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Carly McCameron

Augustana College, Rock Island Illinois

John McCarthy

Augustana College, Rock Island Illinois

Dr. Kevin Geedey

Augustana College, Rock Island Illinois

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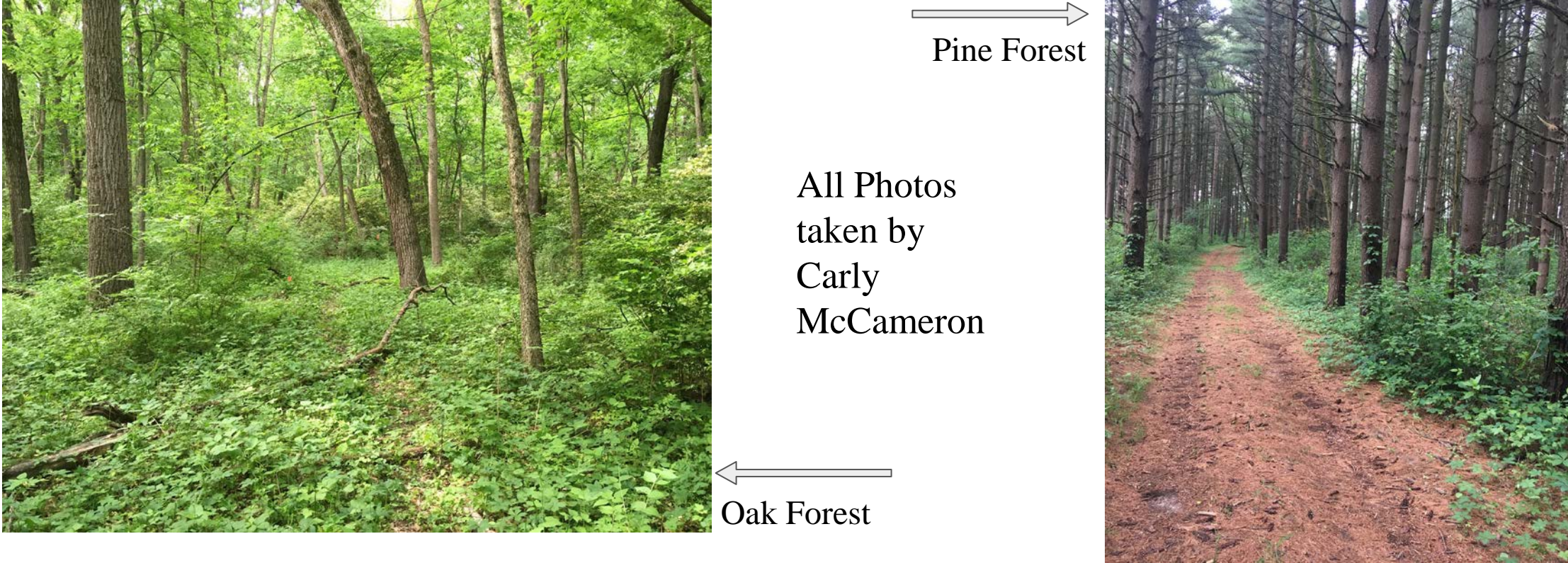
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Do Stands of Native Trees Harbor Different Invasive Species Than Stands of Planted Pine?

