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Surveying Eastern Hemlocks in the Northwestern Portion of Port Sheldon Natural Area for Hemlock Woolly Adelgid

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Frederik Meijer Honors College Senior Project:
Surveying Eastern Hemlocks in the Northwestern Portion of
Port Sheldon Natural Area for Hemlock Woolly Adelgid
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Author Note

I would like to thank Dr. Ali Locher with Grand Valley State University for advising me on this project, Nealy Molhoek with Ottawa County Parks and Recreation for providing me with the necessary equipment and training for surveying, and Taylor Bartz who provided me with technical assistance during the surveying portion of this project.

Questions about this project can be sent to garbarim@mail.gvsu.edu.

Introduction

Eastern hemlock (*Tsuga canadensis*) is a long-lived, shade-tolerant tree, and is the only hemlock species native to Michigan (Tekiela, 2002). Currently, Michigan's estimated 170 million hemlocks are being threatened by the invasive hemlock woolly adelgid (*Adelges tsugae*, HWA) (West Michigan Hemlock Woolly Adelgid Task Force, n.d.). HWA is a small insect native to Asia that feeds on the starches of hemlock trees and can potentially kill them (USDA Forest Service, 2010). HWA is slow to spread and is treatable with pesticides; therefore, it is important to survey for HWA in Michigan as the population is currently concentrated in the western portion of the lower peninsula (West Michigan Hemlock Woolly Adelgid Task Force, n.d.).

The consequences of infestation by HWA can be severe. In the Eastern United States, specifically in the southern Appalachian Mountains, the mid-Atlantic region, and southern New England, there has been severe mortality of Eastern hemlocks (Ellison, Orwig, Fitzpatrick, & Preisser, 2018). The elimination of Eastern hemlocks in Eastern United States has caused significant changes in forest cover and composition (Ellison et al., 2018). The loss of hemlocks in Michigan would cause similar changes, which could have far reaching ecological effects. Eastern hemlocks are an important component of eastern North American forests, and their deep crowns and the cool understory conditions they create provide habitat for over 120 vertebrate species and 300 species of arthropods (Ellison et al., 2018). The loss of hemlocks could also have negative economic effects on the value of residential properties that contain, or are adjacent to, declining hemlock stands (Holmes, Murphy, & Bell, 2006).

The goal of this project was to answer the following question: Are the Eastern hemlocks in the northwestern portion of Port Sheldon Natural Area (PSNA) infected with the hemlock woolly adelgid? The results of this project will help to determine the extent of HWA in West Michigan, and could help with future management of the hemlocks in PSNA in relation to HWA.

Methodology

Site Description

Port Sheldon Natural Area is owned by Ottawa County Parks and Recreation and is located in West Olive, Michigan. The natural area is made up of 440 acres of forest along Ten

Hagen Creek (Ottawa County Parks and Recreation, n.d.). The park is divided into 2 sections by 160th Avenue, the western section was the focus of this project. This western section of the park is accessible via the south entrance, which is located at 5925 160th Avenue West Olive, Michigan. The park has a small trail system and allows off-trail hiking, cross-country skiing, and archery deer hunting in-season (Ottawa County Parks and Recreation, n.d.).

Survey Methodology

We performed a 100 percent tally of the northwestern portion of PSNA for HWA. A 100 percent tally is when every member of the population is visited and measured (USDA Forest Service, 2000). For each hemlock, we recorded the diameter at breast height (DBH) and checked for the presence of HWA. If HWA is detected in PSNA in the future, the recorded DBHs of the trees could be used to calculate the amount of pesticide needed for treatment, as more pesticide is needed for larger trees. The original intent of this project was to survey the entirety of PSNA, but this was not feasible due to the large number of hemlock trees present and the tedious nature of the 100 percent tally. However, the 100 percent tally was necessary to ensure that none of the trees in the northwestern portion were infected. If some of the trees were infected and went unchecked, the affected trees would continue to decline and the infestation could spread to other areas.

During the summer, the woolly adelgid goes dormant and produces a waxy, white covering to protect itself from warm temperatures and predators (USDA Forest Service, 2010). These white coverings are visible on the undersides of hemlock branches near the base of the tree and indicate an infestation. Surveying for HWA involves looking for these coverings, as the insects themselves are too small to see without magnification.

