

# Invertebrate Pitfall Surveys at Glacial Hills Preserve and Buena Vista County Park

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## Abstract

Invertebrates are integral members of the ecosystems they inhabit. However, they are often overlooked and understudied. We performed two pitfall surveys in Buena Vista County in September 2021 to study the diversity and abundance of invertebrate species in the presence and absence of two invasive species: Eastern Redcedar (*Juniperus virginiana*) and Garlic Mustard (*Alliaria petiolaris*). We collected pitfall samples and brought them back to the lab for identification. We found no significant differences in invertebrate abundance between cedar and non-cedar samples, nor between mustard and non-mustard samples. We propose further research focusing on seasonal changes, as these invasives may have more impacts at certain times of year than others.

## Introduction

Invertebrates are crucial to the functionality of ecosystems but are often overlooked and understudied. The depletion of invertebrates can wreak havoc on the surrounding ecosystem, but is often less noticeable and can be overlooked for some time before the problem is realized. The decrease in invertebrate biomass has sounded the alarm for many scientists who are being asked to study them more closely to learn about various trends in populations. The loss of invertebrate density and diversity can impact many aspects of an ecosystem including primary production, pollination and pest control. Those found living within the soil are even more important for caring for multiple ecosystem functions and services including the control of soil erosion and nutrient cycling. Through the study of pitfalling, scientists can gain a better understanding of the functional consequences of the changing biodiversity (The Nature Conservancy 2020).

## Goals

- Observe the ways and extent of which invasive species influence the invertebrate biodiversity and frequency living within a shared ecosystem.
- Study the allelopathic tendencies of garlic mustard and its potential to lead to a decrease of invertebrate biodiversity where it is introduced.

## Materials and Methods

Our redcedar study focused on a relict prairie at The Nature Conservancy's Glacial Hills Preserve near Peterson, Iowa. The redcedars at the preserve were in an area where seasonal grazing from local livestock occurs from early June through mid-August. On September 26, we placed pitfall traps (8 oz plastic cups containing 50% ethanol solution with Dawn detergent) placed beneath (0m) and 5m and 10m from each of 8 redcedar trees at the preserve.

Our garlic mustard study focused on a forested area in Buena Vista County Park, also located near Peterson. This park serves as a campground and recreational area for hiking and biking. On September 26, we placed pitfall cups in a forested area of the preserve that had been invaded with garlic mustard and in an area where garlic mustard was absent. At both sites, we left pitfall traps in place overnight and collected samples after 24 hours. To collect the samples, we used plastic sandwich bags to hold the contents of the cups. The samples were then taken back to the lab to be processed. After initially processing samples to remove dirt and debris, samples were poured from the cup into an empty petri dish to be picked through with forceps. Invertebrates were removed and sorted into ice cube trays whose bottoms were covered with 50% ethanol. We transferred organisms into microfuge tubes and recorded the numbers and types of invertebrates on data sheets. We performed an ANOVA and paired t-tests to compare invertebrate abundance (total # of invertebrates collected) and richness (total # of species collected) between 0, 5, and 10m from redcedars, and we performed an independent-sample t-test to compare invertebrate abundance between garlic mustard and non-garlic mustard samples. We used Excel for all analyses

## Results

**Glacial Hills Preserve:** We found no significant differences in invertebrate abundance between redcedar pitfall samples collected at 0, 5, and 10m (Fig. 1) We also found no significant difference in species richness between 0, 5, and 10m samples.

**BV County Park:** We found no significant differences in invertebrate abundance between samples collected in garlic mustard vs. non-garlic mustard areas (Fig. 2), and we also found no significant difference in species richness between areas.

