Is there a difference in biodiversity related to light levels at Van Cortlandt Park?

Tasbeeh Alsilwi, Alana Corniel, Kathryn Gioiosa, Aidan Peña

Introduction

Van Cortlandt Park, located in The Bronx, is New York City's third largest park. In New York City, "the city that never sleeps", there is constant light pollution from street lights, cars, stores, homes, and other sources. Many species, including humans, rely on circadian clock cycles, influenced by day and night time, to determine their sleep, metabolism, behavior, and growth (Hölker et al, 2010). Scientists have previously found that light pollution caused by artificial light at night, leads to a decreasing amount of light-sensitive species, a disruption of nocturnal species and pollinators, and cultural ecosystem services, such as the aesthetic view of the sky and stars at night. (Hölker et al, 2010). Scientists have found that light pollution, including low levels of light pollution such as moonlight, has decreased bat species abundance and disrupts their foraging and eating habits (Mariton et al, 2022). **Based on these previous findings, our hypothesis is that light pollution does impact biodiversity within Van Cortlandt Park as there will be more species in the interior of the park compared to the exterior of the park.**

Methods

All data was acquired through iNaturalist, a citizen science platform where users share observations of plants and animals. It functions as a community-driven database. We used the proxy that exterior sections would have higher levels of light pollution compared to interior sections when gathering our data. Figure 1 contains total observation of the park. Figures 3 and 5 show examples of how we sampled observations on interior and exterior sections of the park. This was done using tools from iNaturalist in which a small circle can be moved to show only observations within this region. This tool was used to acquire 7 sections along the edge and along the interior of Van Cortlandt as depicted in the graphs. The data from each map has its own graph, which shows the number of observations of different taxonomic groups throughout the past 6 years (2018-2023). The circular sections are rough estimates and distributed so that they don't overlap. In our investigation of the potential correlation between light pollution and biodiversity, we employed the t-test. This tool helps assess whether observed differences in biodiversity between interior and exterior locations are statistically significant.

Figures

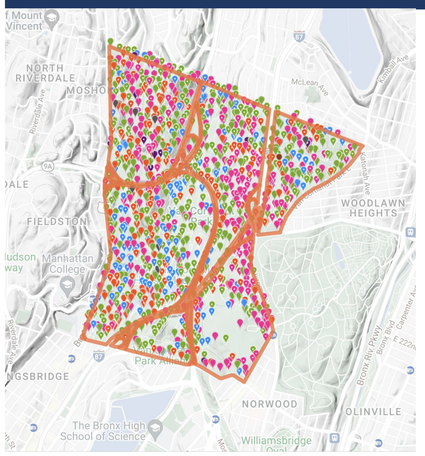

Figure 1. INaturalist Map indicating all observations of biodiversity within Van Cortlandt Park.

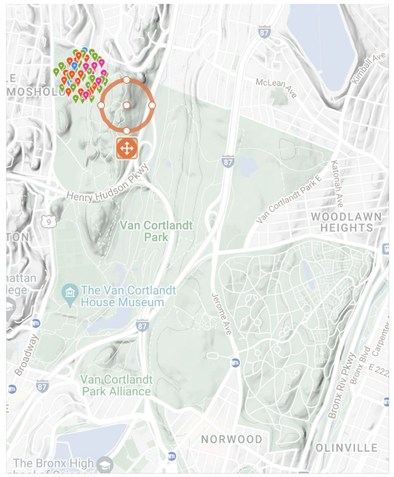

Figure 3. 7 individual sections along the edge of the Park where collected as "exterior" data using a tool that captures a circular area of observations. These sections were captured by placing adjacent circles along the edge of the park

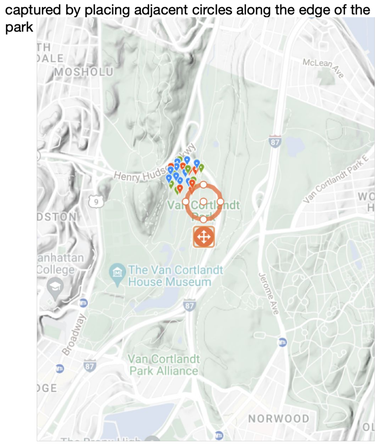

Figure 5. 7 individual sections along the interior of the Park where collected as "interior" data using the same tool discussed in figure 3.

