



The Impact of Soil Composition on Ant Species Richness Across Long Island

Authors: Connor Ackerman, Lilly DeNatale, Michael Ford, Molly Nadler
Mentor: Mrs. Pamela Shanley St. Dominic High School



Introduction

The North Shore of Long Island is known for its rocky glacial moraines and rich soil, while glacial meltwater flowed south creating the outwash and sandy soils of the South Shore (NTVLI 2019). Long Island is also home to many ants, several of whom show sensitivity to soil chemistry, moisture, and many other environmental factors which makes them great bioindicators who provide information about the state of an ecosystem (Akhila M 2022).

In pots with heavy clay soils, ants find it difficult to make their home, and at garden sites bordered by pavement there were fewer ant species present (Advocating for Ant Antics 2023). Ants require habitats that are less homogenous; they prefer those with leaf litter and dead branches to provide food and nesting sites (Advocating for Ant Antics 2023). Therefore, the texture of the soil likely determines the type of ant species that are seen in the area.

This study sought to investigate how ant species diversity is related to the types of soil on each coast of Long Island. It is predicted that the North Shore will have the greatest species diversity since its rich and rocky soil will offer greater variety for the ants. In contrast, it is also predicted that the South Shore will have a lower level of species diversity since its soil is dry and sandy. Through this experiment, we hope to discover the correlation between ant diversity and types of soil on Long Island.