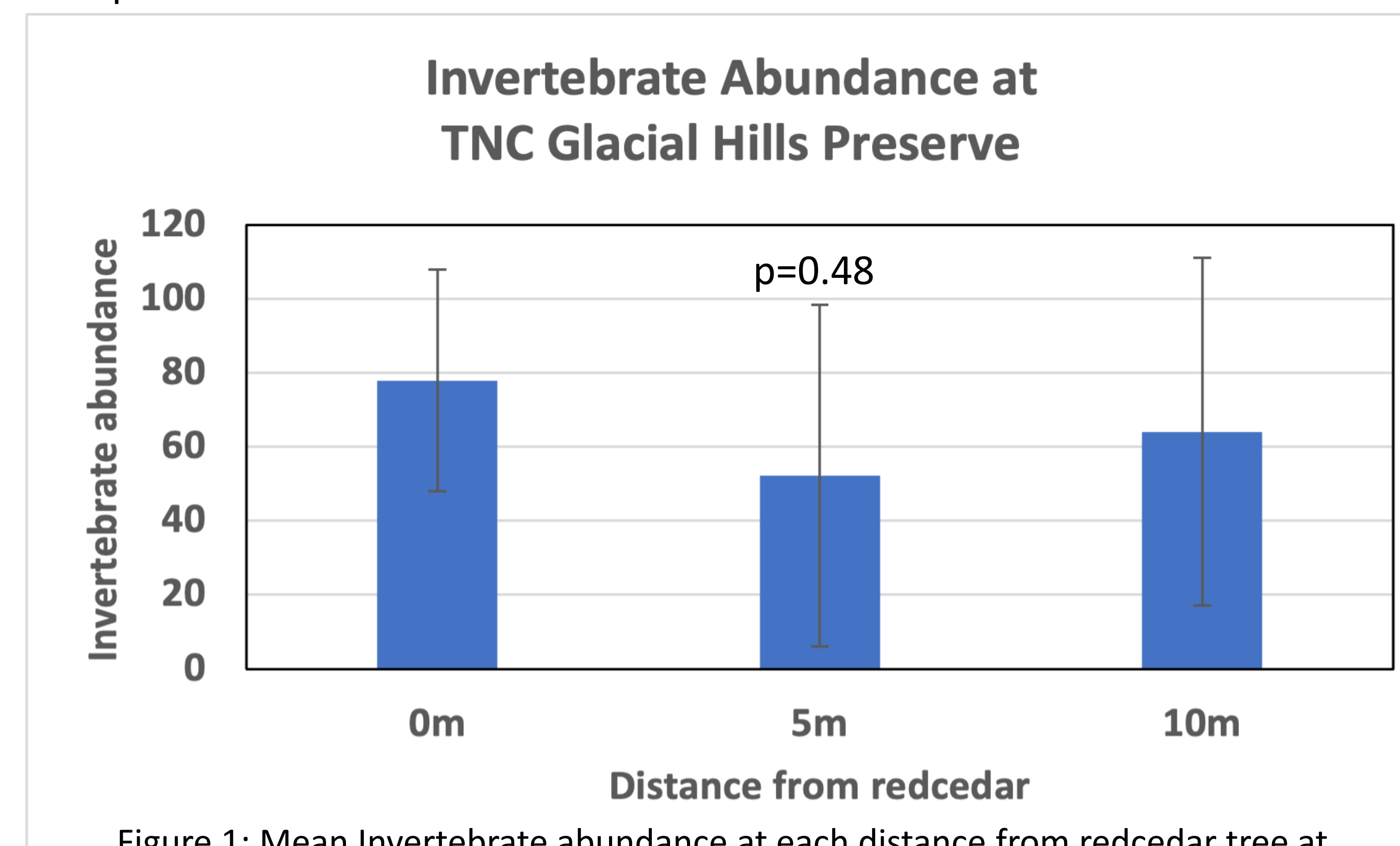


Figure 1: Mean Invertebrate abundance at each distance from redcedar tree at Glacial Hills Preserve. SD bars are shown. Means are not significantly different.

