FORAGING PREFERENCE OF ANIMALS ON CAMPUS AT JUNIATA COLLEGE

Hailey R. Campbell, Jessie R. Freeland, Mel J. Mendez and Bernadette R. Traina

ABSTRACT

Several studies have shown that when animals live in close proximity to humans, they will begin to stray further from their homes. On the campus of Juniata College, this can be seen with squirrels and rabbits. In our study, we wanted to see if animals preferred feeding at ground locations protected from predators by vegetation, compared to ground locations without protection or cover. We had three different locations of food, each varying in distance from dense cover. An ANOVA test was run to test our hypothesis that there would be the most activity at the feeders placed underneath vegetation, and the results provided a p-value of 0.975. This provides us with no significant results because it is higher than the base p-value of 0.05, showing that the location of the feeders relative to vegetation does not influence wildlife foraging habits.

Keywords: visitation, Sciurus carolinensis, Aves, Tamias striatus, *predation*

INTRODUCTION

Sciurus carolinesis (Eastern gray squirrel), *Aves (b*irds), *Tamias striatus* (Eastern chipmunk) and other wild animals are constantly foraging for food when the grounds begin to dry, and the weather starts to get nice. Ground animals tend to search for food around their nests and in areas that are densely covered (Michael Bowers and Bianca Breland 1966). On the campus of Juniata College in Huntingdon, Pennsylvania, the animals have become accustomed to living around humans and have started to stray farther away from their densely covered habitats. The animals in the central part of campus are accustomed to the students and faculty members walking around, while parts of campus that do not see much human activity may have different effects in the selection of trays. In this study, we looked at the foraging habits with respect to ground location of the animals on the campus of Juniata College.

We know that the animals here on campus are used to human activity, but we are unsure of the predation they face. Due to us not watching the trays for the full 24-hour period, predation may have a negative effect on foraging habits. The large scale of animals that could come to the trays is unknown, which leaves us only with the knowledge of how many seeds were eaten.

We hypothesized that feeders placed under bushes and trees with low-hanging branches will receive the most visitation from wildlife. Wildlife tested included native birds of central Pennsylvania, squirrels, rabbits, etc. Our null hypothesis is that each feeder would receive an equal amount of visitation from wildlife, and whether sunflower seeds were put out in the open, under shrubbery, or under large trees would have no effect on where wildlife prefers to feed from. Our reasoning for our hypothesis was that birds and other wildlife would not want to feed without protection from vegetation therefore feeders left in the middle of a field would receive less visitation from wildlife. Large birds would be better able to see *Sciurus carolinesis* and *Tamias striatus* out in the open, so we believed these small animals would prefer to feed where they are hidden. By testing four different locations within a one-mile radius on the Juniata College Campus, we were able to justify whether our hypothesis or null hypothesis was correct.

FIELD SITE

The data were collected from four separate locations around the Juniata College campus, in Huntingdon, PA: the East Riparian Buffer, between the dorms Sunderland and Sherwood, behind the Brumbaugh Academic Center (BAC), and on the quad by the dorm Cloister.

Figure 1. Arial photograph of the feeder locations placed behind BAC. The red dots are the approximate locations of where the seed trays were placed for each data collection.

Figure 2. Arial photograph beside the Riparian Buffer in front of East housing. One tray was placed at the base of a large tree, one under shrubbery in the riparian buffer, and one was out in the open for each data collection.

Figure 3. Arial photograph of the Sunderland and Sherwood lawns. The red dots denote locations of feeders for each data collection.

Figure 4. Arial photograph of the campus quad in front of Cloister. The red dots denote locations of feeders for each data collection.

METHODS AND MATERIALS

We collected data on which ground locations around the Juniata campus animals (such as squirrels, chipmunks, birds, skunks, etc.) prefer to feed at. We mixed three kinds of sunflower seeds (stripped, black oily, and shelled) and placed them in metal trays. We used three seed types to prevent shell hardness from being a factor that discourages animals from eating from our trays. Before placing the feeders around campus, we weighed the seeds we deposited into each tray using a triple beam mechanical balance scale (note: data collected in Table 4 in the "Results" section below was weighed with a digital scale). The data was collected from the four locations around campus as described in the section "Field Site" above. For each data collection, we placed one tray underneath vegetation, one next to the trunk of a large tree, and one out in the open to total three trays. We weighed the seeds left in the trays after 24 hours.

