The Effect of Proximal Urbanization and Tree Species Richness on Animal Activity

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Research Questions
1) How does proximal urbanization affect the circadian rhythms of animals?
2) How does tree richness affect animal richness in urban parks?

Introduction
Having a rich diversity of trees is an important component of forest ecosystems. Trees provide food and habitat for wildlife. For example, trees were shown to be essential for gray squirrels and red squirrels in Europe (2) because of their special diet, which consists of sparsely planted walnuts and black walnuts. That research strain to highlight the relevance of species richness in different ecosystems. Additionally, raconos diets consists of four main species of trees including cherry, dogwood, elderberry, and apple (7). A diversity of tree species is required to maintain a high diversity of animals. The urban environment, however, is often associated with decreased species richness. Urbanization often means decreased plant biodiversity, an essential factor for maintaining healthy animal habitats (4). Our primary objective was to investigate if there was a correlation between tree species richness and animal species richness.

Light pollution from large cities, has been shown to significantly affect birds’ circadian rhythms (3). Components of the urban environment, such as human population density, habitat fragmentation, tree species richness, and amount of available natural land, may affect the circadian rhythms of mammalian species as well. The second part of this study aimed to collect data on circadian activity of animals in five parks in the Bronx and Manhattan to broadly analyze how urbanization impacts mammal activity. Since Central park has the highest average attendance at 42 million yearly, we expected animals to be the most active at night in order to avoid humans. We expected Inwood, with the lowest average attendance of 1601 annually, would have the most animal activity during the day (5,6)

Hypotheses
1) We expect parks with greater amounts of human activity to have animals that are more active at night than during the day.
2) We expect a positive relationship between tree species richness and animal richness.

Methods
Camera Sites: We set up and monitored a total of 15 camera traps throughout Central Park, Highbridge Park, Inwood Hill Park, and Pelham Bay Park. Within Central Park, we placed cameras in more secluded areas including the Hallett, Ramble, and Loch.

Camera Placement: The camera traps were placed strategically on trees facing small clearings for optimal viewing of animals. The cameras were secured to trees of medium size using a master lock. They were placed 15 centimeters or higher from the ground depending on the slope of the surrounding area for clear images.

Camera Setup: The cameras used in this study were motion activated. Therefore, we programmed the cameras at a high sensitivity to ensure capturing the most animals. Cameras were also programmed to take three consecutive pictures when activated with a 10 second delay after being set off.

Data Collection: The cameras were checked at weekly intervals over the three weeks of research. Each week, the pictures were cleared from the camera’s memory card and uploaded to our database. Camera height and placement were adjusted as needed over the course of the study.

Tree Identification: At each camera, a 5 m radius was measured and demarcated by a transect line. Trees in this area were identified using tree identification charts, dichotomous keys, and “Leafsnap” (an electronic plant guide). Only trees at and above chest height were identified and recorded.

Analysis: We calculated the the Pearson correlation coefficient, R, to determine how strong the relationship is between tree richness and animal richness. Additionally, we compared the circadian rhythms of animals using bar graphs during the day and night across all parks.

Results
Trap success was calculated by counting the the number of times the animal was sighted divided by the number of days the camera was active. Furthermore, we divided trap success between day (5:00 AM - 9:00 PM) and night (9:01 PM - 4:59 AM).

Discussion
Our results analyzing tree and animal diversity demonstrate a slight positive correlation between tree richness and animal richness. From the scatter plot, we can see that our data was largely unrelated. However, the best fit line calculated for the data indicates the potential for a positive slope. Although this indicates a weak correlation, it does show a positive trend of increasing animal richness with increased tree richness.

Additionally, we calculated the correlation coefficient, R, which generates a numerical value to compare correlations. Our R value of 0.1772935862 is much closer to a value of 0 than 1, demonstrating that tree richness only has a minor effect on the animal diversity. We think this may have been the case because we may not have captured all the diversity at our sites due to the limited focal length of the cameras, the size of the parks, and limited trap days.

Regarding our circadian rhythm study, we hypothesized that Central Park animals would be more active during the night than animals from the less attended parks of Pelham, Highbridge, and Inwood. However, our results show that animal activity was greater during the day in Central Park. These results suggest that perhaps human activity in urban environments does not have a great impact on animal’s circadian rhythm. It is also important to note that most of our results indicated natural circadian behavior for diurnal and nocturnal animals. It is interesting to see, however, that raccoons were an exception and were more present during the night. This may have resulted from unidentifiable night time pictures since some of the pictures were too dark to ID the animal. Also, we placed one of our cameras near the presence of a raccoon den in Central Park.

Conclusion
Albeit weak, tree species richness was shown to have a positive correlation with animal species richness. Our results show that regardless of human attendance at the parks, we recorded animals coming out more often during the day. In addition, raccoons were seen out as late as 11:00 am and birds as early as 5:00 am. Similar levels of day and night time activity were found, with more day time activity present across all sites. This indicates that one important factor that affects circadian rhythm is the LD cycle. The data collected in this study has implications in the conservation of urban areas, suggesting that tree diversity is required for diverse animal wildlife.

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References

The Pearson correlation coefficient
R² = 0.1772935862

Fig. 5: The Pearson correlation coefficient

Tree and Animal Species Richness

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