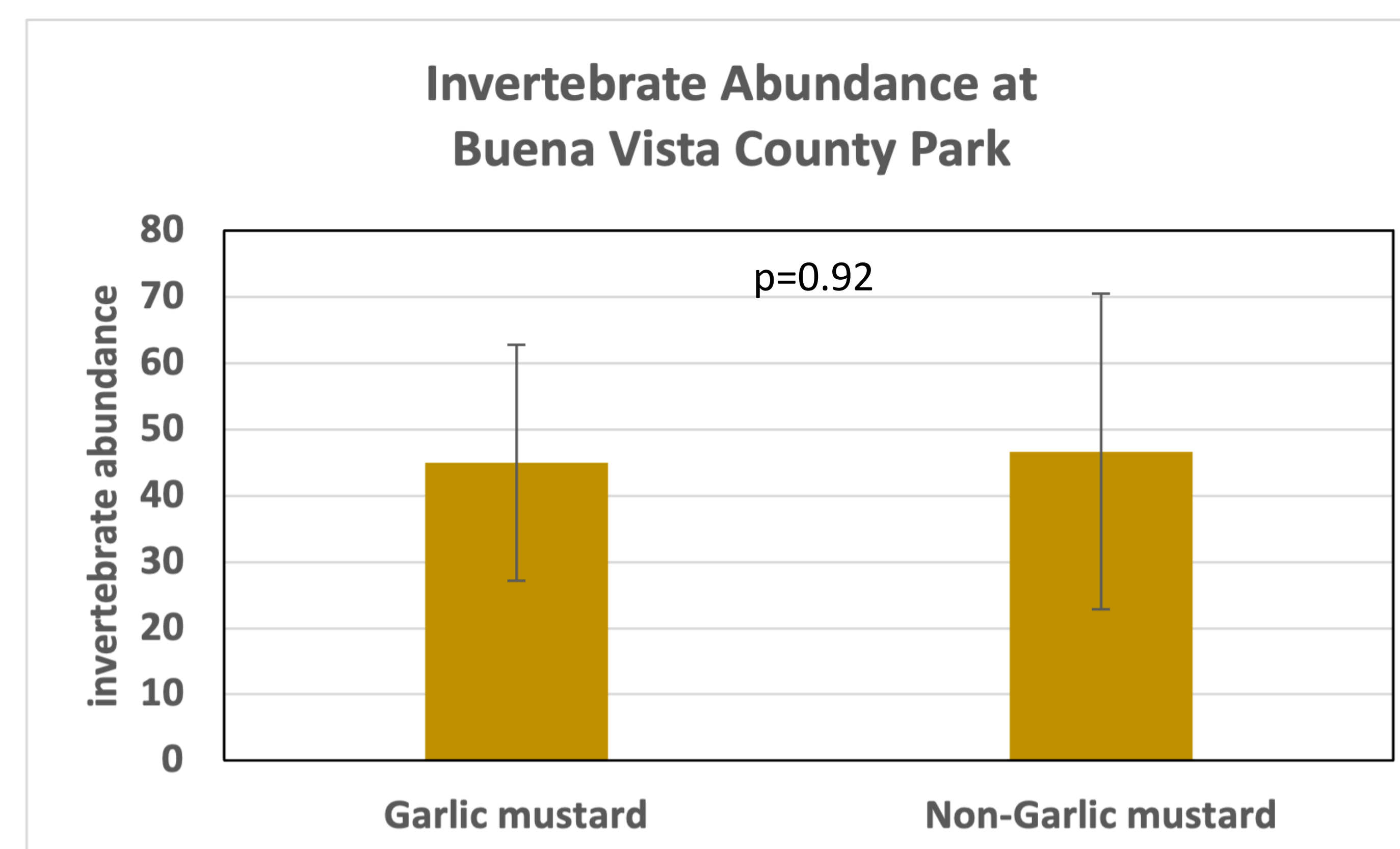


Figure 2: Mean Invertebrate abundance for garlic mustard and non-garlic mustard areas at Buena Vista County Park. SD bars are shown. Means are not significantly different.



M. Kleinhesselink holding a soil plug removed for placement of the pitfall trap in BV County Park.

## Discussion

As a native but invasive species in Iowa's upland prairies, the eastern redcedars at TNC's Glacial Hills Preserve provided an interesting opportunity for study. Based on its other documented negative impacts to the grassland biome (Briggs et. al 2002), we hypothesized that redcedars would negatively affect invertebrate populations in upland prairies, and we predicted a decrease of invertebrate abundance and richness at pitfall traps placed closer to redcedar trees. However, we found no significant differences in invertebrate abundance and richness based on distance from redcedar trees. However, we feel that a larger sample size and continued monitoring from spring through fall over several years may show significant differences that this small study was unable to detect. Ultimately, we believe it would be valuable to determine long-term trends in invertebrate abundance and richness to see if the continued encroachment of redcedars (assuming TNC does not try to control them) affects the invertebrate biodiversity in this location. Along with continuing this pitfall study, we could monitor, or conduct a tree survey every year to see if the number of redcedars increases in this preserve. Garlic mustard is a non-native invasive plant that has negative impacts on invaded forest ecosystems in the Midwest. For example, garlic mustard has been shown to have allelopathic properties, which involves the plants secreting toxins into the soil to kill other species of plants (Wolfe et. al 2008). Given such properties, we hypothesized that garlic mustard would negatively impact soil invertebrates, and we predicted that pitfall samples in areas of garlic mustard would show lower invertebrate abundance and diversity that samples collected in non-garlic mustard areas. We found no significant differences in invertebrate abundance between areas with and without garlic mustard. However, we do not feel that our sample size was adequate, and just as was the case with our redcedar study, we feel that a longer-term study that encompasses the entire growing season over a period of years would more fully elucidate whether garlic mustard impacts invertebrate diversity in Iowa's forests. We further suggest that if only a single pitfalling event is possible, that it be performed in mid-summer, when garlic mustard plants are blooming, rather than late September, when they are drying up and dropping seeds.

## References:

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