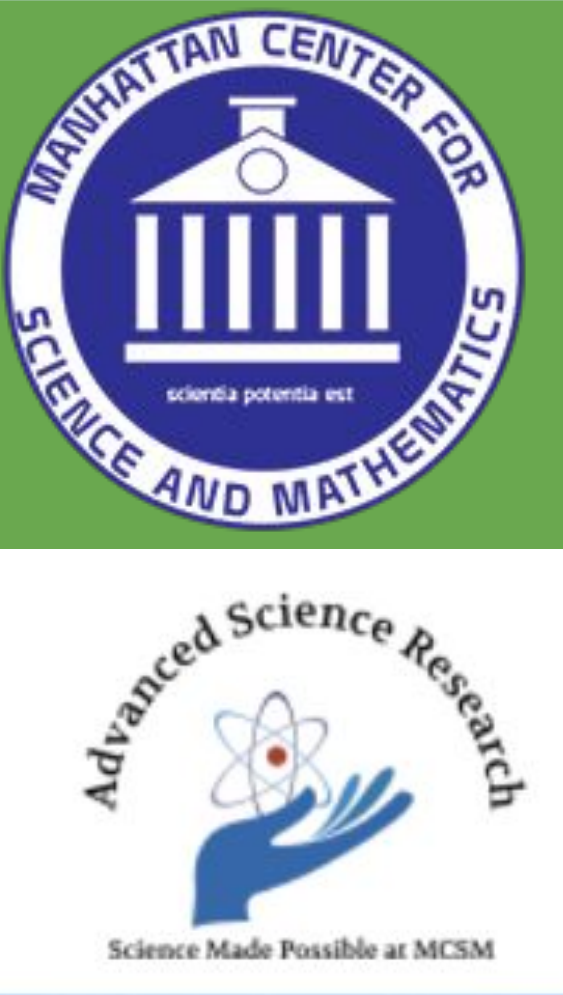# The Impact of Invasive Species on Biodiversity in NYC

Raymilka Rodriguez[1], Rosaura Pantaleon[1], Shiva Karmakar[1], Sadie Waldron[1]

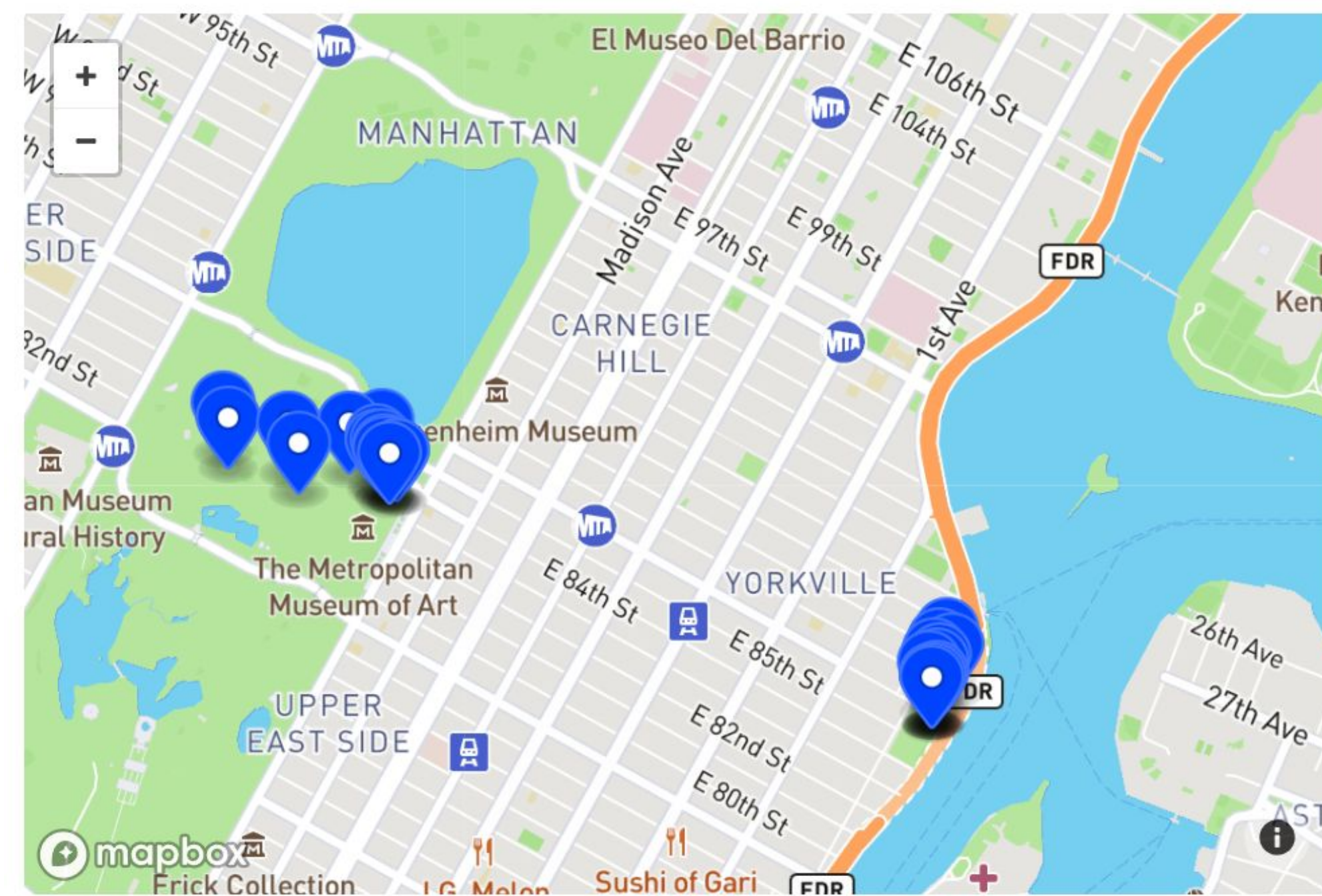[1]Manhattan Center for Science and Mathematics

