Observing the Relationship Between Fungal and Plant Species Diversity Across Parks in New York City

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Introduction

Plant biodiversity is crucial as it contributes to the equilibrium of all ecosystems, ensures food and medicine security, and regulates our climate. Without it, we surely would not be able to sustain life on Earth. Urban green spaces play a pivotal role in the fostering biodiversity of all kinds of organisms, such as plants and fungi. Fungi can negatively and positively affect plants. While they play a crucial role in nutrient cycling and plant symbiosis, some fungi are plant pathogens that can cause diseases to plants, leading to a decrease in plant diversity (Li, 2020). Previous studies have revealed that plant productivity, which is intercorrelated with plant diversity, showed a weak positive relationship with fungal diversity (Yang, 2017). We are interesting in investigating if we could see a similar correlation between plant and fungi diversity. Others have reported that urban green spaces, like Central Park, sustain biodiversity akin to natural ecosystems, revealing a potential for high fungal and low plant diversity coexistence (Kelly et al., 2014). With continued inconsistent correlations between fungal and plant diversity prevailing, we aimed to investigate whether similar patterns would emerge in urban environments. Our research aims to investigate the relationship between fungi and plant diversity in one of the biggest metropolitan cities, New York.

Question & Hypothesis

- **Is there a correlation between high fungal diversity and lower plant diversity in parks within NYC?**
- **Parks with higher fungal diversity will exhibit lower plant diversity compared to parks with lower fungal diversity.**

Methods

We retrieved park size information from NYC Open Data and organized parks by borough, and then sorted by size. A limit was established to exclusively analyze parks with a size of 15 acres and larger, since larger parks could have a more diverse range of species. We used Microsoft Excel to generate random samples of 8 parks from each borough. In total, 40 parks were selected to be part of our research.

We extracted plant and fungi biodiversity information from the iNaturalist platform, a nonprofit social network of naturalists, citizen scientists, and biologists built on the concept of mapping and sharing observations of biodiversity across the globe. We applied the Research Grade filter, which reported species identifications that were in consensus by a majority of observers, at least 2/3 of users leaving an ID.

Results

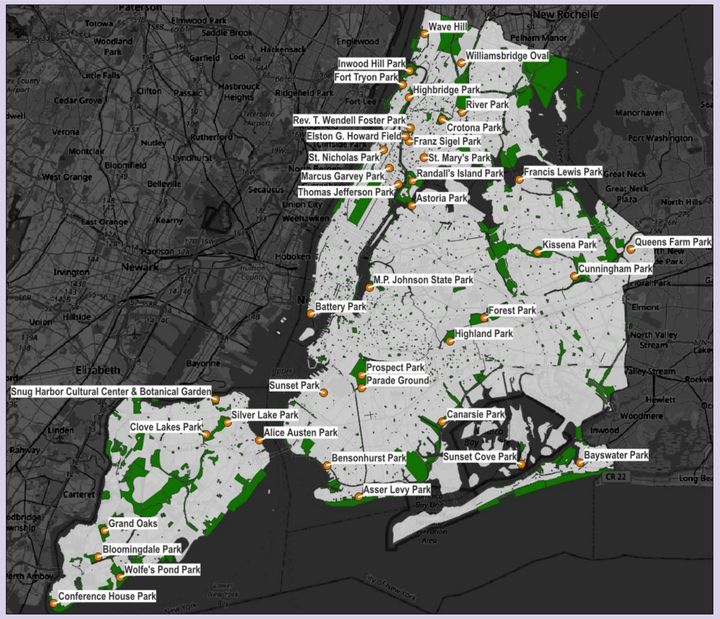

Figure 1: Map of NYC parks (green). Parks with labels were the 40 included in the study. Source: NYC Open Data