Carly McCameron, John McCarthy, Kevin Geedey, Affiliates of Augustana College

Introduction

In 2017, Augustana College sold 395 of the 410-acres it owned at the Green Wing Environmental Laboratory near Amboy, Illinois to the Illinois Audubon Society for 2.1 million dollars (Schlouch 2017). This will allow Audubon to undertake an aggressive program of invasive species control (Schlouch 2017). The most prominent species that have taken control of the area include *Alliaria petiolata* (garlic mustard), *Lonicera maaackii* (Amur honeysuckle), *Rosa multiflora* (multiflora rose), and *Rhamnus cathartica* (buckthorn). Each plant listed has certain characteristics that makes it difficult to contain. For example, garlic mustard can produce up to 8,000 seeds in a single year (Boysel 2013), honeysuckle shades and depletes the moisture in the soil in the surrounding area, multiflora rose is capable of resprouting and layering (Huebner, Olson, and Smith 2004), which allows it to make many new plants, and buckthorn seeds remain viable in the soil for up to six years (Michigan DNR 2012). Characteristics such as these are what have made the eradication of invasive species a \$120 billion dollar industry annually (Crowl 2008). Since Gremel has diverse habitat types, it is important to know if these habitats are uniformly impacted by invasives. A key component is understanding why certain species thrive in certain areas and how they impact that area. One area that we chose to study is a stand of planted eastern white pines on the Gremel property. These pines were planted in the 1940’s and were intended to be harvested as Christmas trees but were never actually harvested (Dziadyk, personal communication). So, how do invasive species in a non-native pine ecosystem differ from invasives in an ecosystem dominated by native trees like Oak, Elm, and Hickory, and how do these plants in turn affect their environments? Based on our observations, we hypothesize that there will be a higher concentration of invasive shrubs in the area dominated by non-native pines in comparison to the area dominated by native trees, which will have a higher concentration of herbs and other smaller plants.



Materials & Methods

For our study we used the line-point method (Jeffery n.d.) as well as other forms of data collection to compare the pine tree habitat to habitat dominated by oak, elm, and hickory. We repeated the line-point method ten times in each ecosystem, which gave us 1,600 total data points. The materials necessary for this experiment included a measuring tape, two stakes, and one flag. During this experiment, one person worked as the recorder while the other person interpreted the results of the experiment. We began by selecting two different ecosystems, specifically we selected an area dominated by eastern white pine trees and another area dominated by trees native to the Gremel. While collecting our data, we decided we would stay in both of the location’s main soil types. To maintain our accuracy regarding this aspect of the data collection, we used a GPS locator to mark our longitudinal and latitudinal points and then we located our point on the UC Davis maps (California Soil Resource Lab 2018). This showed us the perimeter in which we could collect data. Once this was complete, we entered our perimeter and stretched the measuring tape 40-meters into the forest. Then we used the flag as a marker every 2-meters. As we marked each point, we communicated to the recorder the vegetation that the flag intercepted starting at the top canopy and ending with the type of material the flag’s base contacted. On the same note, we also recorded up to three plants the flag’s shaft intercepted between the top canopy and the soil. It is also important to mention that while extending the tape measure we did our best to keep it in a straight, taut line, and we kept it as low to the ground as possible. We arbitrarily chose a starting location and walked ten meters in between each samples plot. Lastly, we repeated this process ten times in order to quantify the soil cover in each location.