The natural resources management agencies in West Michigan (e.g., Ottawa County Parks and Recreation and Ottawa Conservation District) have tried to achieve consistency between organizations by using the same HWA survey method. The protocol is as follows:

- Check the underside of a branch in the lower canopy for evidence of the HWA.
- Check a branch as close to the opposite of that one as possible.
- Used extendable clippers to cut a branch from the upper canopy.
- Do the same to a branch as close to the opposite of that one as possible.
- If a branch is out of reach, use binoculars to check the upper canopy.

(N. Molhoek, personal communication, April 29, 2019).

Additionally, we recorded the DBH of each hemlock tree. For trees with a DBH smaller than 7 inches, we measured the diameter using calipers, For trees larger than 7 inches, we used a DBH tape. Hemlock seedlings, those with a diameter less than 1 inch, were marked with a plastic ID tag. All other hemlock trees were marked with a metal ID tag nailed into the base of the tree, so that if the tree needed to be cut down the tag will remain in the stump. Metal tags were nailed into the north side of the tree. For this project, the sequence of tags began at 501 and increased from there. The metal ID tags and the plastic ID tags each had a separate numbered order, starting at 501. Each tree was given a unique identification number. For example, PSMG501, which indicates Port Sheldon, Murielle Garbarino, Tree 501. Seedlings were designated with an “S” preceding the ID number (e.g., S501).

We also recorded the locations of the Eastern hemlocks we surveyed. Recreational GPS receivers are only accurate to about 10 feet and marking each hemlock tree would not be helpful (N. Molhoek, personal communication, April 29, 2019). Therefore, we recorded the location of each clump of hemlocks. We divided the hemlocks into clumps based on proximity. Specifically, if the branches of the trees were within roughly 10 feet of each other they were considered to be in the same clump. We recorded the location of each clump at the first tree tree we surveyed using a GPS receiver.

PSNA is surrounded by private property and partway through the surveying we were informed about Invasive Species Editor, a GIS application that Ottawa County uses to record the locations of invasive species. The application displays the user’s location as well as property boundaries. We used the Invasive Species Editor phone application to determine our location in relation to the boundaries of PSNA. However, we did not use this application throughout the entire survey process. Additionally, we experienced some difficulties with the accuracy of the application. Some of the points representing our location that the application displayed were clearly wrong based on our visual surroundings. The application would also produce different points when refreshed, even when we had not moved locations.

Data Analysis

The data we collected were entered into a spreadsheet. I created a diameter distribution of hemlock trees using Excel. I used ArcMap 10.4.1 to create a map of PSNA showing the locations

of Eastern hemlocks. I acquired a shapefile of the extent of PSNA from the Ottawa County GIS Department. I used the point data we collected using a GPS receiver to create points representing clumps of hemlocks.

Results and Discussion

We surveyed 393 trees and 492 seedlings, which adds to a total of 885 Eastern hemlocks. The Eastern hemlock trees in the northwestern portion of PSNA had an uneven-aged distribution, and the majority of the trees had a DBH of 3 inches or less (Figure 1). The 885 hemlocks were distributed among 140 clumps in the northwestern portion of PSNA (Figure 2). We did not find any evidence of HWA on any of the hemlock trees that we surveyed. One of the clumps was approximately 327 feet away from the property line of PSNA. This inaccuracy could have been due to unclear signage, inaccuracies with the handheld GPS, inaccuracies with Invasive Species Editor application, or a combination of all factors.

The data recorded during this project provides additional information about the current extent of HWA in West Michigan. HWA has been found in the Michigan counties of Oceana, Muskegon, Ottawa, and Allegan (West Michigan Hemlock Woolly Adelgid Task Force, n.d.). The infestations are concentrated in the western portions of these counties. The eastern portions of these counties, as well as the surrounding counties, are at-risk to HWA infestation. Monitoring is very important in preventing the spread of HWA. This is because if an area that contains HWA is left unchecked, the infestation could spread from that location. HWA can be spread by birds, mammals, and by people via clothing and equipment (West Michigan Hemlock Woolly Adelgid Task Force, n.d.). Eradication of HWA in West Michigan is much more likely if the infestation is contained and treated where it is now. If the infestation becomes too large, eradication is unlikely. To ensure that the entirety of Port Sheldon Natural Area is free of HWA, continued monitoring for its presence is required.

