Forest Heath and Human Involvement: Planted vs Unplanted Sites in Van Cortlandt Park

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Abstract

This project sought to explore the relationship between forest health and human impact, and question whether restoration and management efforts were effective for preserving a healthy forest. We studied data collected in four sites in Van Cortlandt Park; two planted and two unplanted. Forest health indicators such as species diversity and basal area were analyzed from both 2018 data collected by the Natural Areas Conservancy and data collected at a site in the park that was revisited this year.

In comparing the data collected from 2018 we found significant differences in the planted and unplanted sites. All variables, with the exception of midstory native stem count, were not significant between 2018 and 2020. This tells us that in order to understand the impact of humans on forest health, it would be best to wait a longer period of time before revisiting original sites. In spite of the results of the data analysis, human involvement in forest health remains crucial.

Intro

Urban forests provide many important benefits such as recreation, biodiversity support, and improved air and water quality. In particular, New York City's forests are very diverse and dominated by native trees (Pregitzer et al. 2018). Though natural areas management promotes long-term persistence and health of NYC's forests (Simmons et al. 2016), there is a lack of research on management best practices. By first understanding the conditions of NYC's forests, we can then go about implementing management strategies. It is important to do research on these areas in order to figure out the management needs of different forested natural areas and how we can continue to improve the health of different forested natural areas in NYC.

The goals of our project are: (1) to compare forest health between natural areas where management has been conducted, specifically through native tree and shrub planting, compared with unplanted forested natural areas; and (2) to determine whether planted forests remain healthy after management activities are undertaken. Leveraging existing data from 2018 and collecting new data allows us to make connections about forest health and the human interactions with the area. Ultimately, this project will contribute to our understanding of the ways in which human interventions may benefit forest health.

Hypotheses

Compared to the unplanted plots, we hypothesize that the planted plots will have greater species diversity. We hypothesize that the planted plots will be healthier than the unplanted plots, with greater native overstory basal area and greater native midstory stem count, while the unplanted plots will have greater invasive overstory basal area and greater invasive midstory stem count.

Methods Part 1

Our project took place in Van Cortlandt Park where we used the Rapid Site Assessment (RSA), a protocol to characterize forest conditions prior to any restoration, management, maintenance, or monitoring work. Here we compare four sites, two of which are unplanted and the other two were planted with native trees and shrubs in 2011 and 2013 We collected data at one of the planted sites in July-August 2020.

Graphs and Figures

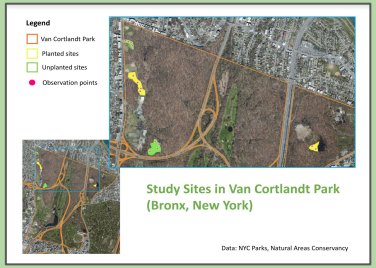

Figure 1: This is a map of Van Cortlandt park with the four sites outlined. There are two different colors showing the planted and unplanted sites, as well as the observation points.

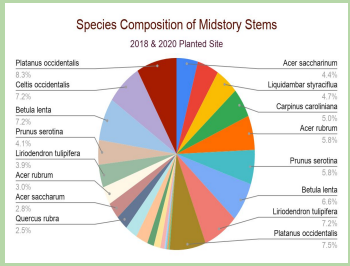

Figure 2: This graph shows the species composition of midstory stems for the site we revisited in 2020 and the data collected at the time of original sampling.

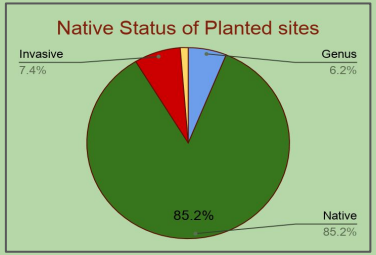

Figure 3: This graph shows the status of the planted sites: there is a greater number of native trees, with a smaller number of invasive stems.

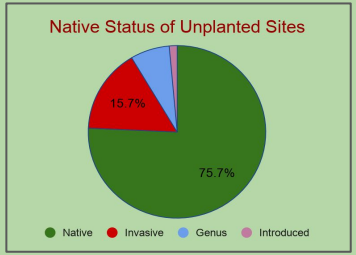

Figure 4: This graph shows the status of the unplanted sites: although there is still majority native trees, there is a greater number of invasive ones.

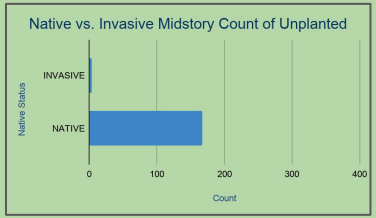

Figure 5: This graph shows the amount of native and invasive midstory stems for the unplanted sites.

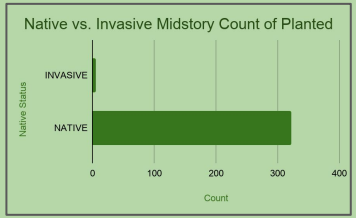

Figure 6: This graph shows the amount of native and invasive midstory stems for the planted sites. There are far more native stems for the planted sites than the invasive ones.

Methods Part 2

We derived the following variables from the RSA data to assess forest health: diversity (Shannon and Simpson indices), native overstory basal area (square meters), invasive overstory basal area (square meters), midstory native stems, and midstory invasive stems. We ran t-tests and two-way permutations for each variable to test for significant differences between the planted and unplanted sites and between data from 2018 and 2020 for the re-sampled planted site.

Results

- The midstory native stem count was significantly greater in 2018 compared with 2020 ($p<0.05$ for t-test and two-way permutation)
- The Shannon Index average for planted plots was significantly greater than the unplanted plots ($p<0.005$ for t-test and two-way permutation).
- The Simpson Index average was significantly greater in the planted plots compared to the unplanted plots ($p<0.0005$ for t-test and two-way permutation).
- The midstory count of invasive plants was significantly greater for unplanted plots compared with planted plots ($p<0.05$ for t-test and two-way permutation).
- The midstory native stem count was significantly greater in planted plots compared with unplanted plots ($p<0.0005$ for t-test and two-way permutation).
- All variables, with the exception of midstory native stem count, were not significant between 2018 and 2020.

Conclusion

Due to data limitations, these results are based on 14 plots located in Van Cortlandt Park. From the midstory stem count in 2018 vs 2020, the only significant data was a decrease in the native stem count which may indicate poor survivorship among planted species. When comparing the data from 2018 to 2020, all other variables were not significantly different between the two years, suggesting that researchers should wait longer than two years before resampling a site.

Both Shannon and Simpson Diversity indices indicate that the planted plots had more species diversity and evenness, suggesting the importance of human intervention in maintaining species diversity and preventing dominance of a single or several species in an ecosystem. Another significant piece of data from the compared plots include the abundance of invasive plants in unplanted sites. This shows how prevalent invasive species are when they are not managed by humans. They tend to out-compete with native species in the area. The last significant data includes the abundance of native midstory stems in planted versus unplanted plots which aligns with prior studies (Simmons et al. 2016). This shows the significance of continuing to build on data as different data sets may reciprocate similar ideas.

Some explanation for inconsistencies in the data may be a result of errors in calculation and sample size. It is also important to have multiple trials to account for any outliers.

The main takeaways from this data is that there are differences in forest health between the planted and unplanted plots but two years between sampling is insufficient to detect ecosystem change. Our data suggest that human involvement is crucial to keep forests healthy, This includes planting trees to even collecting data. It is difficult to track growth in ecology as it can take more than a couple of years, but it is still important to understand the long-term impacts. We hope that this serves as an example for the NAC to show the importance of surveying data through extended periods of time.

Acknowledgments

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