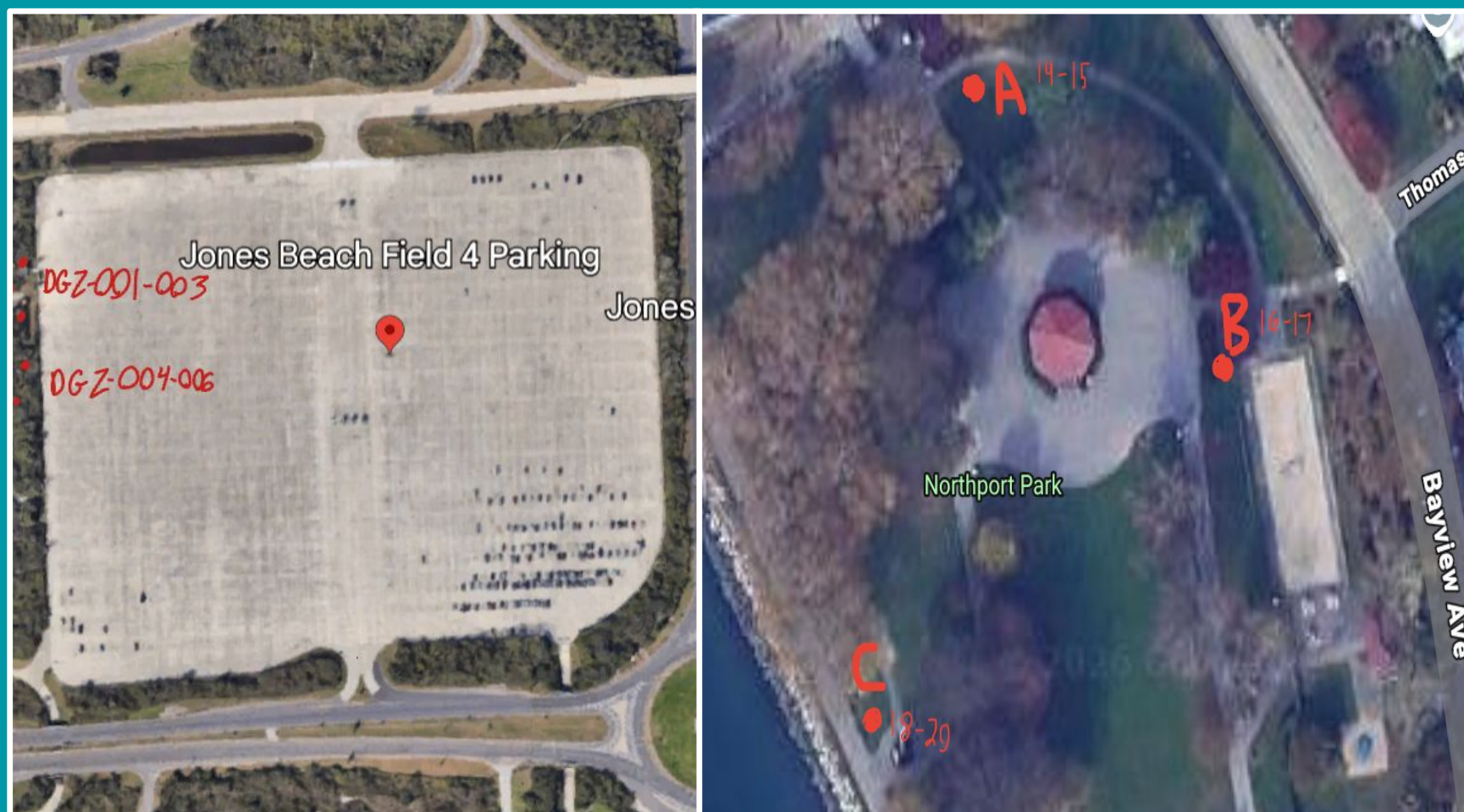


Figure 1. Jones Beach Park (left) and Northport Park (right) sample collection locations

Results

Two different species of ants were discovered at Northport Park, 2 small honey ants (*Prenolepis imparis*) and 5 Labor Day ants (*Lasius neoniger*). We found six pavement ants (*Tetramorium immigrans*) on the South Shore at Jones Beach State Park (Figure 3). Northport Park had a much higher Simpson's Diversity Index (.476) than Jones Beach (0.0) (Figure 4). Similarities between collected species can be seen in the sequence alignment of selected samples (Figure 5)

Materials and Methods

Collection occurred in Northport Park in Northport (North Shore) and Jones Beach State Park in Wantagh (South Shore) in the afternoons 4/18 at Jones Beach State Park and 4/19 at Northport Park (Figure 1)

Collected via pitfall traps, using red solo cups and 95% ethanol to trap the ants then placing them on ice in sealed labeled containers totaling 7 ants from Northport and 6 from Jones Beach

A dissection microscope was used to identify the small ant samples and take three photographs of each of them (Figure 2)

The iNaturalist Seek app was used for morphological identification and the longitude, latitude, sample images, description, and identified species were all uploaded into the sample database website

The Chelex protocol was used to extract ant DNA, and the COI region was then amplified using PCR

Gel electrophoresis was used to determine if there was a band around 658bp, so it could be sent off to be sequenced at GeneWiz

Sequences were uploaded and analyzed using BLAST on DNA Subway, searching for similarities within the sequences.



Figure 2. Images of sample DGZ-04 (*Tetramorium immigrans*)