## Abstract

Identification of invasive species is important in any environment since they tend to harm existing biodiversity. Due to their nature, these species feed off the resources for the species present in the ecosystem causing instability. We believe a large amount of invasive species present in a park will cause low biodiversity because of this disruption. We first collected 30 plant samples from Carl Schurz and Central Park. Next, we extracted the DNA with the silica method and sent the samples off for sequencing. We then identified the species with DNA barcoding and classified them as native or invasive. There was a larger percentage of invasive plants at both parks though Central Park had a slightly higher percentage (75% versus 64.3%). The biodiversity index in Carl Schurz is greater than Central Park (0.01470 versus 0.0137), but both conclude that more invasive species align with a greater biodiversity index, a surprising find.

## Hypothesis

If there is a large number of invasive species present in a park then the biodiversity will be low, because invasive species disrupt ecosystems.

## Introduction

- Biodiversity is very crucial to the environment and humans
- Biodiversity in an urban area tends to be low due to urbanization and industrialization.
- People migrating into urban areas bring invasive species harming other species.
- In order to identify the relationship between invasive species and their effect on the existing biodiversity, we will identify species as invasive or native with DNA barcoding [2]
- DNA barcoding is the process in which DNA is extracted and sent to a lab in order to be identified. This would be conducted by first collecting samples and then analyzing them through DNA barcoding. This will help us to eventually identify the name or the family of the species we collected.



Goals of this study:
- Identify whether the species of plants present at both Carl Schurz and Central Park are native or invasive
- Analyze the relationship between the number of native and invasive species found and plant biodiversity at each park