The data collection was completed three times for each of the four sites to increase our accuracy and precision. The collected data can be seen in Table 1, Table 2, Table 3, and Table 4 in the "Results" section below. When all the data was collected the differences between the initial and final weights of the seeds were averaged together to perform statistical tests on. Treatment effects were tested using analysis of variance (ANCOVA: SYSTAT 10, SPSS Inc., Chicago, IL).

RESULTS

An ANOVA test was run on our data to look at the variance in our data. A plot of seed mass depletion versus habitat was plotted, which indicated that there was not much of a change between the locations of the trays. The ANOVA test gave us a p-value of 0.975, showing that it is not significant. An analysis of the variance was conducted giving an F-value of 0.026, indicating that there was no significant impact on the habitats. Figure 5. shows that there is not a large change in the average seed masses within the three locations of the trays.

Table 1. Average of findings from three 24-hr long data collections behind BAC.

Behind BAC	Initial weight of seeds	Final weight of seeds	Difference of seed weights
Under Bush	315.9 g	82.3 g	233.6 g
Next to Large Tree	371.6 g	156.2 g	215.4 g
In the Open	364.5 g	136.7 g	227.8 g

Table 2. Average of findings from three 24-hr long data collections at the East Riparian Buffer.

East Riparian Buffer	Initial weight of seeds	Final weight of seeds	Difference of seed weights
Under Bush	229.9 g	150 g	79.9 g
Next to Large Tree	387.7 g	382.5 g	5.2 g
In the Open	396.3 g	393.9 g	2.4g

Table 3. Average of findings from three 24-hr long data collections near Sunderland and Sherwood.

Sunderland and Sherwood	Initial weight of seeds	Final weight of seeds	Difference of seed weights
Under Bush	223.5 g	173.0 g	50.5 g
Next to Large Tree	241.7 g	155.9 g	85.8 g

In the Open	261.2 g	207.1 g	54.1 g

Table 4. Average of findings from three 24-hr long data collections on the Quad in Front of Cloister.

On the Quad in Front of Cloister	Initial weight of seeds	Final weight of seeds	Difference of seed weights
Under Bush	283.5 g	221.1 g	62.4 g
Next to Large Tree	247.4 g	173.1 g	74.3 g
In the Open	319.4 g	250.5 g	68.9 g

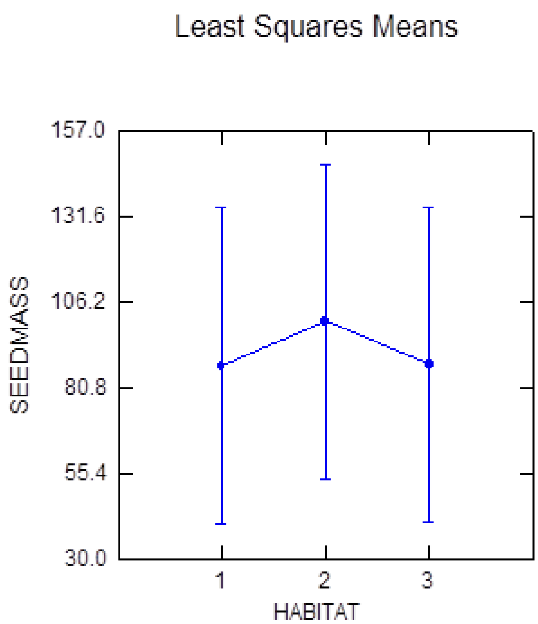

Figure 5. Graph of ANOVA test results – compares variance between the average seed mass differences of the three tray locations. Average seed mass difference (in grams) is the dependent variable, as microhabitat/tray site is the factor of variance.

Table 5. Outlined statistics of the analysis of variance between microhabitats (three tray locations) as detailed in Figure 1. The F-ratio is 0.026, and the p-value is 0.975.

