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## Giving Up Densities of Small Mammal Granivores and Their Foraging Behaviors

by My Nguyen

(Biology 103)

The Assignment: Author a paper describing a field-based experimental research project.

### Abstract

The foraging behaviors of small mammal granivores may be influenced by many combinations of factors. Granivores forage for food in search of preferred food items and with caution against predation risks. It is expected that granivores found in the Russell R. Kirt prairie at the College of DuPage in Glen Ellyn, Illinois are likely to have a lower giving up density with larger seeds than with smaller seeds. It is also hypothesized that the GUD for open microhabitats would be greater than it would be in covered microhabitats. ANOVA was used to make comparative analysis. Results show that the differences in giving up densities for large seeds and small seeds are minute and does not have any significant relationship. However, there is a significant relationship between the microhabitat and the giving up densities. The GUD for open microhabitats are larger than that of covered microhabitats. The study also found that large seeds were consumed more in covered microhabitats than small seeds. There was no significance found between seed size and open microhabitat.

### Introduction

Animals behave in different ways due to their surroundings. The way an animal obtains its food in its natural habitat can be affected by several characteristics. Primarily, animals must think about food selection and availability, risks of predation, and competition with other animals for the same food items. In this experiment, we are observing the giving up densities of a few small granivores foraging on large seeds and small seeds in two types of microhabitats. At the College of DuPage, some of the likely nocturnal granivores found in previous studies feeding on seeds in the Russell R. Kirt prairie included the white-footed mice, meadow voles, and prairie voles.

Wolf and Batzli (2004) found that white-footed mice tended to forage for food items like tree seeds and invertebrates at different seasons. White-footed mice enjoyed nuts, samaras, acorns, and fruit. Wolf and Batzli had found in previous experimental studies that the white-footed mice tended to ignore millet seeds and were more likely to forage in seed trays filled with sunflower seeds. Meadow voles also were found to forage on tree seeds like oak trees, maple trees, and ash trees similar to the white-footed mice (Howe and Brown 1999). They had a preference for dicots in the grassland and agricultural habitats. Morgan and Brown (1996) attest that small mammals forage for food either passively or actively, whichever that would enhance its preference and encounter with food. In their experiments with fox squirrels, the use of an active search mode would allow the fox squirrels to scavenge for its food with a lower GUD with one particular food type while foregoing another food type that may also be present. Hence, the fox squirrel will tend to forage for food that it prefers and spend a longer time obtaining its preferred food than it would to forage for an equivalent mass of food item that is less desirable. Therefore, it would be likely to find small granivores feeding on large seeds like sunflower seeds rather than small seeds like thistle and millet seeds, as it tends to prefer these items much more.

Brown, Kotler, and Mitchell (1994) explains that the longer the time that an animal spends in a seed tray, the less rewarding the tray will be to provide food to the animal. It will no longer be worthwhile for the animal to find food in the same experimental seed tray as the amount of food tends to diminish as the granivore is feeding on it. By tracking the giving up densities we can examine some of

the behaviors that may influence the way animals forage for food. Giving up densities determines the point of quitting harvest rates (Morgan and Brown 1996). To optimize its maximum foraging outcome, animals will tend to spend not too much time at one site when its food availability is diminishing. There would be a point at which it quits foraging for that food item and move on to another site that may have more abundant resources.

Another factor that influences the giving up densities and quitting harvest rates for foraging granivores is the risk of predation. Predation risks are common for animals in their natural habitats. It is only natural that they find protection for itself as it exposes itself while foraging for food. Kelt et al. (2004) saw that various species of the mice such as the *Akodon* foraged more extensively in absence of predation. Covered areas surrounded by shrubs and tall grasslands may provide a place for animals to hide. The open areas with the moon shining down on the animal allow for predators to easily find its prey. Therefore, foraging behaviors are modified when perceived risk of predation is high, open areas are avoided and food is left at higher GUDs (Howe and Brown 1999). In many studies, the giving up densities of food were found to be lower in covered shelters than that of food left in open areas for foraging small mammals (Brown, Kotler and Mitchell 1994, Wolf and Batzli 2004, Kelt et al. 2004). Brown, Kotler and Mitchell (1994) saw seed trays set in plots with bushes received more activity than seed trays set in an open microhabitat. The study on white-footed mice showed that the mean GUDs from open shelters were at least two times higher than the mean GUDs from covered shelters (Wolf and Batzli 2004). The *Octodon*, *Phyllotis*, and *Akodon* consumed more food from trays under shrubs than in open habitats.

It is expected to see that the small granivores feeding in the Russell R. Kirt prairie will feed on favored seeds like sunflower seeds over smaller size seeds. It also expected to see that the small granivores are more likely to have a larger giving up density in open microhabitats than that of covered microhabitats.

## Methods

Seed trays were set up at four experimental sites at the Russell R. Kirt prairie and the Hill prairie and restoration along the Circle Drive at the College of DuPage. Two of the sites that had low growth of mesic prairie or oak savanna with scattered oak trees were considered as open sites. Covered sites contained dead standing plant stalkings from the previous year, which provided some of the predator protection.