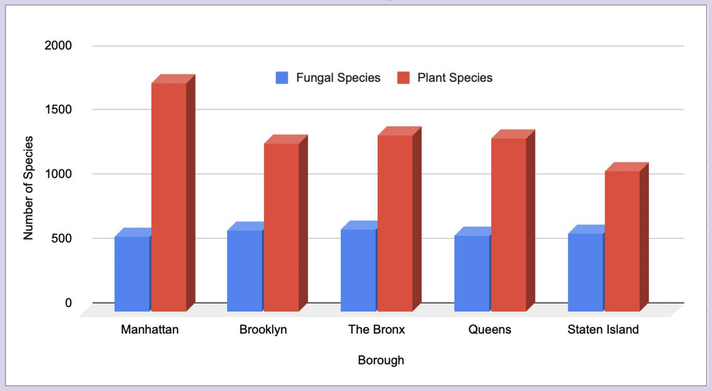

Figure 2: An overview of plant and fungi diversity across the five boroughs.

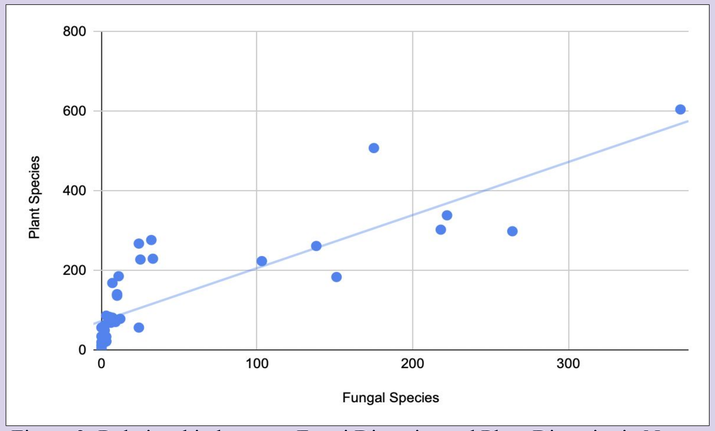

Figure 3: Relationship between Fungi Diversity and Plant Diversity in New York City Parks assessed by analyzing 40 parks across the five boroughs. R=0.84 (strong positive relationship).

Conclusion

- Parks with greater levels of fungi diversity do not seem to have a negative impact on plant diversity as we originally suspected.
- Our results showed a strong positive correlation (R=0.84) between fungal diversity and plant diversity in New York City parks. Correlation, of course, does not necessarily equate to causation, but it is apparent that parks with increased species of fungi also show increased plant species.
- We were surprised to see similar amounts of fungal and plant diversity per borough, considering how different the five are in size. We are unsure what impacts borough size has on fungal and plant diversity, since the surrounding land use outside these parks widely varies between borough.
- Many parks, especially those smaller than 50 acres, recorded little to no research-grade fungi. For our experiment, these areas appeared as fungi-deserts. However, it is highly unlikely that these parks are fungal deserted. It is more plausible that iNaturalist observers have not yet covered these parks for fungi diversity. An issue that may skew the data towards lower fungal diversity in smaller parks.

Future Work

In future investigations, the research can delve deeper into the temporal dynamics of fungal and plant diversity, conducting longitudinal studies to unveil seasonal or yearly variations in their correlation. This question builds on our result because given the unexpected nature of our recent findings, it is essential to investigate if fungal and plant diversity is influenced by any other factor. The goal of this research is to offer a more thorough comprehension of the fundamental processes influencing these ecological communities' temporal dynamics. Additionally, we could investigate the specific fungal species present in the parks and their potential effects on plant diversity. A more detailed exploration of specific fungal species, employing advanced molecular techniques like DNA sequencing, would enhance our understanding of microbial community dynamics. Investigate the soil characteristics in parks with varying levels of fungal diversity. We could explore the potential impacts on local ecosystems, including pollination services, soil stability, and overall ecosystem health. Understanding these broader ecological implications can highlight the importance of maintaining plant and fungal diversity.

Work Cited

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