## Methodology

1. **Collect the samples from two ideal parks in Eastern Manhattan.**
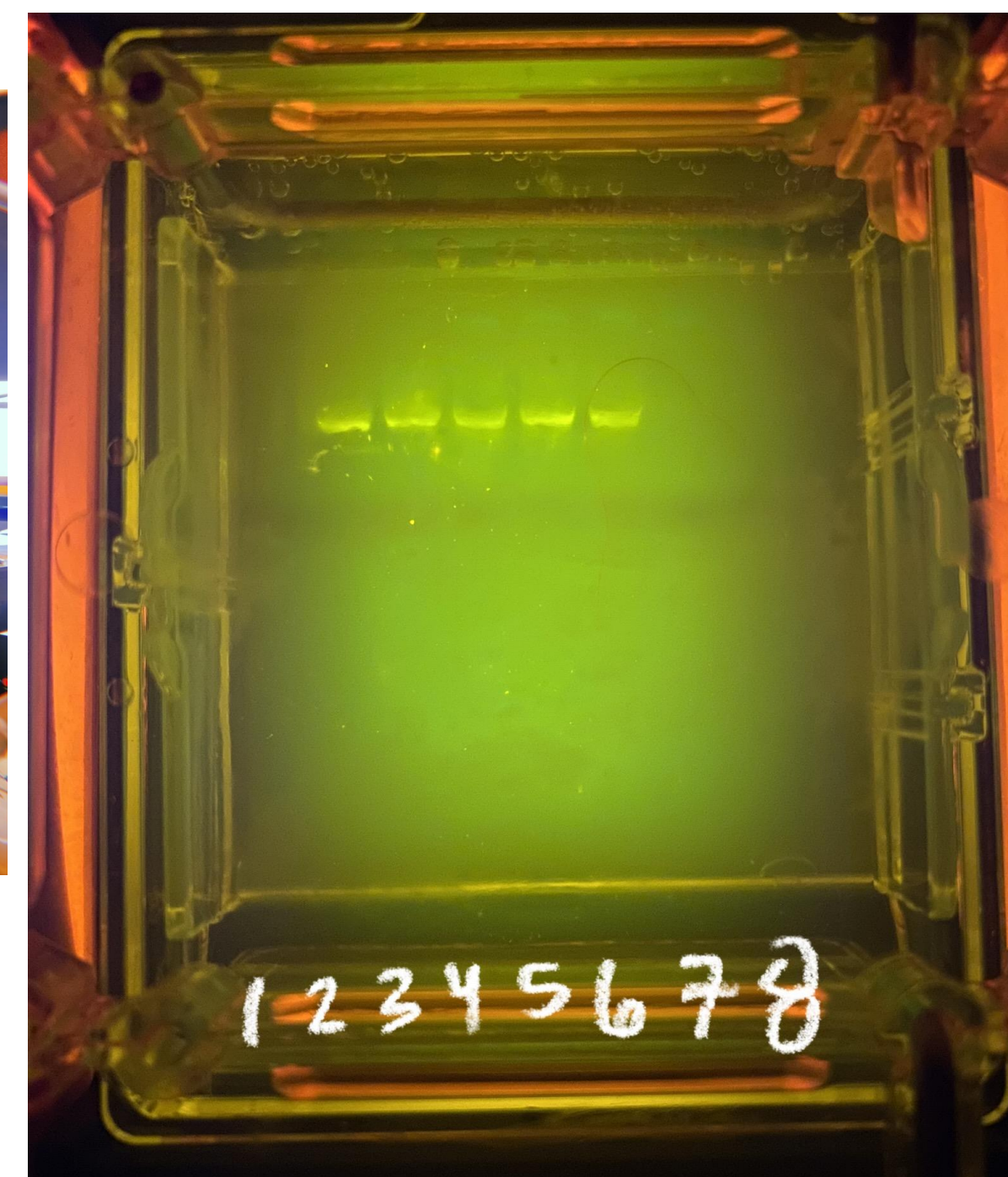