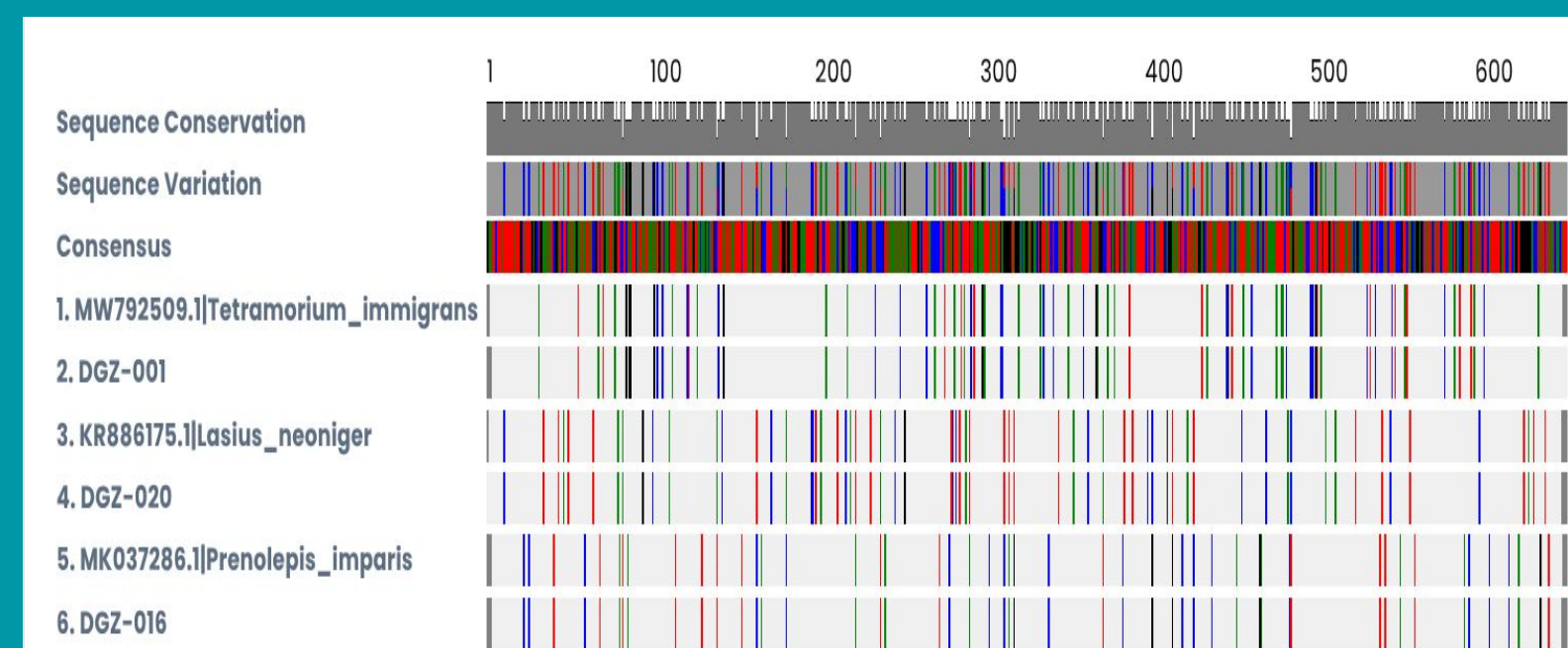


Figure 5. Sequencing alignment for DGZ-001, DGZ-020, DGZ-016.