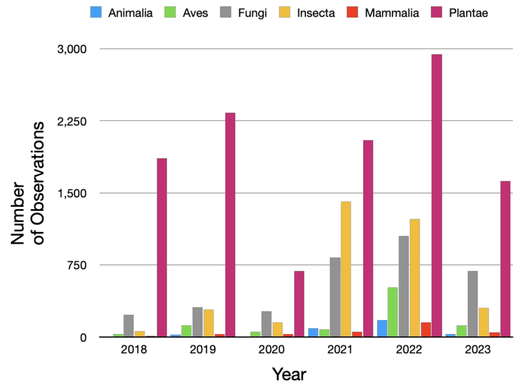

Figure 2: Total Park Observations- Depicts the number of organisms of different taxonomic groups observed in Van Cortland Park throughout the past 6 years.

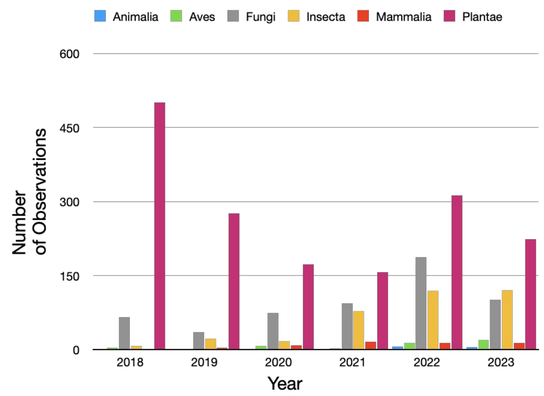

Figure 4: Exterior Park Observations- Shows the number of organisms of different taxonomic groups observed in exterior sections of Van Cortland Park throughout the past 6 years as well as trend lines for each group.

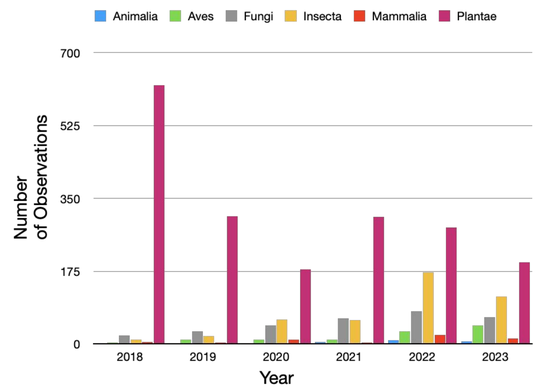

Figure 6: Interior Park Observations- Depicts the number of organisms of different taxonomic groups observed in interior sections of Van Cortlandt Park throughout the past 6 years.

Results

The t-value calculated was -0.08, and the corresponding p-value was 0.93. These results indicate that there is no significant difference in biodiversity between the interior and exterior areas of the park. In other words, the observed differences in biodiversity between interior and exterior locations are likely due to random chance rather than a systematic relationship with light pollution. Therefore, at the 0.05 significance level, we do not have enough evidence to reject the null hypothesis, which states that there is no significant correlation between light pollution and biodiversity in the park.

Conclusion

Our hypothesis was not supported. Light pollution has no relationship with biodiversity. The data supports the fact that there are other variables and factors that influence the decrease of plant observations. Such factors include construction, trampling, bad soil quality, and the decrease of water availability. Given the assumption that the interior of the park would have less light pollution, the data does not support the idea that light pollution would disrupt animals and plants behaviors, which would ultimately hinder their ability to grow and reproduce.

Future Work

Future studies should examine the dynamics between light pollution and wildlife behavior as well as plant growth. It should also investigate the ways in which specific thresholds of light pollution could be detrimental to wildlife and plant growth. Lastly, future studies should explore the impact of the variables that affect the decrease of biodiversity, such as trampling, construction, soil quality, and water availability.

Works Cited

1. Hölker, F., Wolter, C., Perkin, E. K., & Tockner, K. (2010). Light pollution as a biodiversity threat. Trends in Ecology & Evolution (Amsterdam), 25(12), 681–682. https://doi.org/10.1016/j.tree.2010.09.007
2. Mariton, Kerbiriou, C., Bas, Y., Zanda, B., & Le Viol, I. (2022). Even low light pollution levels affect the spatial distribution and timing of activity of a "light tolerant" bat species. Environmental Pollution (1987), 305, 119267–119267. https://doi.org/10.1016/j.envpol.2022.119267