15 samples from Central Park
15 samples from Carl Schurz

2. **Loaded samples into the Barcode Sample Database**

3. **Performed DNA extraction, PCR, and Gel electrophoresis.**
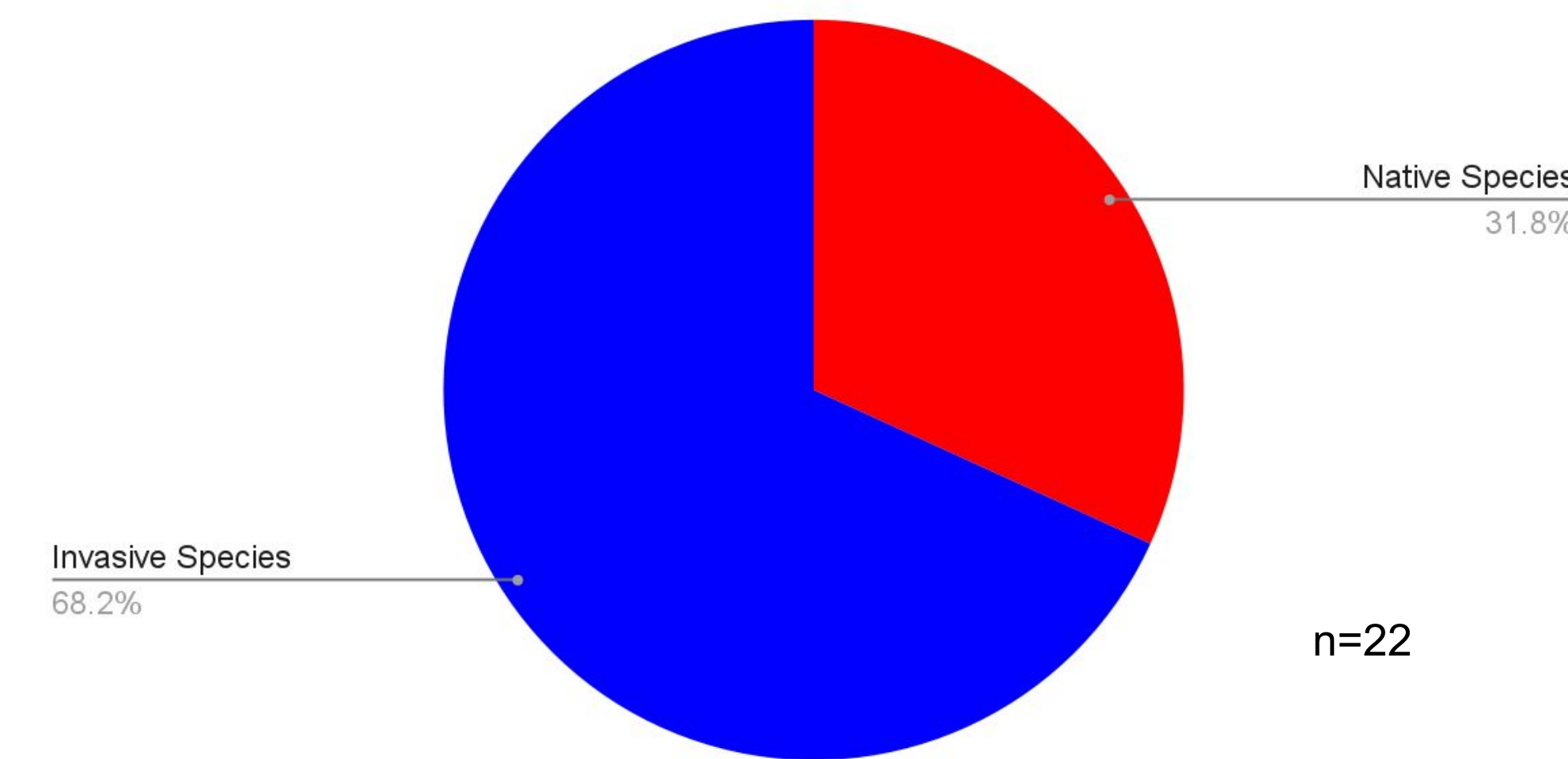


The silica method of DNA extraction.



