of Forestry*: 118-24.
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