

1. Goals and Objectives

The objective of this research project is to investigate the impacts of a common invasive earthworm to Northeast Ohio on woody plants in the underbrush of native forests. The species being studied is the Asian Jumping Worm (*Amyntas agrestis*), which are invasive in Northeast Ohio. To investigate how this species impacts the woody underbrush of forests, this study will examine the worm's potential effects on the diversity of woody underbrush in fenced plots that exclude deer. The goal of this study is to determine the direct effects this invasive worm will have on the diversity of native forests.

The motivations for this work come from the impact invasive species can have on native habitats. Due to the impacts of glaciation on Ohio, Northeast Ohio did not have native earthworm species. The earthworms found today in much of Ohio were introduced through imported soil, discarded fish bait and other sources and have had dramatic effects on Ohio's native habitats. Earthworms are considered to be ecosystem engineers, meaning that they actively change the environment in which they are found. Earthworms are detritivores, meaning they eat dead organic matter like rotting leaves. Before the invasion of forests by earthworms, the soil had a thick layer of decaying plant matter on top. When earthworms invade, they quickly eat this layer, leading to dramatic changes in the soil that the native flora and fauna depend on. This has the potential to have dramatic effects on native species.

Not all earthworm species interact with the soil in the same way. Some earthworms, like the European Nightcrawler, another common invasive earthworm, builds vertical burrows through the soil and will drag plant matter into them to feed, causing mixing of soil layers and changes to the soil that are different from the earthworms that do not build vertical burrows, such as the Asian Jumping Worm. The Asian Jumping Worm does not form permanent burrows like the European Nightcrawler and does not burrow deeply into the soil. The forests of Ohio are additionally heavily impacted by overgrazing by deer and the effects of earthworm invasion is often studied in these conditions. Earthworms and deer could have synergistic effects on the forest. The goal of this study is to determine the direct impacts on native woody flora of Asian jumping Worms divorced from the potentially synergistic effects of deer.

The benefit of this study is that it would provide information that would help conservationists predict the impact of these invasive worm species on native forests, and predict how forests and parts of forests invaded by the Asian Jumping worm would respond, allowing for responses tailored to this specific invading species.

2. Methodology

This study will build off of previous research conducted by Ryan Trimbath at the Cuyahoga Valley National Park, who has investigated the presence of invasive earthworm species in the CVNP and their effects on the native flora. Mr. Trimbath has taken measurements of the height of woody saplings in the underbrush and documented the presence of invasive earthworms nearby, allowing for a second measurement to determine growth to be taken. Mr. Trimbath has set up long term microplots from which data can be collected and compared to previously collected data, enabling this study to investigate effects across time. Permission to utilize Mr. Trimbath's data has already been obtained and the necessary steps to acquire permission to conduct a study in the CVNP have begun, with Mr. Trimbath's assistance.

To conduct this study, 10 plots will be investigated. Each sample will consist of 1 fenced microplot. All 10 samples will be taken from as similar park areas as possible to reduce confounding variables. Each sample will consist of an area of the park that is mostly uniform in nature across the sample that is invaded by a single type of worm. These microplots will be those previously set up and observed by Mr. Trimbath of the CVNP. From each plot, the characteristics of the plot and the surrounding area, such as soil characteristics, slope, dominant tree species in the canopy, canopy cover, and forest type will be recorded. Then, the number of different woody species, the abundance of each woody species, the identity of each woody species in the plot and whether they are invasive or native, will be recorded and used to determine factors such as Species Richness, Species Evenness and Species Dominance for use in calculating a diversity index. The index planned on being used is Shannon's Diversity Index. In plots where there are saplings with previous height measurements, height measurements will be taken and compared to the previous measurements to determine growth. Growth will be compared between worm species.

The effects of the worm species on woody plant diversity will be determined by comparing the diversity indices by abundance of Asian Jumping Worms, and comparing the dominant species and abundance of invasive species between them..

The timeline for the study is as follows:

1. In late August, visit the plots set up by Mr. Trimbath to determine which plots are adequate for use as samples.
2. In late August, Analyze suitable plots for the presence of invasive worms and document species
3. In late August, determine which plots will be used as samples.
4. First week of September, analyze Sample 1
5. Second week of September, analyze Sample 2

6. Third week of September, analyze Sample 3
7. Fourth week of September, analyze Sample 4
8. First week of October, analyze Sample 5
9. Second week of October, analyze Sample 6
10. Third week of October to December 1st- make up time for sample collection.
11. December through February, analyze data and write paper.
12. March 1st - submit rough draft to mentor

Outcomes

The outcome for this project is first and foremost a written report for the honors college, written in the format of a scientific journal article in the journal Nature. A second outcome for this project is to provide data to Ryan Trimbath regarding the microplots he has been monitoring and in general assist Mr. Trimbath in his research into the impacts of invasive worms in the CVNP.

Academic Impact

This project will complement and expand upon skills and knowledge I have obtained during my undergraduate career. In courses such as Ecology, Field Ecology and Flora and Taxonomy, I learned important skills in conducting ecological studies such as how to design ecological studies, how to conduct ecological studies and how to identify plants. I also learned the basics of identifying worms and how they impact forests in Field Ecology. This proposed study will build upon and expand my ability to design ecological studies and sharpen my skills in identifying plants, along with building upon the foundational knowledge I have of invasive worms and their effects on local habitats. This study allows me to apply the skills and knowledge I learned in those classes and teach me more about experimental design, a skill I feel I currently lack.