

# An Im(peck)able Study: The Effects of Urbanization on Birds

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## Introduction

Urbanization bears an impact on natural habitats by drastically changing animal communities. Bird communities in particular have been observed to have fewer species after urban development<sup>1</sup>. As urbanization promotes habitat fragmentation, the destruction of natural areas leaves smaller patches of scattered land behind. As an extensively studied taxon, birds have shown a general pattern of having reduced species richness—animal diversity in an area—in urban communities, especially in cities<sup>11</sup>. This limit of bird diversity is impacted by the lack of natural parks and spaces to preserve wildlife. This is an issue because birds are an indicator of a healthy environment, and a high species richness shows the environment is thriving. Birds are also important to people as they provide valuable ecosystem services. They facilitate plant reproduction through pollination and seed dispersal<sup>10</sup>. However, there is strong evidence to suggest that increasing the number of green spaces in an urban environment is a solution that leads to an increase in bird diversity<sup>9</sup>. With more parks in an urban area, there would be a higher availability of places for species to coexist, hopefully attracting a higher diversity and amount of birds than smaller parks would. For this research project, we are collecting data in one of the largest urban parks in New York City: the Bronx Zoo. The objective of this study is to observe birds species richness, abundance, and behavior at locations around the Bronx Zoo and assess their correlation to environmental factors such as human activity, canopy coverage, and water quality.

Pictures of birds we captured at each site:



Common Grackle

Grey Catbird

Blue Jay

## Methods

Three relatively equidistant sites were chosen within the Bronx Zoo. They were chosen based on the streams that ran through the area in which we could observe bird activity. Site A was at a small stream behind the rhino exhibit in the zoo, adjacent to a single path. Site B was at a small stream that was fenced off and adjacent to a path that connected to two more paths. Site C was at a small stream, attached to the larger Bronx River, adjacent to a forest path located at the Mitsubishi Riverwalk right outside the zoo. Sites were visited three days a week for 25 minutes each between 10:30 AM and 12:15 PM. At each site, we measured the temperature, we recorded the weather, and we collected data for five variables:



Map of the Bronx Zoo with labeled site locations

**Bird Diversity and Abundance:** A double observer fixed point count method<sup>7</sup> was used within an area with a 15-meter radius. All birds that entered the perimeter of the point count boundaries were identified, tallied, and recorded. The number of individuals per species (abundance) and the total number of species (richness) were recorded per day.



Image of the double observer point count method at Site A

**Bird Behavior:** Using a continuous ethogram sampling method<sup>4</sup>, we observed birds near the water body at each site. We recorded their Behaviors and interactions with the water (exploring, bathing, preening, drinking, resting, fighting, foraging, and swimming) and the time start and end for each of those activities. This was recorded within the 25 minutes we spent at each site.



Photo of a temperature reading being done at Site C

**Human Activity:** At each site, there was a path adjacent to the habitat patch where we observed the birds in the water. Using a tally counter, the amount of pedestrians that were on the path and passed within the boundaries of the circle during the survey was recorded.

**Water Quality:** At each site, a jar of water was collected daily and taken back to the lab. Using a Low Phosphate Testing Kit, the phosphate level of the water was tested to see how the quality compared between sites.



Picture of water testing samples being done at the classroom

**Canopy Coverage:** The average canopy coverage was estimated for Each point count circle using a spherical densiometer and following the methods from Strickler, 1959<sup>12</sup>.

## Research Questions & Hypotheses

### How does urbanization affect birds in the Bronx Zoo?

Is there a relationship between human activity and bird species diversity, abundance, and behavior?

- We predict that with an increase in human activity (people crossing the pathway) at each site
  - ❖ Bird diversity will decrease
  - ❖ The abundance of invasive bird species will increase, while the abundance of native species will decrease
  - ❖ Birds will spend less time interacting with the water

What is the relationship between canopy coverage and bird diversity, abundance, and behavior?

- We predict that with an increase of canopy coverage
  - ❖ Overall bird diversity and abundance will increase
  - ❖ Birds will spend more time interacting with the water

Does water quality at each site correspond to the bird diversity, abundance, and behavior?

- With a higher average value of phosphates in the water
  - ❖ Overall bird diversity and abundance will increase
  - ❖ Birds will spend more time interacting with the water

## Results

Site	Total Number of Birds	Shannon Diversity Index	Total Human Activity	Average Water Quality	Average Canopy Cover
A	156	1.60	788	1.7	86.40%
B	196	1.62	1722	1	92.60%
C	254	2.14	53	0.2	89.80%

Table 1 The total number of birds, average diversity, total human activity, average water quality, and average canopy cover at each site

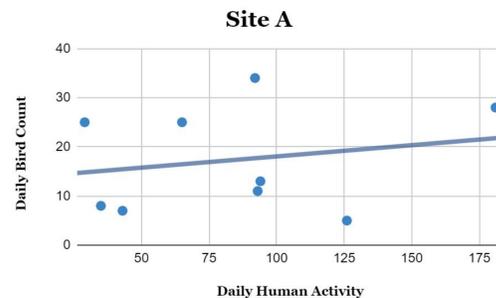


Fig 1 The total amount of people counted versus the total number of birds counted daily at site A