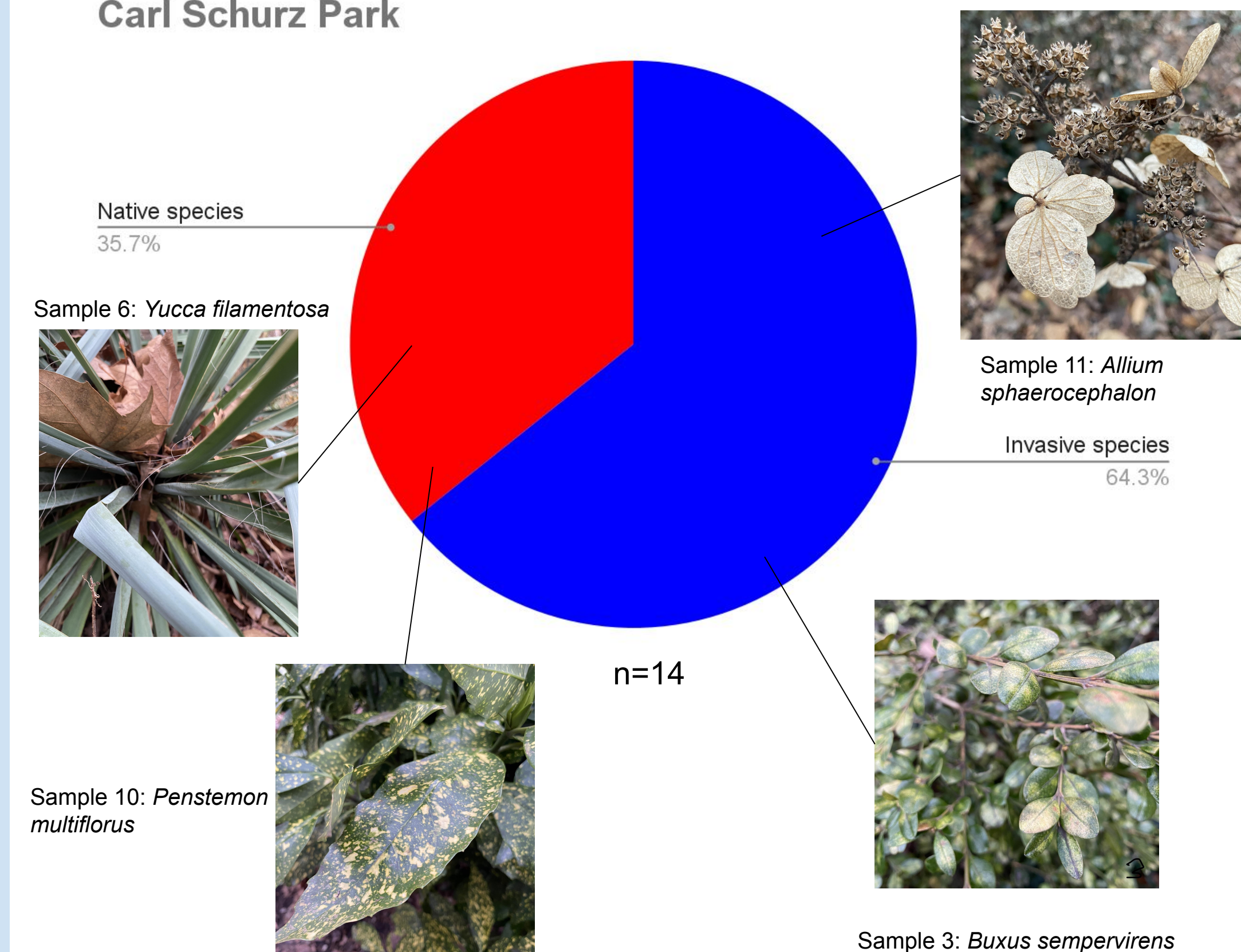One of our gels. Samples 2, 3, 4, 5, and 6 were successful.