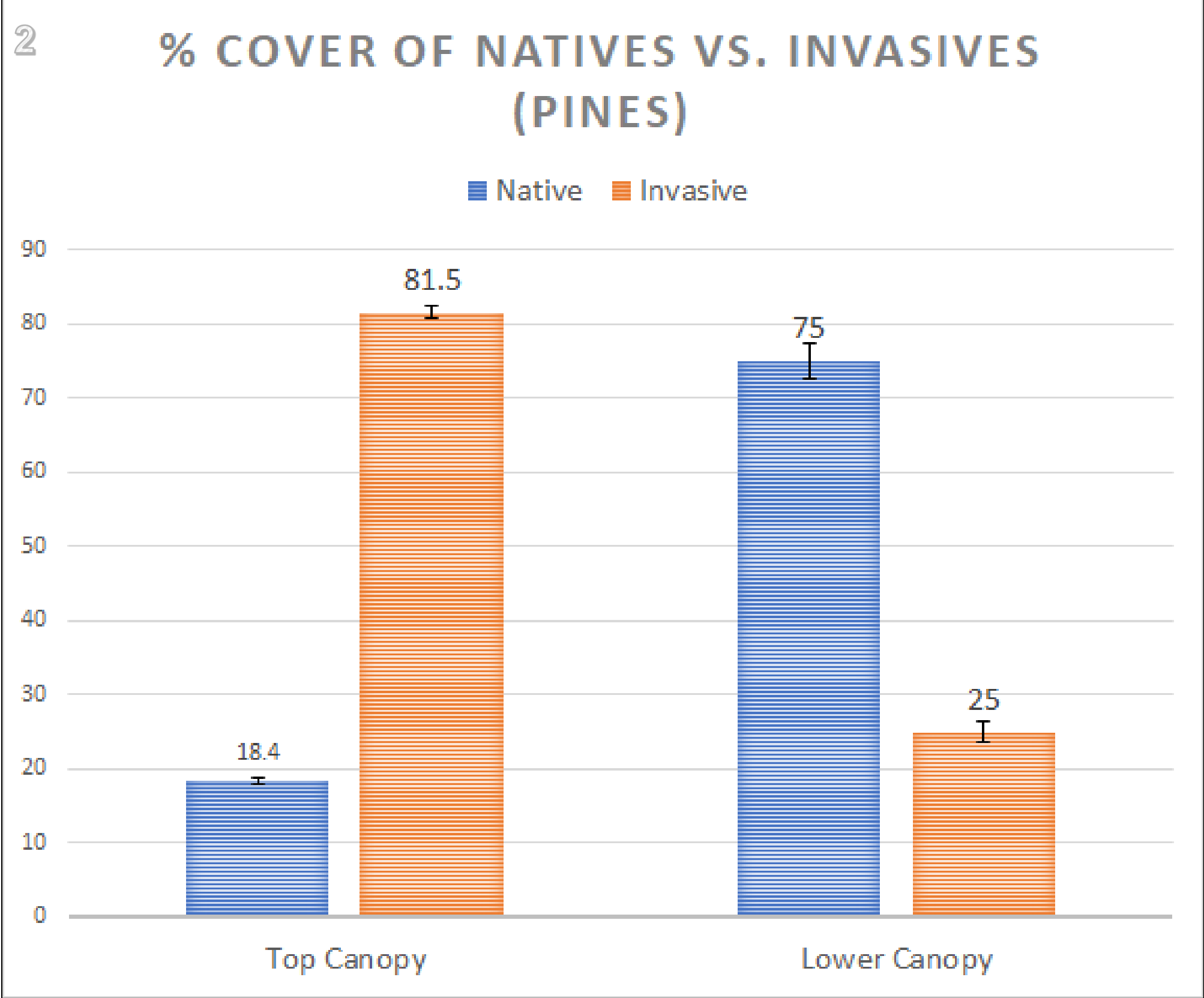
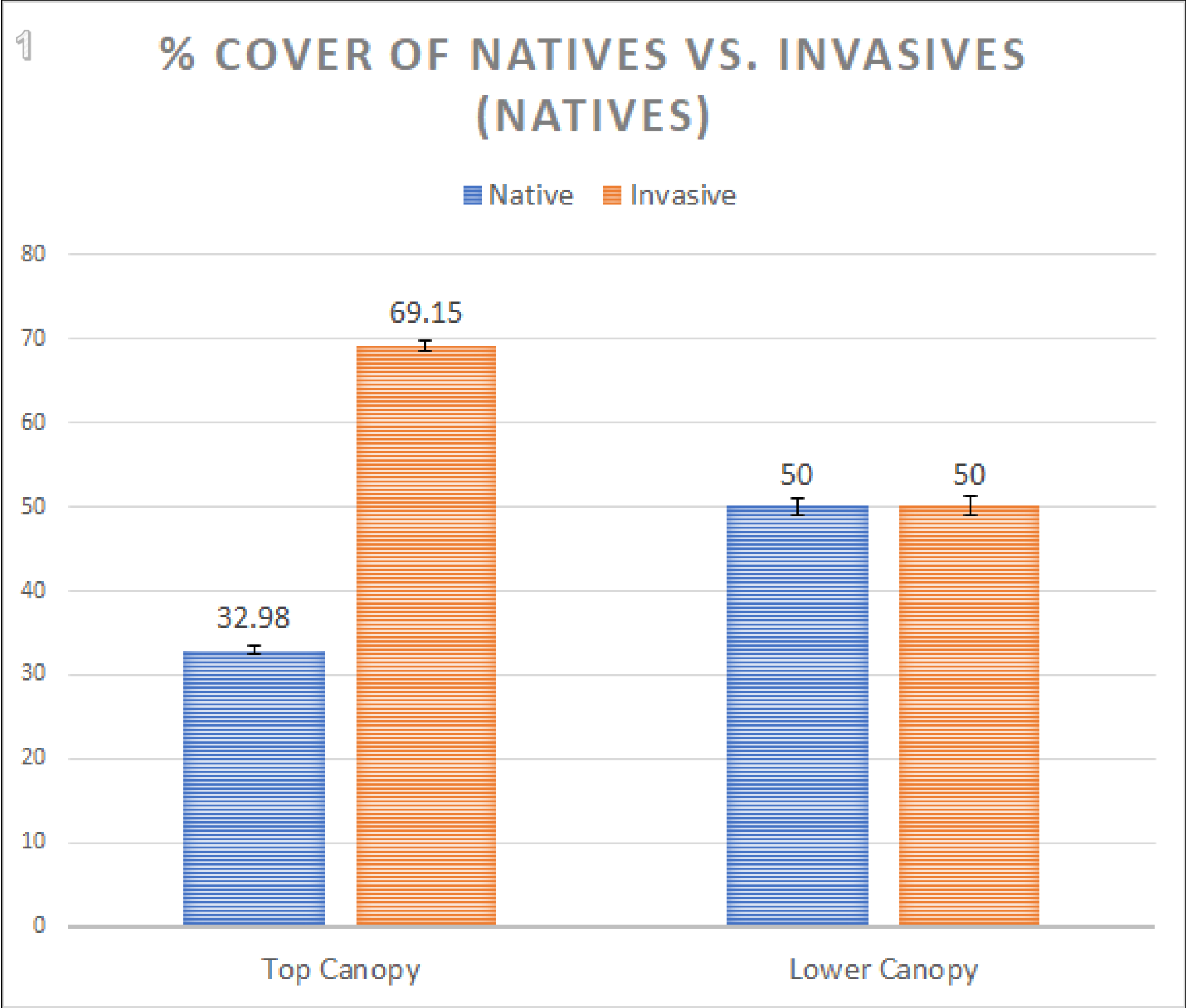