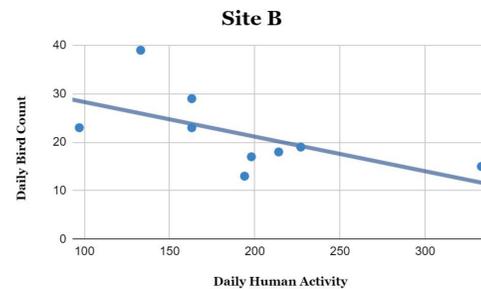


Fig 2 The total amount of people counted versus the total number of birds counted daily at site B

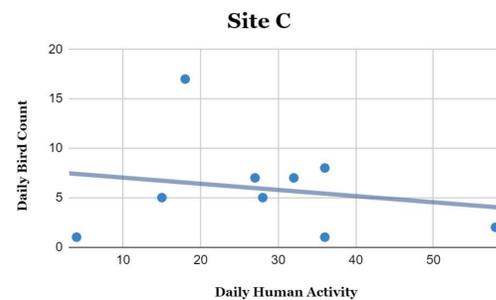


Fig 3 The total amount of people counted versus the total number of birds counted daily at site C

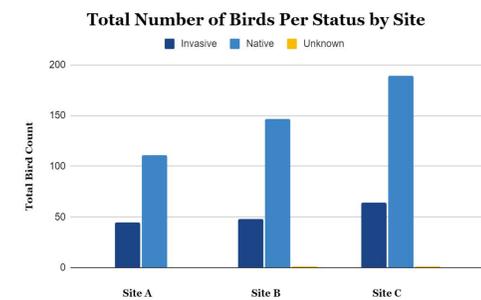


Fig 4 The total number of invasive, native, and unknown birds at each site

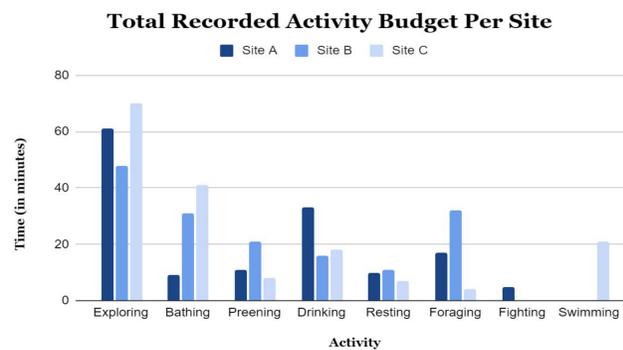


Fig 5 The total time recorded for each behavior across all birds per site

## Conclusion

Bird diversity was calculated and categorized using a formula which gave us a Shannon Diversity Index number for each site. This number holds its significance when compared to other values. A higher index means the location held a higher diversity of birds, which was the case at Site C. The shade cover for all three sites were very similar to each other which gives reason to believe that canopy coverage did not have a large effect on the bird diversity, abundance, or behavior in this study. The graphs we made from human activity versus total bird count showed patterns that were not strong enough to make conclusions from. Looking at Figure 2, we see a negative trend indicating that an increase in human activity led to a decrease in bird abundance. However, Figures 1 and 3 showed an opposite trend, with much larger variation between the data points. Because of these inconsistent patterns, we do not have evidence to support our hypothesis about the relationship between bird abundance and human activity. The average phosphate levels at each site were quite different from each other, as seen in Table 1. However, when looking at Figure 5, we can see that the total time spent by birds for each activity was similar across all sites. We were expecting more activity at Site A, due to the mean higher phosphate level (helping to reduce lead corrosion and thus resulting in cleaner water), but we do not have evidence to support this hypothesis. There were more individuals of native bird species than invasives at all sites, but Site C had the highest percentage. Overall, the species richness, abundance, and activity of birds was very similar at each site which suggests that the bird communities behave similarly throughout habitat patches in the Bronx Zoo, and that the level of human activity is not a notable factor affecting these variables.

## Discussion

Biodiversity is an important byproduct of maintaining healthy ecosystems. By preserving living spaces for animals like birds, we can promote a healthy environment. The Bronx Zoo is one of the largest urban parks that does its best to conserve wildlife in a public area. By conducting this project, we were able to see which locations across the park held the most bird species, abundance of birds, and where they were most active. Our results suggested that every location had similar levels in diversity, abundance, and behavior in relationship to canopy cover, human activity, and water quality. This suggests that the zoo provides consistent habitat patches for birds throughout its area. However, for a future study it would be important to find a stronger relationship between an urban factor and why bird communities were slightly more diverse at Site C. An idea for a future project might be to look into air quality and noise levels in the area. Measuring those factors may be able to explain the difference in abundance and diversity. This data and data from future studies will provide information about how to create larger urban green spaces that birds, along with other animals, can thrive in.

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