4. **Sequenced the successfully extracted DNA through DNA Subway to identify the samples. Then we categorized the species as invasive or native to New York.**
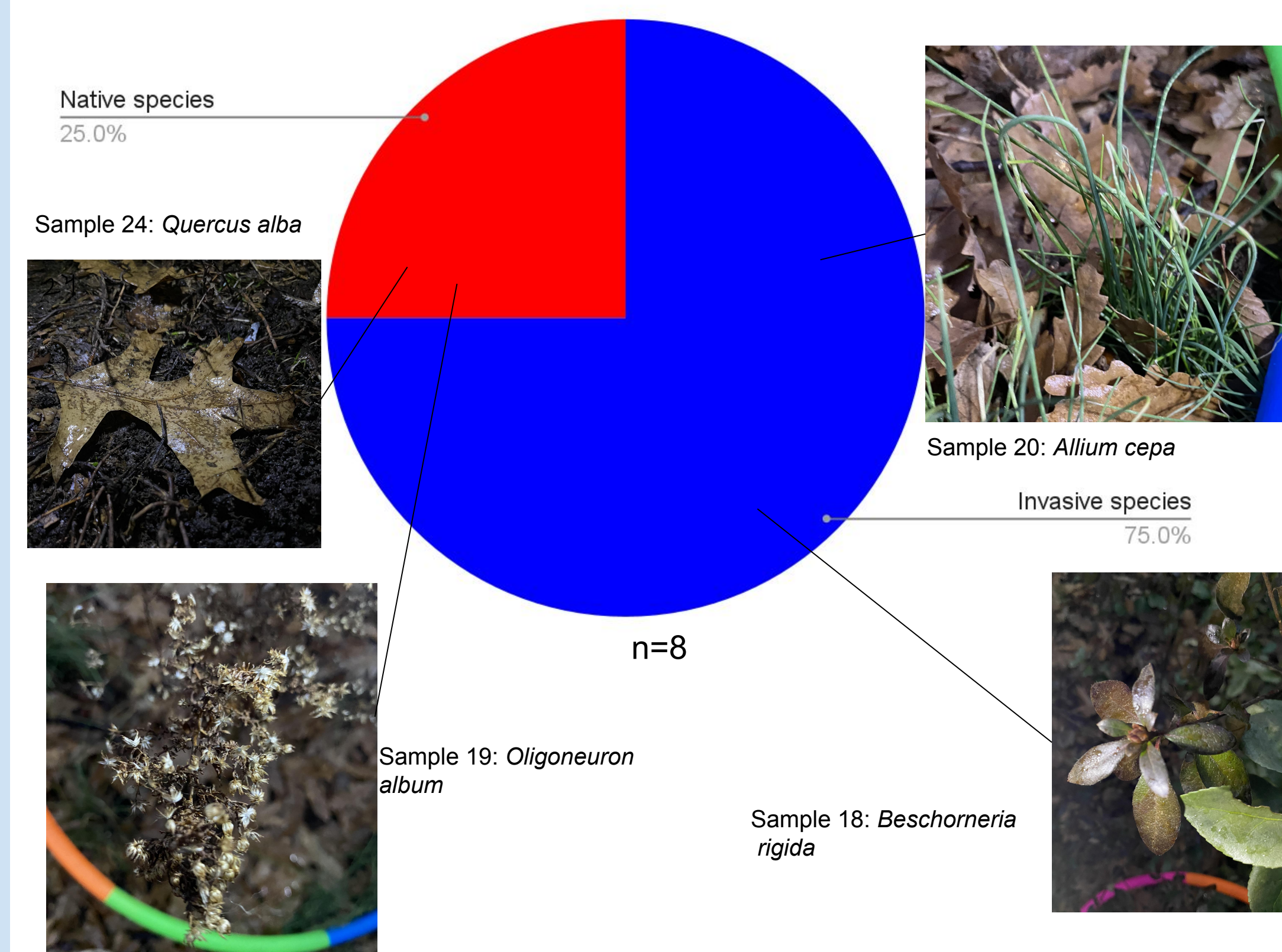
## Results

**Plant Sample Identification from Carl Schurz and Central Park**



Native Species 31.8%
Invasive Species 68.2%
n=22

**Carl Schurz Park**



Native species 35.7%
Invasive species 64.3%
n=14

Sample 6: *Yucca filamentosa*
Sample 11: *Allium sphaerocephalon*
Sample 10: *Penstemon multiflorus*
Sample 3: *Buxus sempervirens*