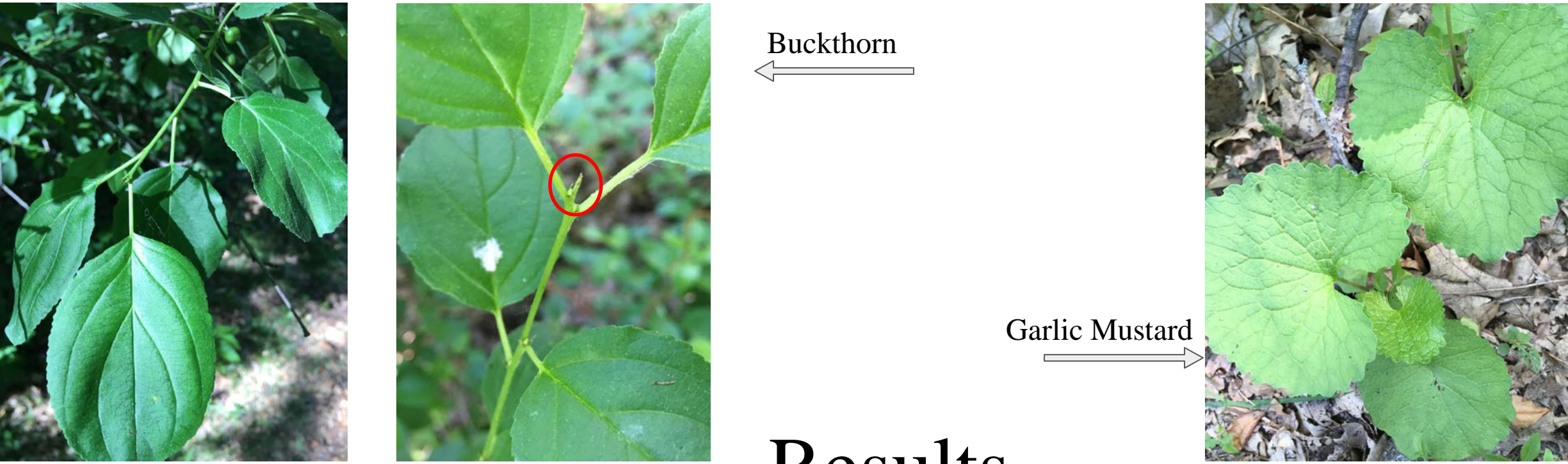


