

Abstract

This study aimed to assess the effects of air pollution on biodiversity by comparing the biodiversity of bryophytes in an urban area (Central Park, New York City) and a suburban area (Davis Johnson Park, Tenafly, NJ). Bryophytes were chosen as indicators of air pollution due to their sensitivity to changes in their environment and reliance on air to obtain nutrients, as they lack roots and are therefore less affected by water and soil pollution. A total of 20 moss samples were collected, and DNA barcoding was performed to determine the species. The Simpson's index of Diversity Formula was used to calculate biodiversity scores. The results showed that Davis Johnson Park exhibited greater biodiversity (D = 0.96) compared to Central Park (D = 0.71), supporting the hypothesis that areas with higher air pollution levels have reduced biodiversity. The findings underscore the importance of addressing pollution to protect Earth's ecosystems. However, the study had limitations, including a small sample size and limited species identification. Replicating the study with a larger sample size and considering additional organisms would enhance the comprehensiveness of future investigations. Ultimately, these results contribute to understanding the relationship between air pollution and biodiversity, emphasizing the need for pollution mitigation and conservation efforts in urban areas.

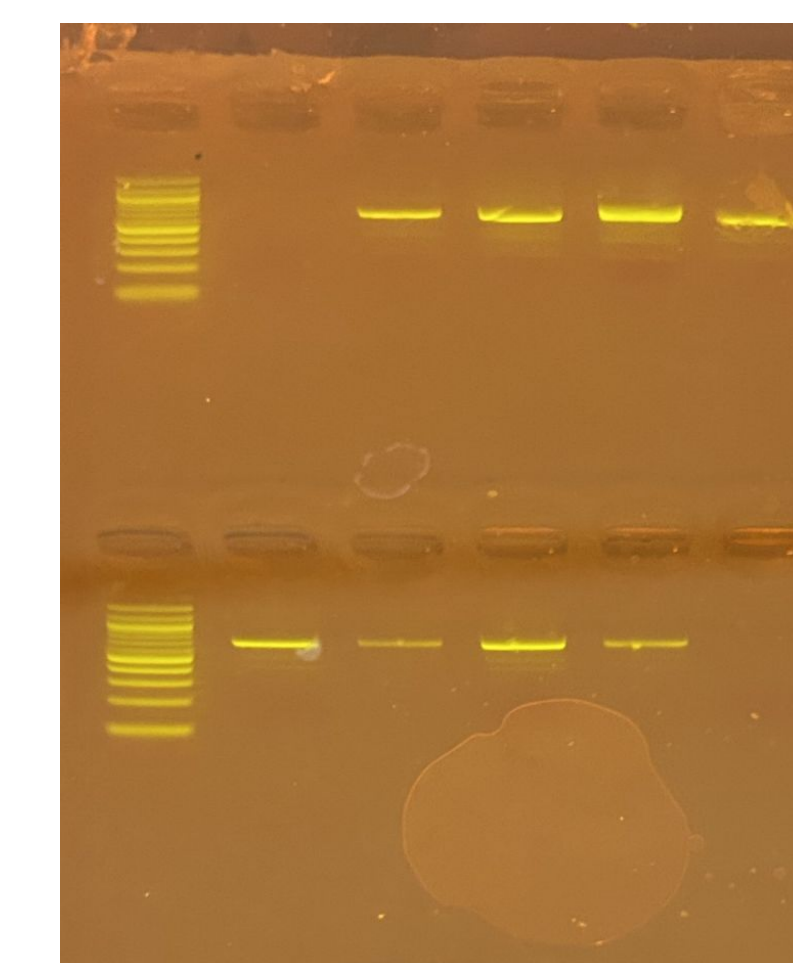
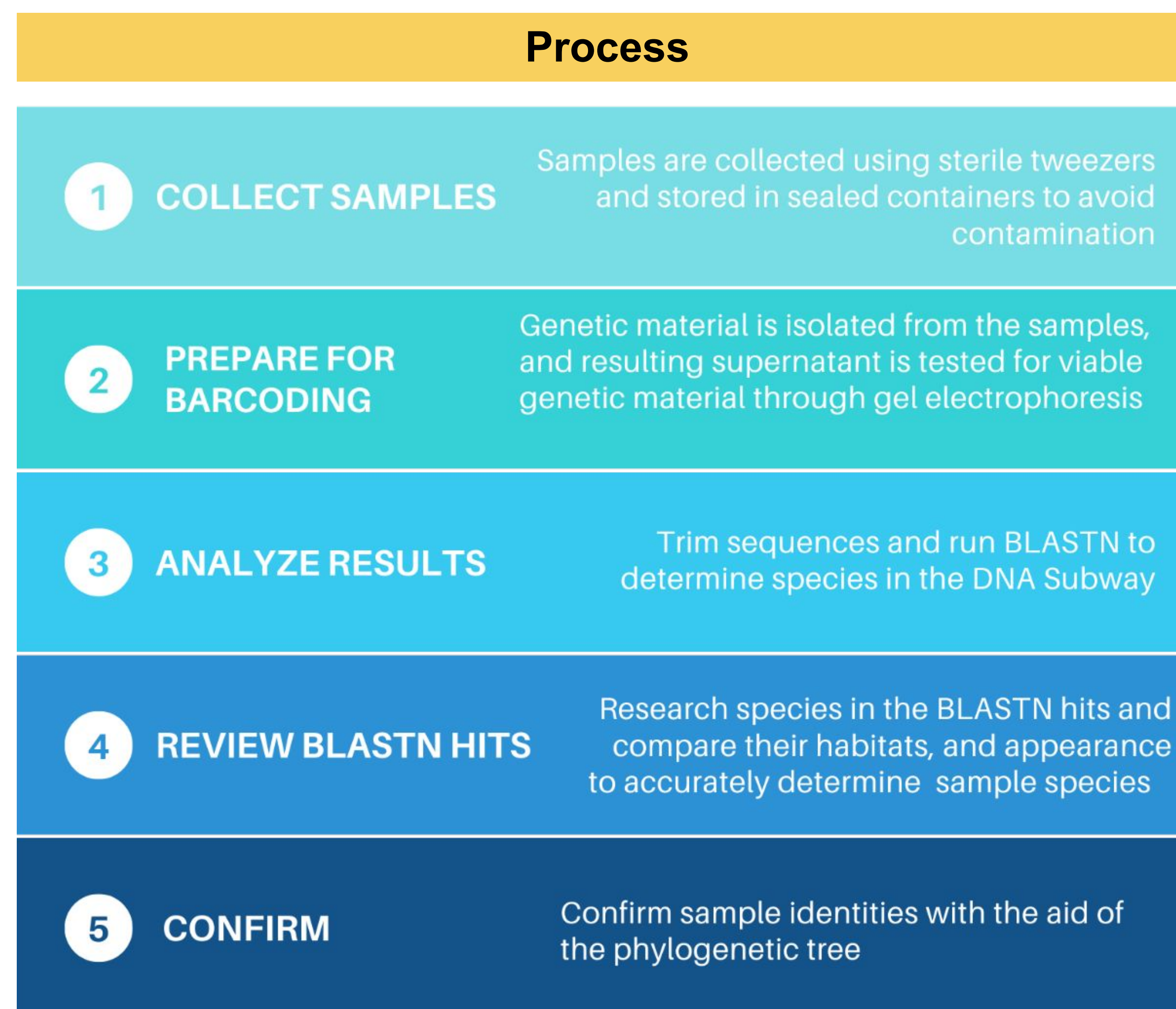
Introduction