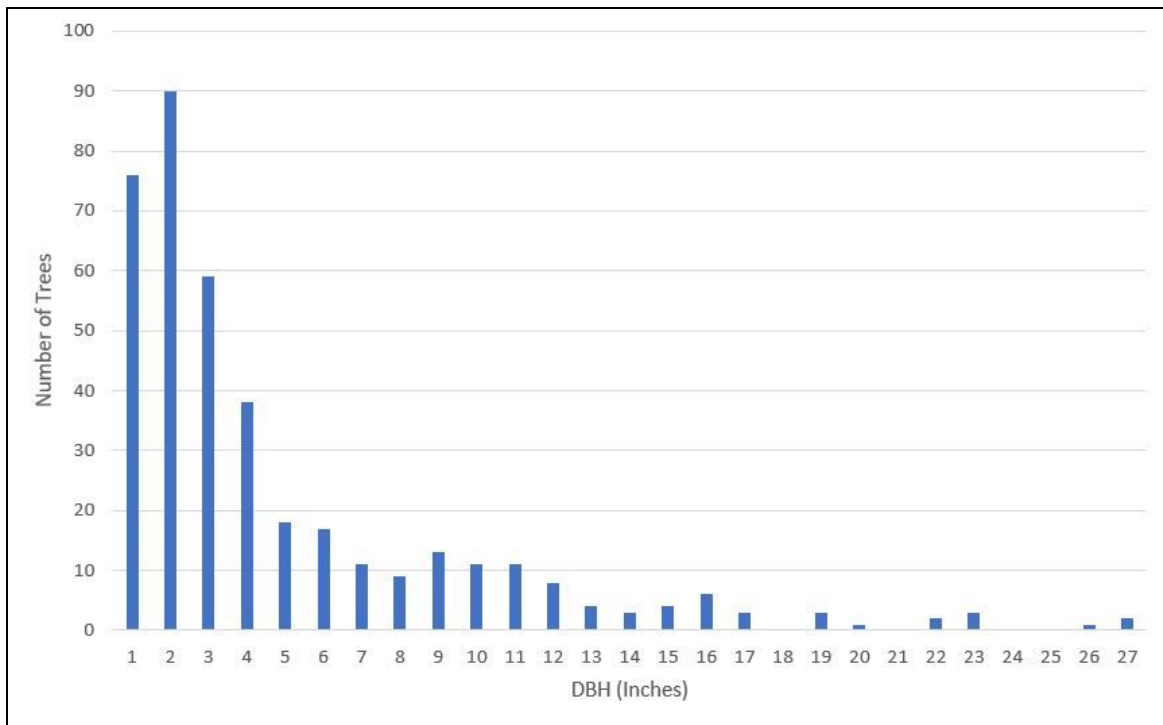


Figure 1. Diameter distribution of Eastern hemlock trees in the northwestern portion of Port Sheldon Natural Area, West Olive, Michigan. A tree is defined as a stem with a diameter at breast height (DBH) greater than or equal to 1. A total of 393 trees are included in this distribution. Data were collected in the summer and fall of 2019.