Each site contained 30 trays with a total of 120 trays for all 4 sites. At each site, there were 15 small seed trays and 15 large seed trays. Each seed tray consisted of sand mixed with 5.0 grams of either small seeds consisting of thistles and millet seed or large seeds containing black oil sunflower seeds. A pair of the seed trays was spaced approximately 1 meter apart. Each pair of seed trays was spaced at least 3 meters apart from each other. The trays were semi-randomly placed and were partly staggered across the site to occupy the majority of the site. The seed trays were set out on the field sites on April 21, 2004 at about 7:00 pm. The seed trays were taken in the next morning at 6:30 am. Due to wet conditions, some of the seeds were air-dried before weighing. After drying, the seeds were separated from the sand and were then weighed to figure for the giving up densities. The measured GUD of the seed trays assess the foraging behavior of the small mammal granivores found in the Russell R. Kirt prairie, such as the white-footed mice, meadow voles, and the prairie voles. The different sites and seed size were compared using the analysis of variance (ANOVA) with a significance of  $p=0.05$ .

## Results

The two types of sites and seeds sizes were compared using analysis of variance. The granivores were more likely to forage in seed trays that were in covered sites than they were to seek food in seed trays that were out in the open prairie grasses. There was a significant relationship found between microhabitat and giving up densities ( $\bar{X} = 4.31$ ,  $F(1,116) = 19.96$ ,  $P = 0.0002$ ). Covered sites had a

significantly lower mean GUD than that of open sites; both covered sites had a mean giving up density of 3.81 grams, whereas, both open sites had a mean GUD of 4.82 grams (Figure 1).

There was no significant relationship found between seed size and giving up densities ( $\bar{X} = 4.32$ ,  $F(1,116) = 2.41$ ,  $P = 0.1230$ ). Figure 2 shows that for small and large seeds, there was a not much of a difference in the giving up densities. However, when comparing microhabitat x seed size, figure 3 will show that there is a significant relationship between seed sizes in the covered habitat ( $\bar{X} = 3.81$ ,  $F(1,116) = 5.06$ ,  $P = 0.0264$ ) when measuring the mean GUD. Small seeds in covered sites had an average GUD of 4.24 grams. Large seeds in covered sites had a mean GUD of 3.38 grams. Conversely, there is not much of a difference in GUD between seed sizes in open sites. Small seeds in open sites had a mean GUD of 4.74 grams and large seeds in open sites had a mean GUD of 4.90 grams.

### Discussion

My hypothesis suggested that the small granivores would feed on the larger seeds over the smaller seeds in the experiment. However, it was found that the relationship between seed size and the giving up densities are not significant. The white-footed mice, meadow voles, and prairie voles were just as likely to consume the large sunflower seeds, as it was to consume the small millet and thistle seeds.

Conversely, there was a significant relationship found between seed size and microhabitat with giving up densities. The granivores in the covered sites consumed more of the large seeds than that of the small seeds. This shows that with a decreased risk of predation, the granivores are more likely to consume preferred food items when presented with an equal abundance of both food types.

There was also a significant relationship found between the microhabitat site and giving up densities. The data demonstrates that granivores were more likely to consume more food in covered areas than food in open areas as hypothesized. There was much support in previous studies claiming the same theory (Brown, Kotler and Mitchell 1994, Wolf and Batzli 2004, Kelt et al. 2004). With a decreased risk of predation, the granivores would forage for food more extensively and thoroughly.

This study was first targeted to observe the giving up densities of both birds and granivores. However, due to the unexpected rainfall, the study could not be completed to include observing the foraging behaviors of birds during the day. Future studies would help to demonstrate the various foraging behaviors of both birds and nocturnal small granivores. Future studies would also go into delving into more information about which predators may be lurking for their prey at the Russell R. Kirt Prairie.

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Figure 1: Mean Giving Up Densities

