Exploring the Effects of Park Management on Species Richness in New York City Parks

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Introduction

With over 22 million residents, it's no surprise that the local wildlife of New York City parks is greatly affected by the influences of urbanization.[1] One such influence is that of human maintenance within the many parks scattered around the metropolis; park areas range from the near completely undisturbed to the heavily managed. The question, then, arises: how does park management, or lack thereof, actually influence the species richness of the wildlife in those areas?

Species richness refers to the amount of different species in a given area. For the purpose of this study, species richness of trees, small mammals, and carrion beetles was compared across managed and unmanaged sites. Plants in managed sites tend to receive more rigorous maintenance as a result of human input.[2] Conversely, unmanaged sites are often more abundant in undisturbed vegetation, which provides ample shelter to small mammals.[3] Carrion beetles live on the corpses of small mammals left to rot within the parks, and they make quick work of the body, reducing it to a skeleton in just hours. Prior studies have demonstrated a host preference of certain beetles to specific animals, so a mammalian species rich area may yield more food and shelter to these decomposers.[4] Overall, due to the lack of anthropogenic pressure, we expect that unmanaged sites will have a greater species richness of trees, small mammals, and carrion beetles.

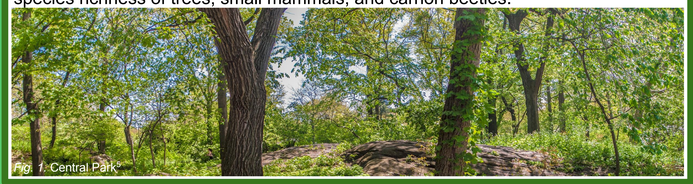

Fig. 1. Central Park

Methods

Selecting Sites

- We used 4 different NYC parks: Central Park, Inwood Hills Park, Highbridge Park, and Pelham Bay Park.
- Between the four parks, we selected 6 sites. 3 were considered "managed" and the others "unmanaged" based on visual observation and prior knowledge.

Tree Species Richness

- At each site, we used a transect to establish a four meter radius.
- Trees that grew to chest height (approximately 4' 6'') or above were identified using tree field guides as well as iNaturalist, a mobile identification network.

Small Mammal Species Richness

- We placed and baited one track tube with uncooked oats at each site; they were re-baited on a weekly basis and checked for mammal prints 24 to 48 hours after being set.
- We removed the contact paper bearing the prints from the tube and treated it with hairspray to seal the ink for future identification.
- We identified small mammal prints with mammal field guides.

Fig. 2. Raccoon Print

Carrion Beetle Species Richness

- At each site, we hung one hanging beetle trap from a branch and baited it with a piece of chicken approximately 4 cm in length and 1.5 cm in width.
- We checked traps for carrion beetles one week after they were baited.
- We collected and identified beetles using an insect field guide and dichotomous keys.

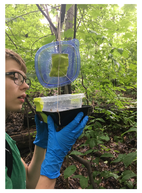

Fig. 3. Student checks beetle trap

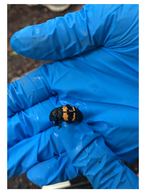

Fig. 4. Nicrophorus tomentosus

Carrion Beetle Bait Preference

- At each unmanaged site, we hung two additional beetle traps from trees and baited one with a piece of fish and the other with a pinkie mouse, both similar in size to the chicken bait.
- Along with the traps baited with chicken, we checked these traps for carrion beetles a week after baiting.
- We recorded the amount of carrion beetles within each trap to compare abundance of carrion beetles attracted to the three different kinds of bait.

Research Questions & Hypotheses

How does park management influence species richness?

- **How does the species richness of trees, small mammals, and carrion beetles differ between managed and unmanaged sites?**
  Hypothesis: The species richness of trees, carrion beetles, and small mammals will be greater in unmanaged sites than in managed sites.
- **How does tree species richness influence the species richness of small mammals?**
  Hypothesis: As tree species richness increases, small mammal species richness will also increase.
- **How does small mammal species richness influence the species richness of carrion beetles?**
  Hypothesis: As small mammal species richness increases, carrion beetle species richness will also increase.
- **How does the type of carrion affect the abundance of carrion beetles attracted?**
  Hypothesis: Carrion beetles will be most attracted to the mouse bait, followed in abundance by chicken and then fish.

Results

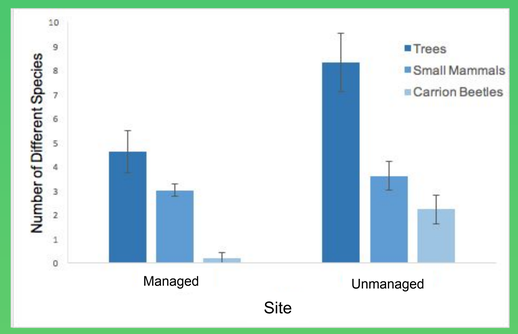

Fig. 5. Species Richness in Managed and Unmanaged Sites. Difference in species richness of trees, small mammals and carrion beetles between both kinds of sites. Error bars are standard error.