- New York City is one of the most populous cities in the United States at about 8.5 million people [1]. In contrast, Tenafly, NJ is a suburb of New York City with a population of approximately 15,000 people [2].
- New York City is far more densely populated than Tenafly [3,4] and therefore has more sources of pollution, specifically air pollution, concentrated in a specific area, leading to worse air quality [5].
- As the world continues to become more urbanized, air pollution levels, along with other types of pollution, are projected to rise in the coming years [6]. This could pose a serious threat to the biodiversity of Earth's ecosystems as air pollution, and pollution in general, can cause reduced biodiversity [7]. This is especially concerning as biodiversity is a key factor in maintaining the health and quality of the ecosystems [8].
- We assessed the impact of air pollution on biodiversity examining the biodiversity of bryophytes in Central Park, Manhattan, and the Davis Johnson Park in Tenafly, NJ.
- Bryophytes are ideal indicators of air pollution and air quality as they lack roots as a result, they must absorb all water and nutrients from the air and are less affected by water and soil pollution [11].

Using DNA Barcoding to Compare Biodiversity of Urban and Suburban Settings -Understanding the Effects of Air Pollution on Biodiversity

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Methods



Results

Final Species	
KRD - 002	Entodon seductrix
KRD - 003	Anomobryum filiforme
KRD - 004	Brachythecium plumosum
KRD - 005	Entodon seductrix
KRD - 006	Pylaisia polyantha
KRD - 007	Brachythecium buchananii voucher
KRD - 008	Hygroamblystegium varium
KRD - 009	Plagiomnium cuspidatum
KRD - 013	Hygroamblystegium varium
KRD - 014	Brachythecium buchananii
KRD - 015	Plagiomnium cuspidatum
KRD - 016	Atrichum undulatum voucher
KRD - 017	Plagiomnium cuspidatum
KRD - 018	Plagiomnium cuspidatum
KRD - 019	Plagiomnium cuspidatum

	DAVIS JOHNSON	CENTRAL PARK
n (number of species)	7	4
N (number of samples taken)	8	7
Simpson's Index of Diversity Score	0.96	0.71

Results (cont.)

Once we determined the species of our samples, we used the Simpson's index of Diversity Formula to calculate the biodiversity scores for each location. We used the formula $D = 1 - (\sum n(n-1) / N(N-1)) [5]$ with "n" signifying the total number of organisms of each species of bryophytes and "N" signifying the grand total of all the bryophyte samples we collected. The scores that Davis Johnson Park and Central Park received were 0.96 and 0.71, showing that Davis Johnson park's bryophytes had greater biodiversity, and supporting our initial hypothesis.

Conclusion/Discussion

- The collected data supports our initial hypothesis that the suburban area of Tenafly, with lower pollution levels, exhibits greater biodiversity compared to the urban center of New York City.
- This finding holds significant importance in the light of the anticipated rise in air and other pollution due to global urbanization, which poses a serious threat to Earth's biodiversity [6][7]
- However, it is important to acknowledge the limitations of this study. One being the relatively small sample size, as only around 20 moss samples were collected, and species identification was possible for only 15 of those samples. Replicating this study with a larger sample size would provide more comprehensive results. Additionally, expanding the scope of the study to include other organisms such as lichens would enable a more comprehensive assessment of biodiversity differences between the two locations and allow for comparisons with the bryophyte data.
- Nevertheless, our data establishes a correlation between higher air pollution levels and decreased biodiversity, thus proving our hypothesis.

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