Analysis of Variance Between Microhabitats

Dep Var: SEEDMASS N: 12 Multiple R: 0.075 Squared multiple R: 0.006

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P

HABITAT	446.795	2	223.397	0.026	0.975
Error	78698.527	9	8744.281		

	SMBUSH	SMTREE	SMOPEN
N of cases	4	4	4
Minimum	3.000	26.600	0.700
Maximum	233.600	215.400	227.700
Mean	87.375	100.550	87.850
95% CI Upper	247.777	229.045	243.354
95% CI Lower	-73.027	-27.945	-67.654
Std. Error	50.402	40.376	48.863
Standard Dev	100.804	80.752	97.726

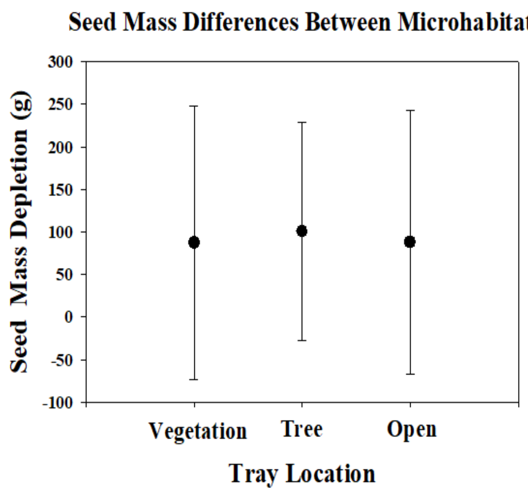

Figure 6. Graph of means of seed mass depletion vs. microhabitat/tray location. Error bars are the 95% confidence intervals for each microhabitat.

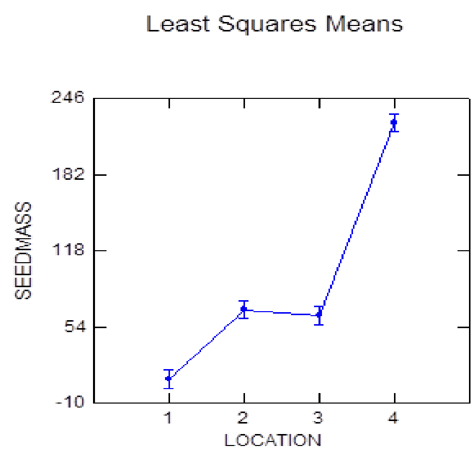

Figure 7. Graph of ANOVA test results – compares variance between average seed mass differences found at each of the four sites. For the X-axis, 1 corresponds to the East Riparian Buffer, 2 corresponds to the Quad in front of the Arch and Cloister, 3 represents the Sundy and Sherwood lawns, and 4 denotes the lawns behind BAC. Average seed mass difference is the dependent variable, as campus site is the factor of variance.

Table 6. Outlined statistics of the analysis of variance between site locations as detailed in Figure 6. The F-ratio is 146.637, and the p-value is less than 0.001.

Analysis of Variance Between Campus Locations

Dep Var: SEEDMASS N: 12 Multiple R: 0.991 Squared multiple R: 0.982

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
LOCATION	77731.729	3	25910.576	146.637	0.000
Error	1413.593	8	176.699		

	SM1	SM2	SM3	SM4
N of cases	3	3	3	3
Minimum	0.700	62.400	50.500	215.400
Maximum	26.600	74.300	85.900	233.600
Mean	10.100	68.533	63.500	225.567
95% CI Upper	45.712	83.335	111.897	248.634
95% CI Lower	-25.512	53.732	15.103	202.500
Std. Error	8.277	3.440	11.248	5.361
Standard Dev	14.336	5.958	19.482	9.286