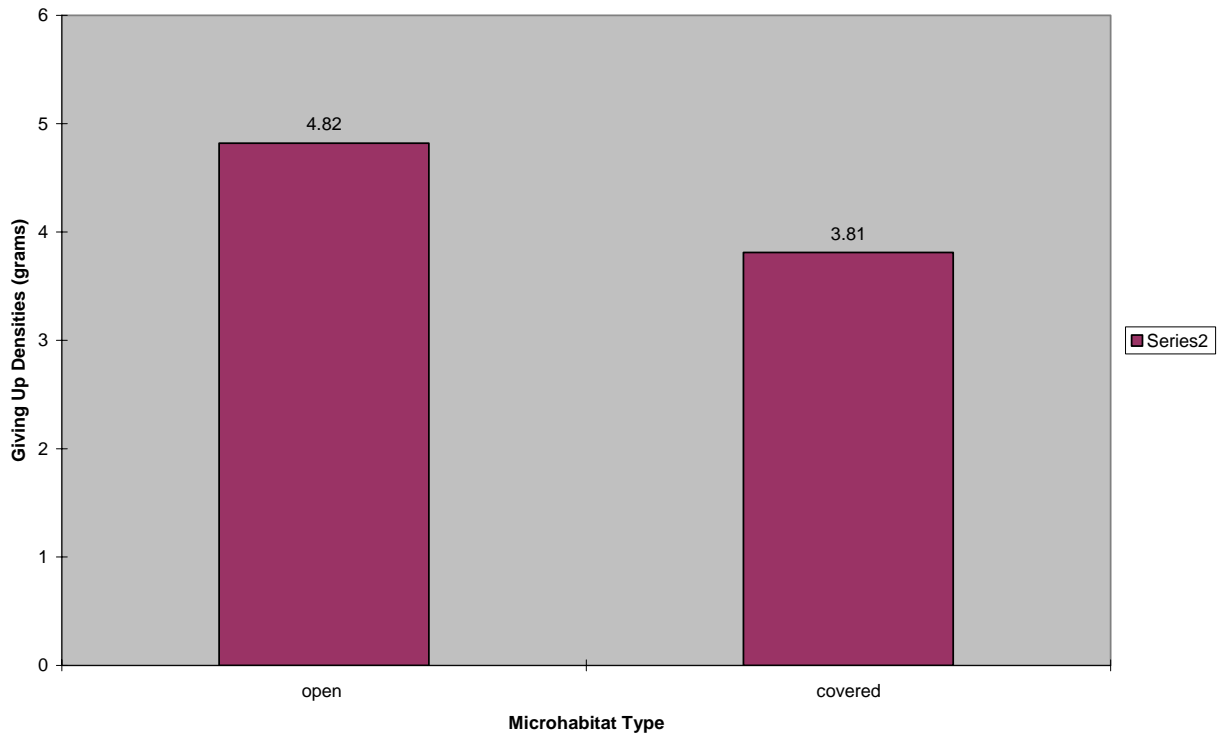


Figure 2: Mean Giving Up Densities  
Small vs. Large Seeds

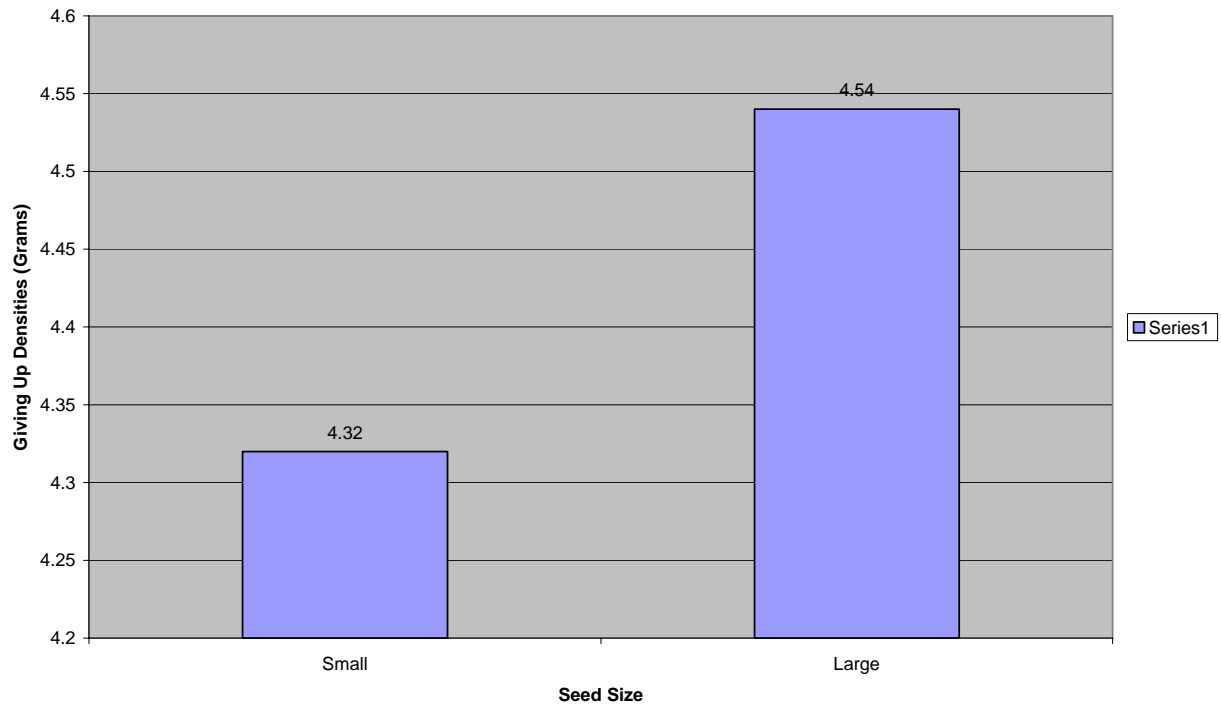


Figure 3: Mean Giving Up Densities  
Microhabitat vs. Seed Size