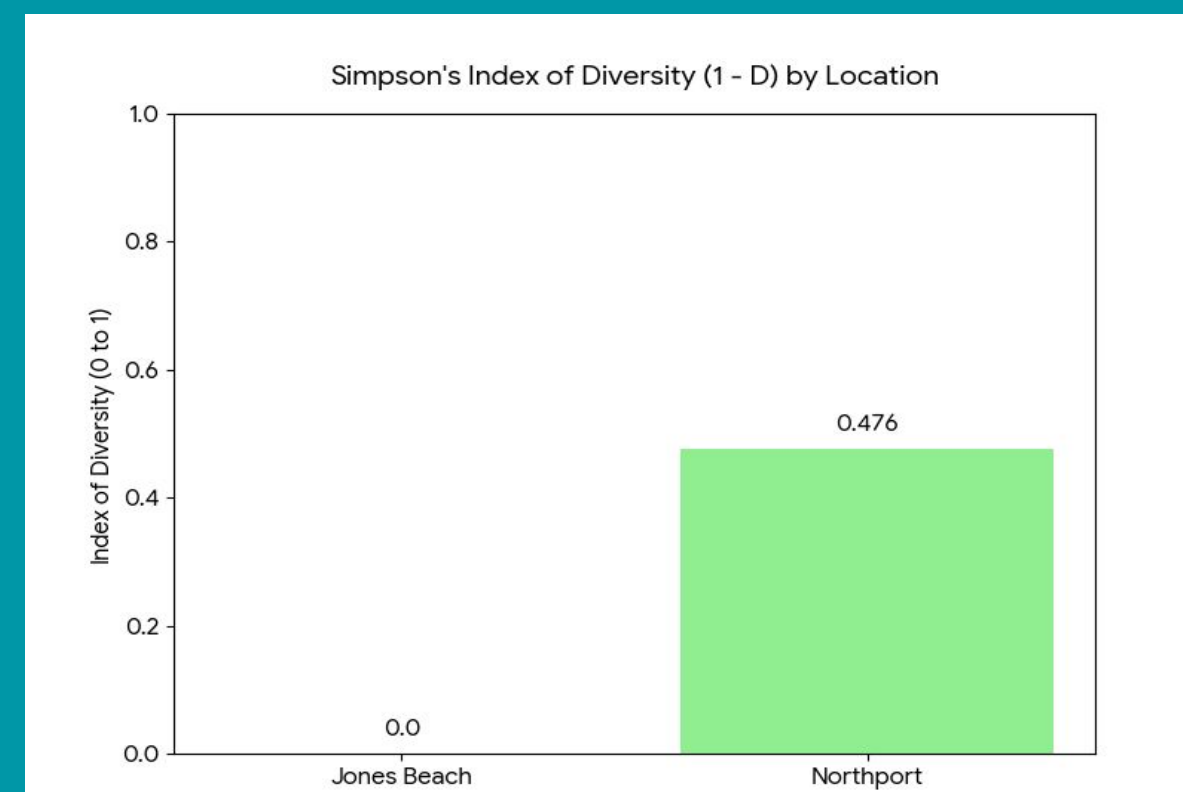


Figure 4. Simpson's Diversity Index bar graphs for Jones Beach State Park and Northport Park