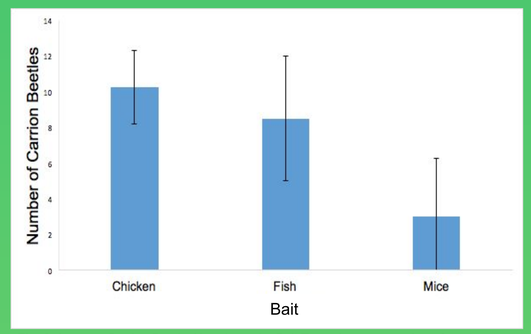

Fig. 6. Average Carrion Beetle Abundance by Bait Type. Average number of carrion beetles found across all unmanaged sites separated by bait type. Error bars are standard error.

Fig. 7. Tree Species Richness vs. Small Mammal Species Richness. Relationship between the species richness of trees and small mammals. R^2= 0.911

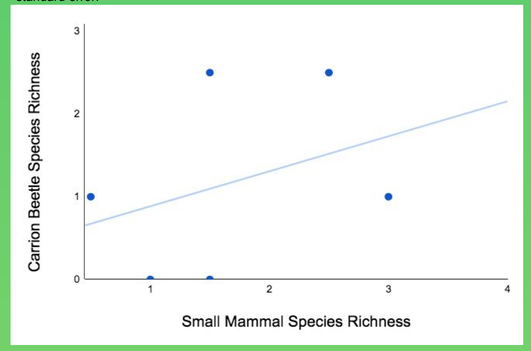

Fig. 8. Small Mammal Species Richness vs. Carrion Beetle Species Richness. Relationship between the species richness of small mammals and carrion beetles. R^2= 0.122

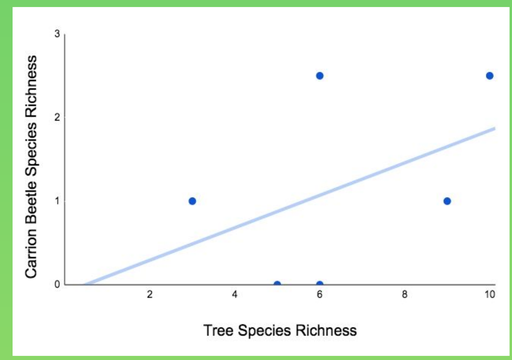

Fig. 9. Tree Species Richness vs. Carrion Beetle Species Richness. Relationship between the species richness of trees and carrion beetles. R^2= 0.144

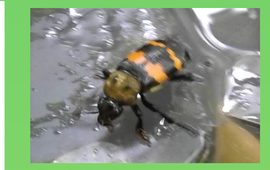

Fig. 10. Nicrophorus tomentosus; gold-necked carrion beetle

Fig. 11. (From left to right) *N. tomentosus, N. orbicollis, N. vespilloides*

Fig. 12. Gray Squirrel Footprint

Discussion

Effect of Management on Species Richness

Our hypothesis that the species richness of trees, carrion beetles, and small mammals would be greater in unmanaged sites than in managed sites was supported by our data (*Fig. 5*). This could be because a greater diversity of tree species in unmanaged sites have more time to grow than those in managed sites, which are largely populated by young shrubs and saplings. Also, unmanaged sites are less frequently disturbed, making it easier for small mammals and carrion beetles to establish diverse communities.

Fig. 13. The Hallet Sanctuary in Central Park[6]

Bait Preference and Carrion Beetle Abundance

Our hypothesis that carrion beetles would be most attracted to the mouse bait is refuted by our data. The majority of the carrion beetles were attracted to the chicken bait, followed closely by the fish. The mouse attracted far fewer beetles than expected (*Fig. 6*).

Since the only beetles observed were of the genus *Nicrophorus* which is shown to have a degree of host preference, it can be determined that infantile mice are not attractive to these decomposers. The mouse also attracted fewer carrion competitors such as bottle flies and flesh flies. Since carrion beetles arrive to the corpse after these insects leave, the lack of these competitors could have also discouraged the beetle from utilizing the mouse bait.

Correlation Between Various Species' Richness

Tree species richness and small mammal species richness have a strong positive correlation, therefore supporting our hypothesis (*Fig. 7*). Although there was also a positive correlation between the species richness of small mammals and carrion beetles, the relationship was weak (*Fig. 8*). Our data shows that carrion beetle species richness is slightly more influenced by tree species richness than by small mammal species richness (*Fig. 9*). This ultimately suggests that diverse tree species help to support both invertebrate and small mammal communities.

Future Research

Future studies should consider gathering a greater amount of data over a longer period of time; doing so would likely increase the significance of the results. Increasing the radius for tree counts would provide a more accurate representation of the site. Pitfall beetle traps should also be used instead of hanging traps as beetles are ground-dwelling invertebrates.

Fig. 14. Raccoon[7]

References

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Acknowledgments

We would like to thank the Wildlife Conservation Society, the National Science Foundation, and Fordham University. Many thanks also to Dr. Jason Aloisio and Dr. Jason Munshi-South for all their help and guidance. Special thanks to Jocelyn Harrison and Emmy Casper for being such supportive leaders, as well as to Olivia, Rochelle, Julia, and Lindsay for making this experience as enjoyable as it was.