



# The impact human activity has on ant diversity at Wantagh High School

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## Abstract

We examined how the difference in environments, human-affected and natural, can impact ant species between areas in close proximity of Wantagh High School compared to ants living in the nature of the Forest Lake woods. Forest Lake woods are a natural forest close to our high school that is also in close proximity to a lake. Although they are close, they are two distinct different types of environments. The High School was a good place to conduct the study since human activity close to the school at the tennis courts and bleachers could impact how the ants live and their diets. We lured ants from both locations using potato chips and got them using cups and pitfall traps. We then examined their DNA samples in order to show us the range of different species in both locations. We were able to discover that although there were 2 species in the wooded location and 1 species in the school location, the overall biodiversity was low in both. With this data, we examined the reasons as to why this phenomenon occurred using information about the natural habitats of pavement ants.

## Introduction

At Wantagh High School, the bleachers and tennis courts are a place where humans and ants coexist. The human activity at these places can possibly interfere with ant lives, which could lead to differences in population, diversity, species, and diets. Humans in these areas sometimes step on the ants and kill them, which can actually alert other ants to come to the area (Donnerman, 2008). This could be a reason why so many ants have been found around areas where there are also humans. Food brought by people to these areas could also make a difference in the ants’ diets, which also leads to changes in their size and phenotype (Sanford, 2025). The infrastructure of the school could also impact the ants’ ability to make their homes (Leitch, 2024).

In Forest Lake woods, ant hills are not affected by humans since very few people go into the woods. Ants that live in the woods will have a larger and more natural food source, as they are surrounded by plants. The area around the school doesn’t allow for as many natural resources to grow, meaning that the ants will not be able to eat food from their natural diet. Although they can still eat human foods, popular citrusy snacks like oranges can be harmful to them (Asby, 2024). This could make places around the school a less ideal environment for the ants.

With all of this in mind, we proposed to examine if there would be a difference in biodiversity between the natural habitats of the Forest Lake woods and the human-affected habitat of Wantagh High School.

## Methods

We used potato chips in order to lure the ants close to us, and then used various methods to trap the ants using food. In the woods, we used a pitfall trap to make sure the ants couldn’t get out and waited until we had enough to store in a cup or other container. In the school areas, we trapped the ants via cup and paper, since a pitfall trap is not possible on concrete. In both traps, we used Cape Cod potato chips to lure the ants in. After collection, we froze them. By measuring their mass and length, we observed if there was a difference in the ants' size, weight, and physical appearance depending on where they lived.

We tested 10 samples from each location, however due to a limited amount of supplies, the DNA extraction was only conducted on 18. We extracted the DNA of 18 ants (10 from the school, 8 from the natural woods.) We then used chelex protocol to isolate the DNA and amplify the COI gene. Because the COI gene is found in the mitochondria, any organism with a mitochondria will have that gene present. It is also species specific. We then looked at the sequences of that gene to determine which species of ant we have collected. Taxonomic keys may not be definitive because ants of different species can look similar to each other. After confirming amplification through gel electrophoresis, only certain samples showed results so we could not test results from 2 samples (1 from each location). This left 9 samples from the school and 7 from the woods. With this in mind, we analyzed our sequences using DNA Subway and went through the nucleotide base local alignment search tool (BLAST) and multiple sequence comparison by log-expectation (MUSCLE) with them to see what species our samples were.

## Results

By using the MUSCLE tool to create a sequence similarity table (Fig. 3), we were able to find out which species our samples were. The sequence similarity table consists of our 17 ant sample sequences, along with the sequences of 2 ant species from the database. Along with this, a sample sequence from a common US ant was included, shown under the consensus sequence. We found that all of our samples seemed to come from the same genus and narrowed the species down to *Tetramorium caespitum* and *Tetramorium immigrans*, whose images can be seen below. From our sequence similarity table, we could tell that the overall ant diversity was not large, since the DNA sequences looked very similar. We deduced this because of the similarity in sequences towards the end of the strands, however DJM-008 was the only sample that differed. Additionally, the phylogenetic (Fig. 4) tree displays *T. caespitum* and *T. immigrans* as closely related, which shows there is low genetic diversity. To add on, there is an overlap within the sequence similarity tree between both species (Fig. 3). This highlights the fact that the ant diversity is low in both the natural and pavement areas around Wantagh, because this can be seen throughout the samples collected in both areas.