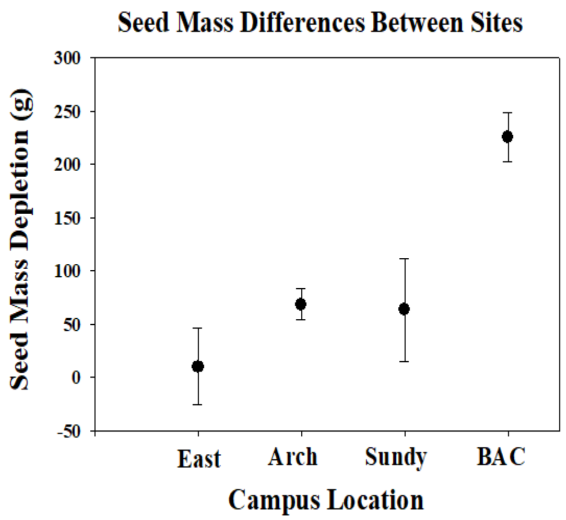

Figure 8. Graph of means of seed depletion mass at each campus site. Error bars are the 95% confidence intervals for each site.

DISCUSSION

Figure 5 displays results of an ANOVA test comparing variance of average seed mass depletion between tray locations, and Table 5 details statistical findings associated with the test. The p-value of the test is 0.975, much higher than the point at which we can consider our test to show significant results (0.05). The F-ratio is 0.026. The F-ratio tells us how much of the data variation is due to the factor of variance (which in this case is microhabitat/tray site) relative to the amount of variance due to the precision of the replicates. The small value of the F-ratio shows our precision between the replicates was poor. In the graph of Seed Mass Differences Between Microhabitats in Figure 6, we see no significant difference between each tray location (underneath vegetation/bushes, next to a large tree, and out in an open field), as shown by the large overlap between the standard error bars on the graph. As a result, we cannot support our hypothesis that the greatest mass of seeds would be lost at the trays underneath vegetation for animals to hide from predators. We support the null hypothesis that there is no significant difference between the three selected ground feeding preferences of animals on campus.

We ran a second ANOVA test to look for variance between average seed mass depletion and campus location, as detailed in Figure 7. Table 6 outlines the statistical findings associated with this test. The p-value is noted as 0.000 because the value is too small to report without scientific notation. Since the p-value is less than 0.05, we found significant difference. Furthermore, the F-ratio is 146.637, meaning most of the data variance is a result of the factor of variance, which in this case is campus site. Both the p-value and F-ratio support the conclusion that there is significant difference of seed depletion masses between the four campus sites. Additionally, the small error bars of 95% confidence intervals for each site in Figure 4 show the good accuracy of the replicates for each data collections. Looking at the graph in Figure 8, it is evident that the seed trays placed behind BAC received the most activity with an average of 225.6 g of seeds lost after each 24-hour data collection. This is likely because fewer people walk on the lawns there compared to the lawns of the other three sites, creating less of a fear landscape for the animals to forage comfortably. There are also plenty of trees behind BAC, possibly where many of the squirrels on campus live – feeders placed outside their homes would have been convenient for them to feed on. From the graph, we see the East Riparian Buffer hardly had any activity, with an average seed depletion of 10.1 g. Animals likely avoided this area due to its proximity to East Housing, the East parking lot, and occasional dog walkers, all of which would have created noise and/or fear that would have scared animals away from feeding in the area.

Our study shows that animals did not prefer feeding at a certain microhabitat like we hypothesized, but instead preferred feeding at the feeders placed behind BAC. For the future, it would be interesting to research wildlife activity specifically behind BAC, such as the time of day squirrels prefer to forage at, or if squirrels prefer one of the three sunflower seed types we used in our experiment.

ACKNOWLEDGMENTS

We thank Dr. Douglas S. Glazier for his suggestions, assistance, and providing us with all the materials we needed.

LITERATURE CITED

Bowers, M.A. and B. Breland. 1996. Foraging of gray squirrels on an urban-rural gradient: use of the gud to assess anthropogenic impact. Ecological Applications **6**: 1135-1142.

Ditchkoff, S.S., S.T. Saalfeld and C.J. Gibson. 2006. Animal behavior in urban ecosystems: modifications due to human-induced stress. Urban Ecosystems **9**: 5-12.

Koprowski, J.L. 1991. Response of fox squirrels and gray squirrels to a late spring – early summer food shortage. Journal of Mammalogy **72**: 367-372.