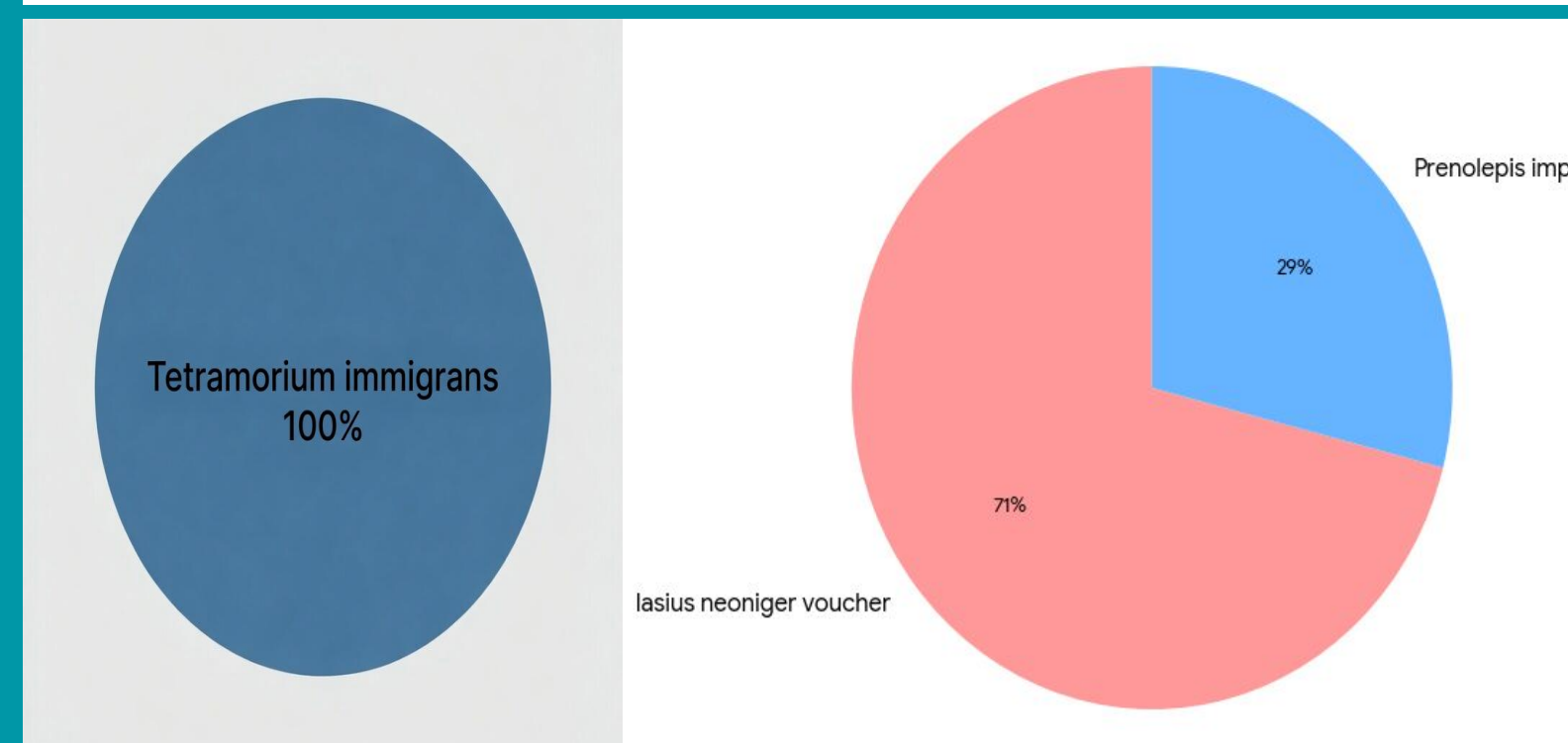


Figure 3. Percentages of ant species within Jones Beach State Park and Northport Park respectively.



References

Abstract

Ants are a diverse group, with over 15,000 known species across the world. Long Island provides an interesting location to examine ant diversity due to its variety of soil types, from rocky soil on the North Shore to sandy on the South Shore. This study investigated whether soil composition impacted ant species richness. Ants were collected from Northport Park and Jones Beach State Park via pitfall traps. Two different species of ants were found on the North Shore and a single species on the South Shore, showing Simpson's Diversity Indices of 0.476 and 0.0, respectively, which may imply that soil composition of the North Shore allows for a diverse spread of ant species to inhabit it making it more resilient to environmental stressors. However, due to the small sample sizes increased diversity in North Shore soils cannot be conclusively determined.

Discussion

Greater diversity was found in Northport, as expected in the hypothesis, though this is based on a small sample size that must be replicated on a larger scale. These results imply that the soil composition of the North Shore allows for a diverse spread of ant species to inhabit it, in contrast to the South Shore, making it more resilient to environmental stressors due to its richness of species.

These results are important because they provide evidence for how the local geology (soil composition) on Long Island affects the ecosystem. It confirms that soil texture is a factor in the distribution of life which can help inform urban planners and environmentalists which areas require more protection or which species hold a greater ability to thrive in specific soil types. Soil components are more important in ant diversity than plants in a relative area (Boulton 2005).

There were a few sample collection errors that may have resulted in less valid results. Some of these issues included improper storing of samples and the subsequent need to recollect from locations. Lack of specification between group members left room for error with trap locations, leading to a large number of one species collected and lack of variety. The traps in Northport Park were more spread out than the ones at Jones Beach. Finally, our original experimental design included a third location at Eisenhower Park to represent the middle of Long Island between both shores, but no samples were collected successfully from that location, leading to the elimination of that location from our study.

In the future, more locations on each shore should be added for both Nassau and Suffolk counties. This could show more diversity across Long Island west to east rather than just north to south.

Acknowledgements

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