**Central Park**



Native species 25.0%
Invasive species 75.0%
n=8

Sample 24: *Quercus alba*
Sample 20: *Allium cepa*
Sample 19: *Oligoneuron album*
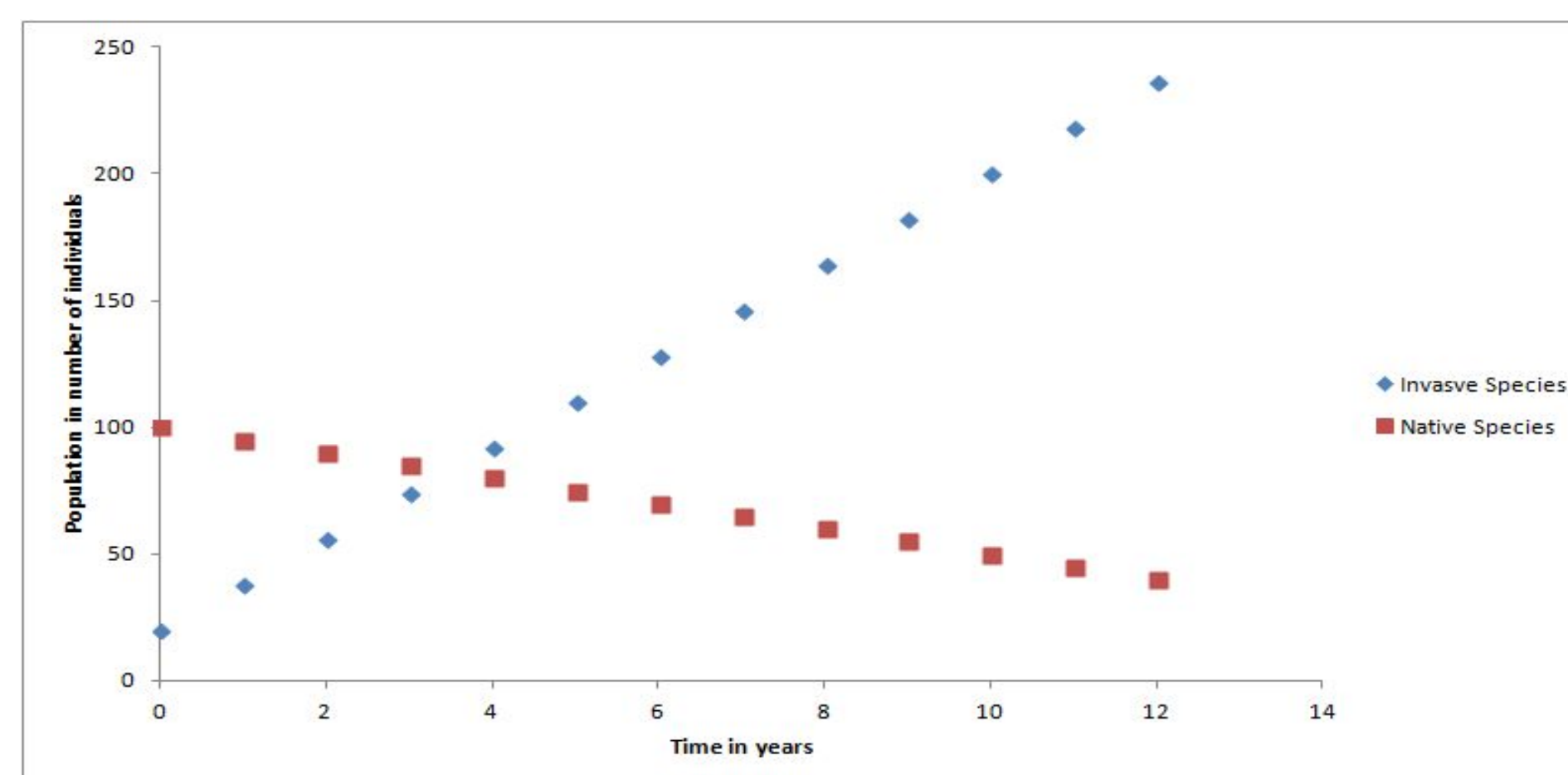Sample 18: *Beschorneria rigida*

## Discussion

- Collectively more invasive than native species within both parks
- Based on iNaturalist, Carl Schurz park has a total of 612 plant species.
  - Biodiversity index=0.01470
- Central Park has a total of 438 species.
  - Biodiversity index=0.0137
- Carl Schurz had a large number of invasive species and a larger biodiversity compared to the biodiversity index of Central Park.
- Based on these biodiversity indexes we can draw a connection between more invasive species and a higher biodiversity index, hence more biodiversity
- We assumed more invasive species meant the ecosystem was less biodiverse since the native species would have been killed off, but our data does not support it

## Next Steps

- Increasing our sample size considerably to increase the success rate of DNA extraction and the validity of our experiment
- Collect samples from other parts of the parks not just the East side
- Collect samples from areas not visibly manicured as they are more likely to include invasive species planted for aesthetics

## References

[1] Andersen, M. C., Adams, H., Hope, B., & Powell, M. (2004). Risk assessment for invasive species. *Risk Analysis*, 24(4), 787–793. https://doi.org/10.1111/j.0272-4332.2004.00478.x

[2] Hebert, P. D., Cywinska, A., Ball, S. L., & deWaard, J. R. (2003). Biological identifications through DNA barcodes. Proceedings of the Royal Society of London. Series B: Biological Sciences, 270(1512), 313–321. https://doi.org/10.1098/rspb.2002.2218

[3] Hulme, P. E. (2009). Trade, transport and trouble: Managing invasive species pathways in an era of globalization. *Journal of Applied Ecology*, 46(1), 10–18. https://doi.org/10.1111/j.1365-2664.2008.01600.x

[4] Martínez-Ramos, M., Ortiz-Rodríguez, I. A., Piñero, D., Dirzo, R., & Sarukhán, J. (2016). Anthropogenic disturbances jeopardize biodiversity conservation within Tropical Rainforest reserves. *Proceedings of the National Academy of Sciences*, 113(19), 5323–5328. https://doi.org/10.1073/pnas.1602893113

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