## Discussion

*T. caespitum* are known as the pavement ant, since they are commonly found on pavements and roads searching for foods. This would lead us to believe that more of our samples that were collected from the concrete areas of Wantagh High School were part of the *T. caespitum* species. Similarly, *T. immigrans* can be found in pavement as well, but are more commonly found nesting deeper into the pavement and are known to be well adapted to urban environments. Although all of the samples had similar MUSCLE alignments, we assume that the samples collected closer to the Twin Lakes had ants from both species, while the samples collected at the infrastructure at Wantagh High School were only from *T. caespitum*. We think this because the *T. immigrans* species can have nests in natural habitats as well as under pavements (Davis). This would make it realistic for our sample ants to have nests under pavements containing both species, and could travel into the Twin Lakes area. As seen in Figure 1, the forested area around twin lakes is in close proximity to a suburban housing area that contains lots of concrete pavements on the side of roads, meaning that the ant samples could have nests there. Because of this, we could make the claim that the ant diversity at Wantagh High School is lower since we only found 1 species there. However, overall we can say that the biodiversity was low in both ant sample collection locations, Wantagh High School and Forest Lake woods.

Figure 1. Map of Collection Locations

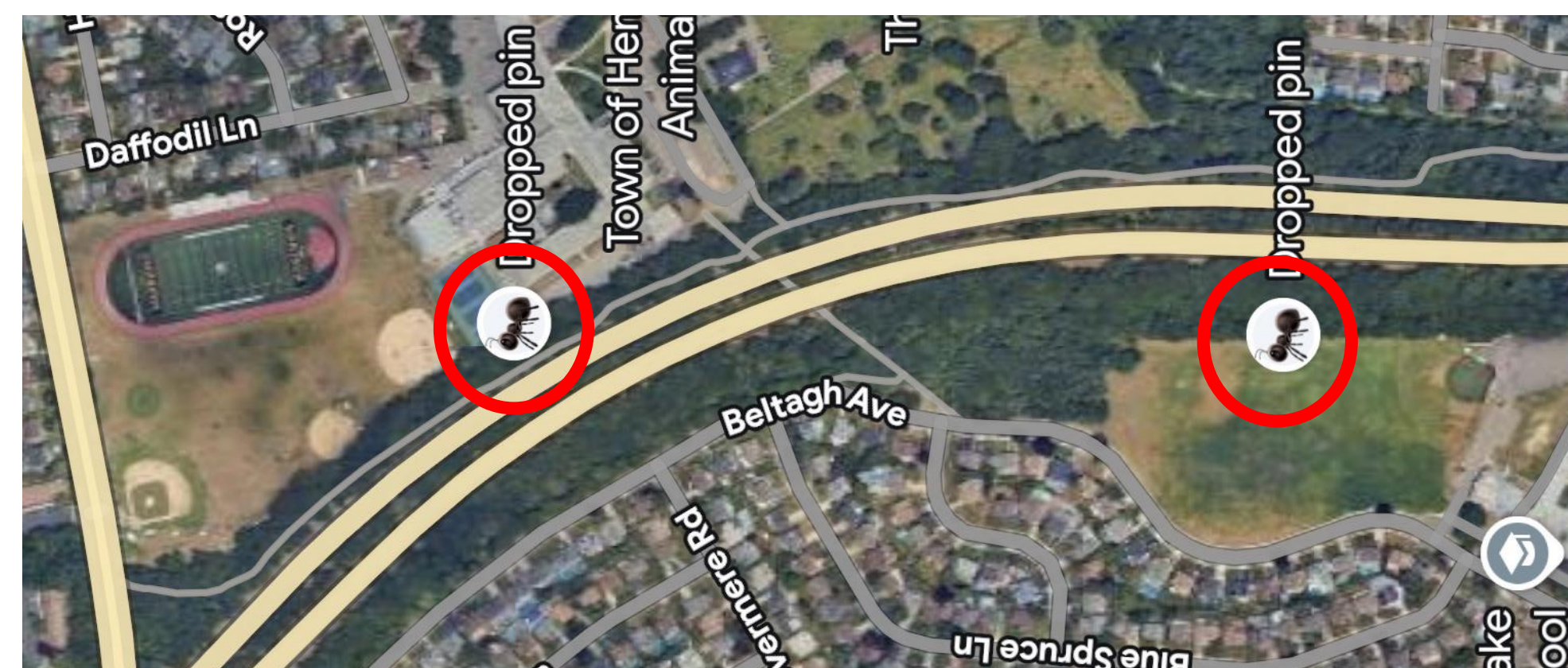


Figure 2. Ant Species



a. *Tetramorium caespitum*



b. *Tetramorium immigrans*

Figure 3. Sequence Similarity Table

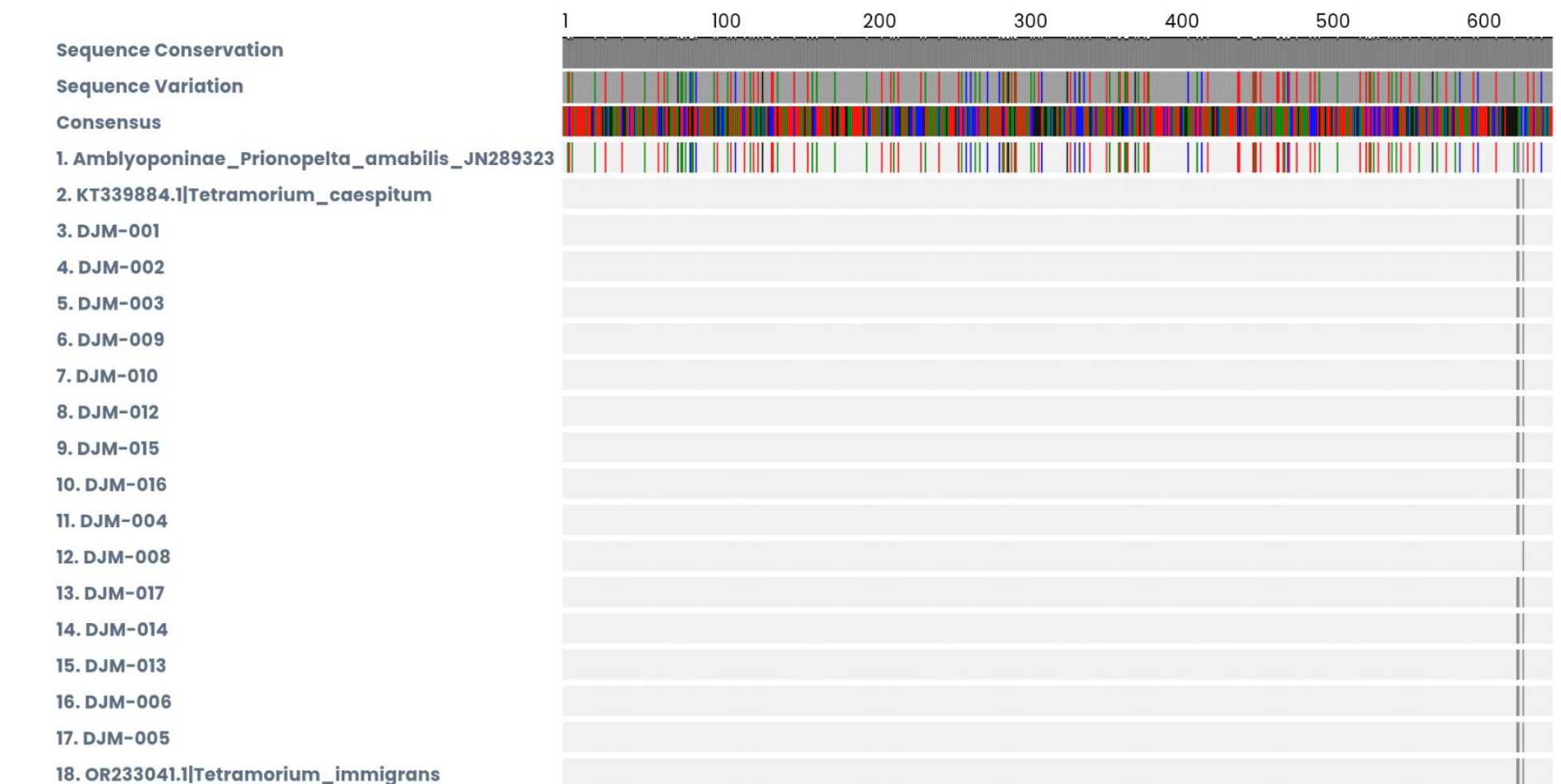
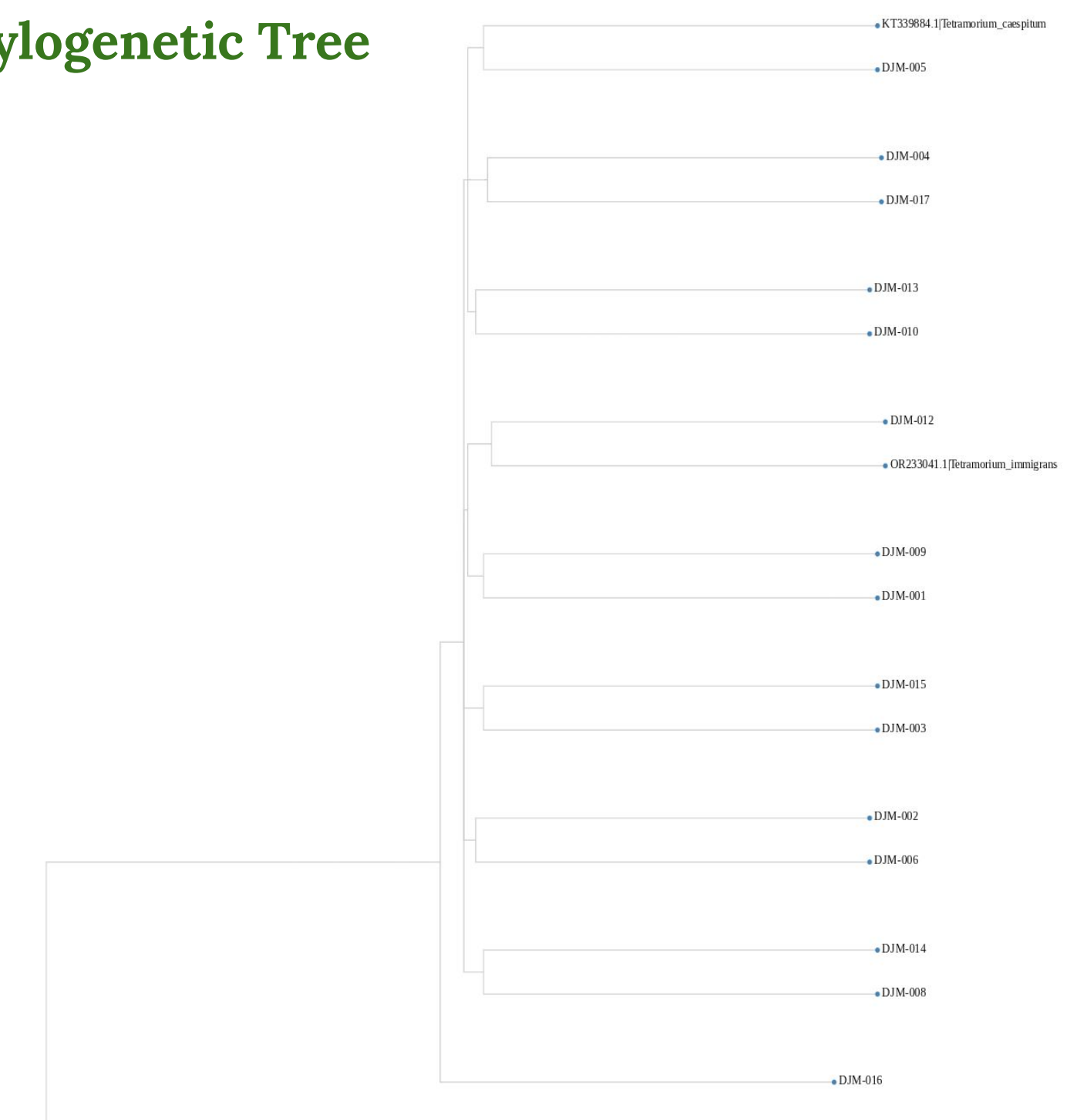


Figure 4. Phylogenetic Tree



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