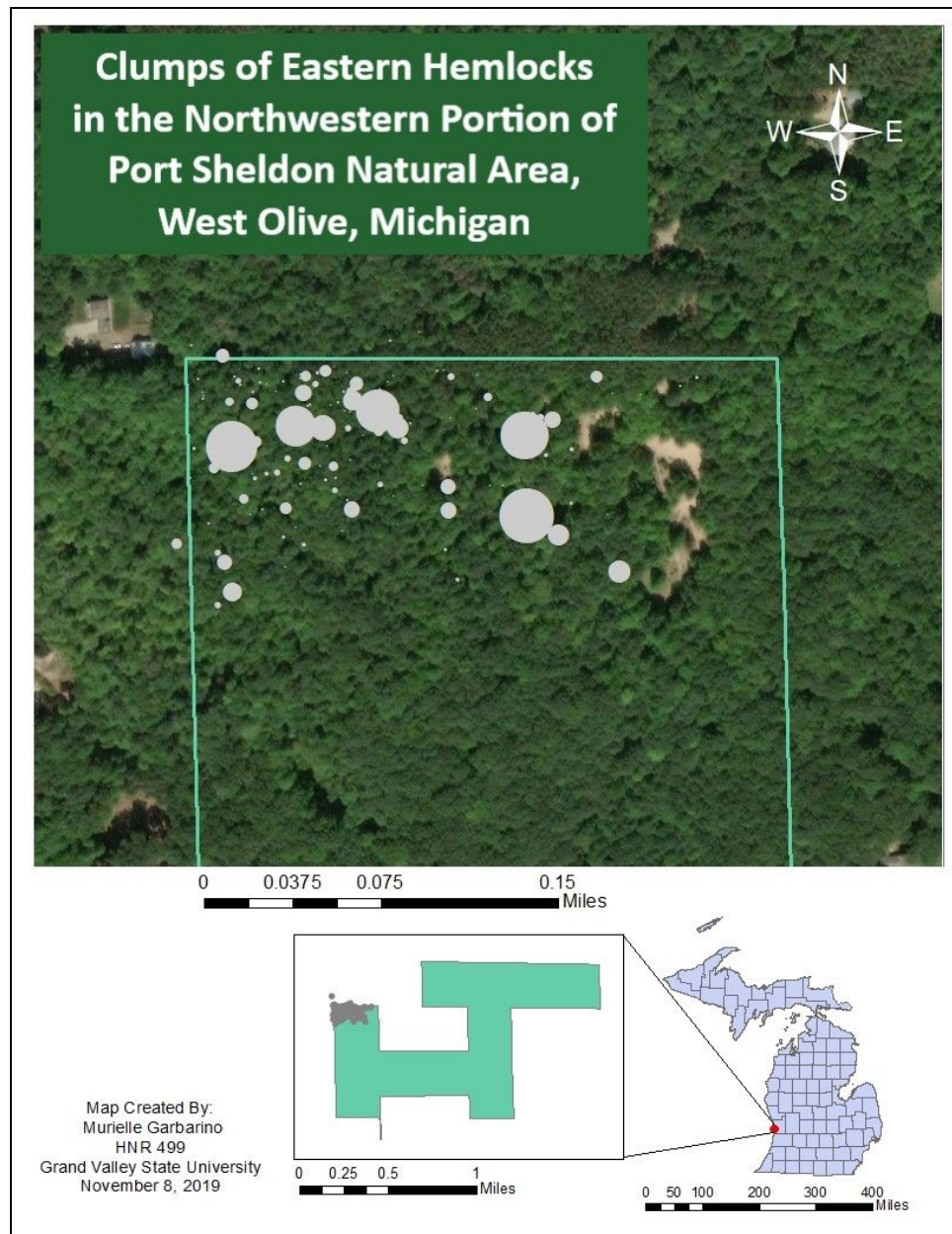


Figure 2. Distribution of Eastern hemlocks in the northwestern portion of Port Sheldon Natural Area, West Olive, Michigan. Each point represents a clump of hemlocks. A clump is defined as a group of hemlocks where their branches are within approximately 10 feet of each other. Larger points indicate a greater number of hemlocks in the clump. No evidence of the Hemlock woolly adelgid was found. Data were collected in the summer and fall of 2019.

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Project Reflection

When I was trying to decide on a topic for my honors project, I wanted to do something constructive. I consulted with Dr. Ali Locher, and she suggested I survey one of Ottawa County's properties for the invasive hemlock woolly adelgid. I contacted Melanie Manion, Natural Resources Manager for Ottawa County Parks and Recreation, about my project and she assigned me to survey Port Sheldon Natural Area for the hemlock woolly adelgid.

Completing this project was challenging, but rewarding. I spent over 50 hours surveying Port Sheldon Natural Area for the hemlock woolly adelgid. I spent additional time inputting the data I collected into a spreadsheet, making a map of Port Sheldon Natural Area, and writing a report detailing my results. The process was very difficult at times, but it helped me gain confidence in my ability to do natural resources work. Additionally, working on this project helped me to realize that sometimes, despite my best efforts, there will be constraints that prevent me from accomplishing tasks I intend to complete. I had very high expectations for this project, and I had planned on surveying the entire western portion of the park, measuring approximately 140 acres. However, doing a 100 percent tally, which involves checking each tree individually, in an area with many hemlocks turned out to be unrealistic. Unfortunately, I was unable to complete surveying the entire western section over the course of the summer and the fall semester. Regardless of the fact I did not survey the entire section, it was rewarding to assist Ottawa County Parks in their efforts to determine the extent of HWA in West Michigan. I gained valuable experience surveying for HWA, which I can utilize further ahead in my career. Additionally, I was able to use what I have learned throughout the course of my natural resources management studies to do something useful.