



The Effect of Urbanization on Herbivory Rates

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ABSTRACT

Research demonstrates that herbivores may actually excel in an urban setting because there are fewer predators than in a naturalized setting. We studied the effects of urbanization on herbivory rates by measuring percent surface area lost (SAL) of two species: black-eyed Susans, and wild bergamot. We conducted observational research in two plots, a naturalized and urban area at two sites, Prospect Park and the Bronx Zoo. We found that in Prospect Park rates of herbivory increased as canopy coverage increased. This demonstrates the relevance of canopy coverage for herbivores in any setting but this link is especially interesting given that we found increased canopy coverage in the more urban plot.

INTRODUCTION

As the world population rises, urbanization increases. Urbanization has been shown to decrease vegetation and biodiversity, while increasing air and water pollution. This has an overall negative effect on the environment. However, not all organisms negatively respond to urbanization. Studies have shown that herbivores can thrive in these areas because there are fewer predators than a naturalized setting. Herbivory can be harmful to plants due to the damage in leaves which decreases production by photosynthesis. If there is less photosynthesis, there is less energy for plant flower production. Thus, pollinators would be less attracted to these plants because there would be fewer flowers per plants. Our study examines the extent to which urbanization affects herbivory rates amongst black-eyed Susans and wild bergamot at the Bronx Zoo and in Prospect Park.

QUESTION AND HYPOTHESIS

Question: How does urbanization affect herbivory rates of black eyed-Susans and wild bergamot?

Hypothesis: If urbanization increases, then herbivory rates will increase.

METHODS AND STUDY SITE

The two sites used for our research were the Bronx Zoo and Prospect Park. Within the two sites, we selected two plots, urban and naturalized. In each plot we placed 10 quadrats, creating 40 total. Within each quadrat, we took a random sample of ten leaves of our study species using a random number generator. We used ImageJ to later calculate percent surface area lost (SAL) from each leaf. We then used the statistical program, R, to analyze our results. We used the Mann-Whitney-Wilcoxon test to compare the percent surface area lost to the two plots, as well as to compare the average canopy cover to the plots at Prospect Park. We used the Spearman Correlation test to compare canopy coverage to herbivory at Prospect Park

RESULTS

We found there was no difference in surface area lost in the Bronx Zoo plots, urban and natural. However, there was a marginally significant difference in the Prospect Park plots ($p=.08175$) (Figure 1). There is a correlation of marginal significance between % surface area lost and canopy coverage at Prospect Park, as well. ($p=0.07298$) However, we did not find this correlation at the Bronx Zoo (Figure 2). There is no difference between average canopy coverage between Bronx Zoo plots. However, there is a relationship between average Canopy Coverage in the Prospect Park plots ($p=0.006841$) (Figure 3).

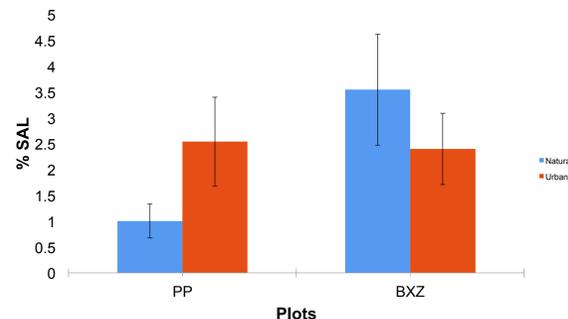


Figure 1: Percent surface area lost in urban and naturalized plot at Prospect Park and Bronx Zoo

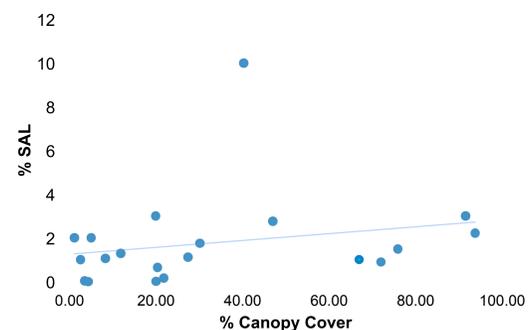


Figure 2: Percent surface area lost VS. canopy coverage at Prospect Park

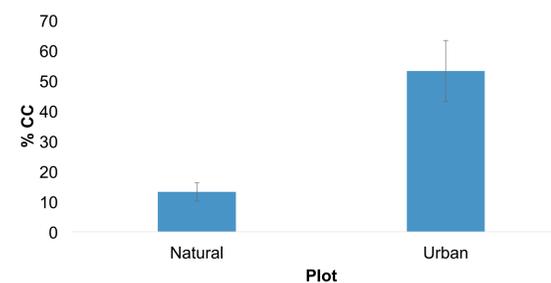


Figure 3: Percent canopy cover (CC) in naturalized and urban plots at Prospect Park.

DISCUSSION

Our hypothesis that as urbanization increases, the rate of herbivory will increase was supported by our findings. We saw that the herbivory rates did not differ between the urban and naturalized plots at the Bronx Zoo (Figure 1). However, there was a marginally significant difference in the rate of herbivory in the Prospect Park plots. We also discovered that the urban plot had a higher herbivory rate than the naturalized plot. To understand the differing trends between zoos, we investigated the relationship between canopy coverage and SAL lost in both plots. We found that canopy coverage was correlated with herbivory at Prospect Park but not at the Bronx Zoo (Figure 2). Since canopy coverage was higher in the urban plot than the naturalized plot at Prospect Park this offers an explanation of why there was less herbivory in the naturalized plot (Figure 3). Herbivores are attracted to plants in a shadier area which explains why the urban plot had more herbivory than the naturalized plot.

LITERATURE CITED

Christie, Fiona J., and Dieter F. Hochuli. "Elevated levels of herbivory in urban landscapes: are declines in tree health more than an edge effect." *Ecology and Society* 10.10 (2005).



Figure 7: Data collection at the Bronx Zoo



Figure 4: Hummingbird moth with wild bergamot



Figure 5: Heavily herbivorized leaf



Figure 6: Black-eyed Susan

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Prospect Park Alliance