Figure 1&2: Canopy cover of native and invasive species in both environments. (1) In the oak, elm and hickory environment the top canopy was dominated by invasive species, which composed 69% of the top canopy. The lower canopy was evenly split between native and invasive species. (2) In the pine forest, the top canopy was almost entirely invasives, which composed 81% of the canopy. The lower canopy was dominated by native plants which composed 75% of the lower canopy.



Results

The analysis we ran returned three statistically significant results. The first result showed that the presence of invasive species differed on whether the top canopy or the lower canopy was being surveyed ($p=.000258$). The second result showed that the presence of invasive species differed based on which environment was being surveyed (.003643). The third result showed that there was an interaction between these two variables (1.36E-11). As depicted in the graphs on the left, the top canopy of the pine forest had a very high concentration of invasive species (81.5%) and the lower canopy had a much lower concentration of invasive species (25%). In the oak forest the top canopy had a high concentration of invasives (69%) but it was lower than the pine forest. Here, the lower canopy had a much higher concentration of invasive species (50%). In sum, our hypothesis was mostly supported because there was a higher concentration of honeysuckle in the pine forest and a higher concentration of garlic mustard in the area dominated by oak, elm, and hickory.

Discussion

The most notable conclusion we drew from our research was that when surveying invasive species, the environment and the canopy that the plants are in are dependent on one another. There was a higher concentration of invasive species in the upper canopy of the pine forest than there was in the oak forest. On the other hand, there was a higher concentration of invasive species in the lower canopy of the oak forest than there was in the pine forest. Previous studies have shown that invasive species including multiflora rose, garlic mustard and honeysuckle appear in 40% of sampled plots (Crocker 2009). Beyond that, the USDA Forest Service’s northern research station performed a study on the forests of Illinois from 2001 until 2006, and found fewer than 10% of the occurrences, out of 1,329 occurrences, had a plant cover of greater than 70% (Crocker 2009). Further research would need to be conducted to prove the following assumption, however, according to our data, the amount of nonnative, invasive plant cover over the past 12 years has increased significantly (Crocker 2009). These results could show that the overall health of Illinois’ forests is declining as a result of the decrease in native plant species. We hypothesized that there would be a higher concentration of invasive shrubs in the pine tree dominated area than in the area dominated by oak, elm, and hickory, which would have a higher concentration of herbs and other smaller plants. While we did our best to gather bias free data, we were unable to avoid a few limitations. Limitations of the current study include inexperience at plant identification, inability to always get the tape line perfectly straight due to thick vegetation, and possible accidental destruction of plants by trampling in the field. There’s no doubt it had an impact on our results, but it was negligible.

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Honeysuckle



Multiflora Rose