A Comparison of the Environment Quality and Lead Levels in Black Rock Forest and Central Park

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Abstract

Mushrooms serve as valuable indicators of environmental quality due to their sensitivity to soil conditions and their ability to accumulate heavy metals from contaminated environments. This study focuses on the pH level and lead concentration of soil, with a target lead level of less than 50 ppm and an optimal pH range of 6.0 to 7.0 for soil suitability. Mushroom specimens were collected from Black Rock Forest and Central Park, revealing significant differences in pH and lead levels between these environments. The objective of this research is to assess the role of environmental factors, including temperature and pollutants, on fungal communities. Fungi play vital roles as decomposers, mutualists, and bioindicators, making them crucial for understanding ecosystem health. Samples from Central Park, situated in the heart of Manhattan, and Black Rock Forest, a suburban area, are compared to explore the impact of population density on environmental pollution and genetic diversity. The findings suggest that fungal communities are sensitive to environmental changes and can serve as reliable indicators of pollution levels in different ecosystems. This study contributes to our understanding of the relationship between human activities, environmental quality, and fungal biodiversity.

Introduction

Mushrooms as a fungi indicator in the environment have different sensitivity to the quality of soils. As the soil was contaminated by hazardous chemicals, mushrooms are able to absorb and accumulate heavy metals from soil and water. Due to the different metals mushrooms can absorb, the number and species of mushrooms indicate the soil contamination of one environment. This research focused on the pH level and lead level of the soil. Soil naturally contains lead, and an appropriate lead level should be less than 50 ppm. Soil would be most suitable for planting when it has slight acidity, and the most appropriate pH level is 6.0 to 7.0. The mushroom specimens were collected from Black Rock Forest and Central Park, and the difference in pH level and lead level between these two situations was significant. The objective of this study was to determine the role of environmental variance including temperature and pollutants. As decomposers, mutualists to many species, and bioindicators, fungi are fundamental to the operation of many living systems in nature. Bioindicators are organisms that can be analyzed to make inferences about their environment quality. This study examined the ways that fungi can indicate changes and overall health of its environment, such as pollution levels, specifically air and soil quality. Fungi are particularly sensitive and quick to respond to changes in their environment, so environmental changes will be reflected in the fungi's nature. For these reasons, fungi have been identified as a reliable source to compare pollution in Central Park and Black Rock Forest. Fungi samples were collected from Black Rock Forest and Central Park. Central Park is located in Manhattan, New York.

Materials & Methods

- Fungi Collection
  - 6 samples were collected from Black Rock Forest, NY.
  - 3 samples were collected from Central Park, NY.
- Sample Preservation
  - Samples stored in individual Specimen Containers
  - All samples were frozen at 0°C to ensure their preservation until DNA extraction
- DNA Extraction
  - DNA extraction and analysis performed according to the Urban Barcode DNA Extraction and PCR Protocol

Results

Samples	Species	Location of Samples	Lead exposure risk	pH of soil	Succession of PCR
001	Crepidotus applanatus	Black Rock Forest	**6**	**6.5-7.5**	Failed
002	Flammulina velutipes	Black Rock Forest	**6**	**6.5-7.5**	Worked
003	Oyster Mushroom	Black Rock Forest	6	**6.5-7.5**	Failed
004	Hygrocybe flavescens	Black Rock Forest	6	**6.5-7.5**	Sample discarded
005	Boletopsis leucomelaena	Black Rock Forest	6	**6.5-7.5**	Worked
006	Fly agaric	Black Rock Forest	6	**6.5-7.5**	Worked
007	Crepidotus applanatus	Central Park	10	5.6	Failed
008	Flammulina velutipes	Central Park	10	5.6	Failed
009	Oyster Mushroom	Central Park	10	5.6	Sample not processed

Figures

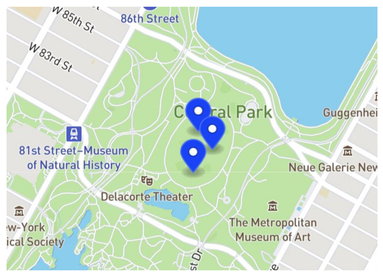

Image 1: Location of (left) Central Park samples and (right) Black Rock Forest samples.

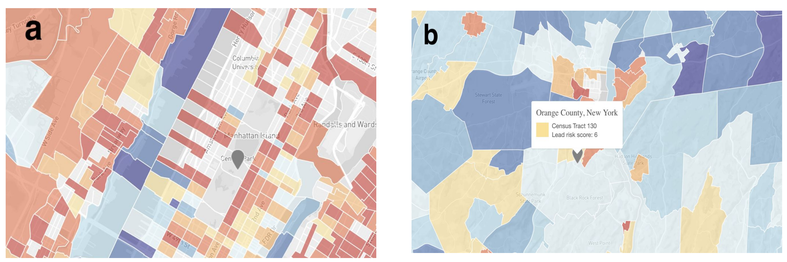

Image 2: (a) Color map of lead exposure risk in NYC and (b) in Cornwall, NY, near Black Rock Forest.

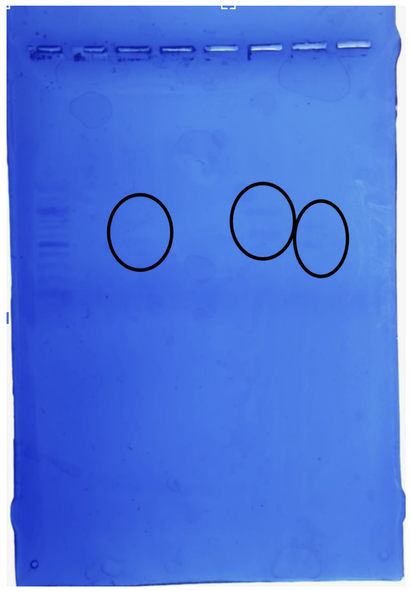

Image 3: Electrophoresis gel following PCR Amplification and gel stain.

Discussion

According to Atlas Specific Environmental Robotics, optimal soil pH for plant cultivation, specifically mushrooms, is 6.0 to 7.0 ("7 Factors, 2023). The pH of the soil that the mushrooms were collected from in Central Park however, was noted by Soil Series to be 5.6 while the soil in Cornwall, where Black Rock forest is located, has a pH level of 6.5-7.5 (*Cornwall Soil*, 2004). Seeing as the soil in Central Park is less fit for the cultivation of mushrooms, it can be inferred that the DNA of the mushrooms in Central Park have altered and would inherently be different from the DNA of the mushrooms in Black Rock Forest to better fit the harsher environment that it is in. This fact can also be exhibited with the use of lead exposure risk of the soils in both Central Park and Cornwall (where Black Rock Forest is located). It is noted that, as seen in Table 1, the lead exposure risk of soil in Central Park 10 while in Black Rock Forest, the lead exposure risk is 6, with 10 being the highest level of exposure risk and 0 being the least (Frostenson & Kliff, 2016). As a result, it can be concluded that compared to Black Rock Forest, Central Park is not the ideal place to grow mushrooms and this would be represented through the DNA of the samples collected from both places.

Conclusion

Despite efforts during DNA sequencing, the anticipated sequences could not be attained, primarily because the gel electrophoresis following PCR failed to conclusively demonstrate the presence of DNA. Had the sequences been attained, they would have played a crucial role in determining lead levels in the environment. While this particular study did not yield the expected outcomes, it served as a valuable learning experience and highlighted the complexities inherent to scientific inquiry.

Reference & Acknowledgements

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Citations:

(Scan Q.R. Code for access to citations)