Studying Stem Density, Animal Activity, Road Proximity, and Invasive Plants in NYC Forests

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Introduction

Urban ecology is the study of biotic and abiotic factors and their interactions within the urban environment. By studying urban ecology, individuals are able to learn about what they can do to better the environment, such as removing invasive plant species and preventing mammal and bird habitat disruption. Our studies researched animal activity in relation to stem density, forest maturity, road proximity, and invasive plant species. Typically, older growth forests consist of large trees in the overstory, fallen dead trees, and a low stem density. Newer growth forests, on the other hand, have fast-growing trees and bushes that flourish in places with abundant sunshine, small tree circumferences, and a higher stem density. In well-kept new growth parks, plant life is rigorously protected and maintained due to human activity and park workers, which would result in an increase of biodiversity. (1)

Invasive species can be detrimental to animals and habitats, causing a difference in animal richness between sites. They often outcompete native plant species, and outtake resources. In addition, invasive plant species have been shown to be positively correlated with tree stem density. (2)

Roads that are near forests can be influenced by human activity. Measuring road proximity from sites of interest allows scientists to help measure the human activity that occurs around camera traps. From this information, we are able to observe the effects of urbanization on animal activity. (3)

Hypotheses

- Stem density will be positively correlated with activity.
- Higher stem density will result in a positive correlation with invasive plants.
- There will be a negative correlation between animal activity and proximity of camera to the road.
- A higher abundance of invasive plant species will result in a negative correlation with animal species richness.

Methods

Camera sites: 15 cameras were placed across 5 different NYC parks, 2 in Pelham Bay Park, 2 in Inwood Hill Park, 2 in Highbridge Park, 1 in Riverside Park, and 8 in Central Park (3). Sites were chosen according to the perceived minimal amount of human activity in an area with open space.

Camera placement and set up: Camera traps were placed on trees of circumference approximately 75 cm. The cameras were programmed to take 3 pictures when the sensor detected movement and pause 10 seconds before a second round of 3 pictures. The cameras were then secured around the tree approximately 15-40 cm above the ground. Pictures were imported from an SD card and reviewed for camera adjustment.

Collection of surrounding forest data: A 5 m radius was measured with the camera tree as the central point. Within the 5 m radius, all of the trees were counted and individually identified using tree guides, dichotomous keys and apps, such as “leafsnap.” A record of tree species, tree count within the radius, and stem circumference of each tree was kept. Distance to road was measured in meters with one end of a measuring tape attached to the camera tree and the other end to the closest road/paths/trail.

Collection of invasive species data: The amount of invasive species was quantified using 1 m² plots. A 1 m² plot was measured around the invasive plant species and the percent coverage of that abundance in the plot was recorded. To obtain total coverage of invasive plants in the 5 m area, the percents of all the 1 m² plots were added, and the total percent coverage was obtained.

Data Analysis: Pearson correlation tests were performed to analyze the relationship between the variables in each hypothesis.

Results

Animal activity and stem density

As shown in Figure 5, there is a positive correlation between tree stem density and animal activity, which supports our hypothesis. Higher stem density is indicative of newer growth forests. Often, newer growth offers more protection for smaller mammals that were captured in the camera traps due to higher understory coverage and density. An area with higher stem density often has more human activity since the area is newer, while older growth with low stem density is more common in forests that are preserved and untouched. Humans can protect animal habitats and better preserve the surrounding forest through preservation, rehabilitation or even the removal of litter and other waste.

Amount of Invasive Plants and Animal Richness

As shown in Figure 2, the data supports our hypothesis. The areas with more invasive plant species correlate negatively with animal species richness. A possible reason for this would be that in areas of high invasive plant coverage, food sources may be limited due to invasive vegetation out-competing the native vegetation. The niche of certain animals, for example raccoons, is significantly broader. This enables them to survive in areas such as the Hallett in Central Park, which contains a high amount of invasive vegetation.

Amount of Invasive Plants and Stem Density

As shown in Figure 3, we found that areas with higher stem density have more invasive plants, supporting our hypothesis. A possible reason for these results would be that forests with higher stem density have younger trees, allowing for more sunlight to reach ground, thus aiding small plant growth. Smaller invasive plants also tend to have a lower amount of competitors in forests with younger trees as opposed to older trees, due to factors such as sunlight and ability to thrive in non-native habitats. This shows why invasive vegetation tends to grow more in areas with higher stem growth.

Road Proximity and Animal Activity

As shown in Figure 4, there is a negative correlation between animal activity and distance to road, which does not support our hypothesis. It was predicted that increased human activity would disrupt small mammals and birds, possibly increasing their death toll, or cause them to move to a different area. It is possible that sites affected by humans can respond positively because the animals have adapted to urban areas. Certain animals (such as raccoons) scavenge litter, making it a possibility that they gravitate towards places they are most likely to find anthropogenic food. Animals can also use roads and corridors to travel between forested areas.

Conclusion/Discussion

Animal activity and stem density

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References