

Behavioral Differences of Red Squirrels (*Tamiasciurus hudsonicus*) and Eastern Gray Squirrels (*Sciurus carolinensis*) on an Urban College Campus -Update



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Introduction

The behavioral patterns of two interacting species of squirrels, American red squirrels (*Tamiasciurus hudsonicus*), and eastern gray squirrels (*Sciurus carolinensis*), were observed on Concordia College's campus in Moorhead, MN. The Competitive Exclusion Principle states that two species are not able to coexist in the same habitat, providing they are competing for similar resources in a similar way (Hardin 1960). This may apply to red and gray squirrels since they are potentially competing for a similar food source in the same location. However, if the two species are able to use the resources in different enough ways, they may be able to coexist. They are also interesting because not that many animals share such close associations with humans (Koprowski and Steele 2001).

Often, in natural habitats gray and red squirrels coexist (Bryce et al. 2002). Both species are diurnal and feed primarily on acorns, seeds, and nuts in the fall, fungi in the winter, and buds in the summer (Moller, 1983). Red squirrels are known to be more territorial (Figure 3) and tend to favor areas of conifers (Boutin et al. 2012). Red squirrels are known to use a larder hoard (Figure 1) where they bury food around a central location (Boutin et al. 2012). Gray squirrels use a scatter hoarding food burial method, and favor both conifers and deciduous trees (Boutin et al. 2012).



Figure 1. Observed storage of resources by a red squirrel.

With construction on campus and a poor acorn crop this year, resource availability has been disrupted since our initial period of observations.

Our overall hypothesis is that red and gray squirrels will exhibit different behavioral time budgets representing differential use of resources found on campus. Our secondary hypothesis is that behavioral budgets will vary yearly based on changes in resource availability and abundance.



Figure 2. Gray squirrel spotted moving on Concordia College's Campus.

Methods

- An ethogram was used to record behavioral data (modified from Falck 2009)
- Every 15 seconds, the behavior of each squirrel was recorded, for a total of 5 minutes
- In 2016 we observed a total of 31 squirrels (16 gray and 15 red) on Concordia College's campus. In 2017 we observed 39 squirrels (28 gray and 11 red).
- T-tests were used to compare behaviors and years

Results

When looking specifically at 2017, gray squirrels (Figure 2) spent significantly more time foraging ($t=3.08$, $df=38$, $p<0.01$) and moving ($t=2.17$, $df=37$, $p=0.04$). Red squirrels spent significantly more time chasing ($t=2.72$, $df=38$, $p<0.01$) and social interactions ($t=2.69$, $df=38$, $p<0.01$). In the previous research, there was a trend which showed that gray squirrels bury their food more often than red squirrels. The squirrels were observed doing many other behaviors as well (Figure 4)



Figure 3. A red squirrel spotted chasing a gray squirrel out of its territory.

Discussion

Potentially the two species are able to find a way around the Competitive Exclusion Principle possibly because red squirrels are territorial and gray squirrels are much less so. We have reason to believe that the squirrels inhabit different territories because we observed red squirrels defending their territory by chasing out gray squirrels. Also, red squirrels store their food within their defending territory. In contrast, gray squirrels scatter-hoard, where they bury their food across a wide area. Thus red squirrels spend more time in chasing and social interaction related to territorial defense and gray squirrels in moving and foraging as there is no territory to defend.

This research is a step towards understanding an animal's behavioral decisions and methods of foraging and storing food. Future research could include looking at the behaviors of radio collared and un-collared squirrels to see if collared squirrels spend more time with specific behaviors, like grooming (Figure 5).

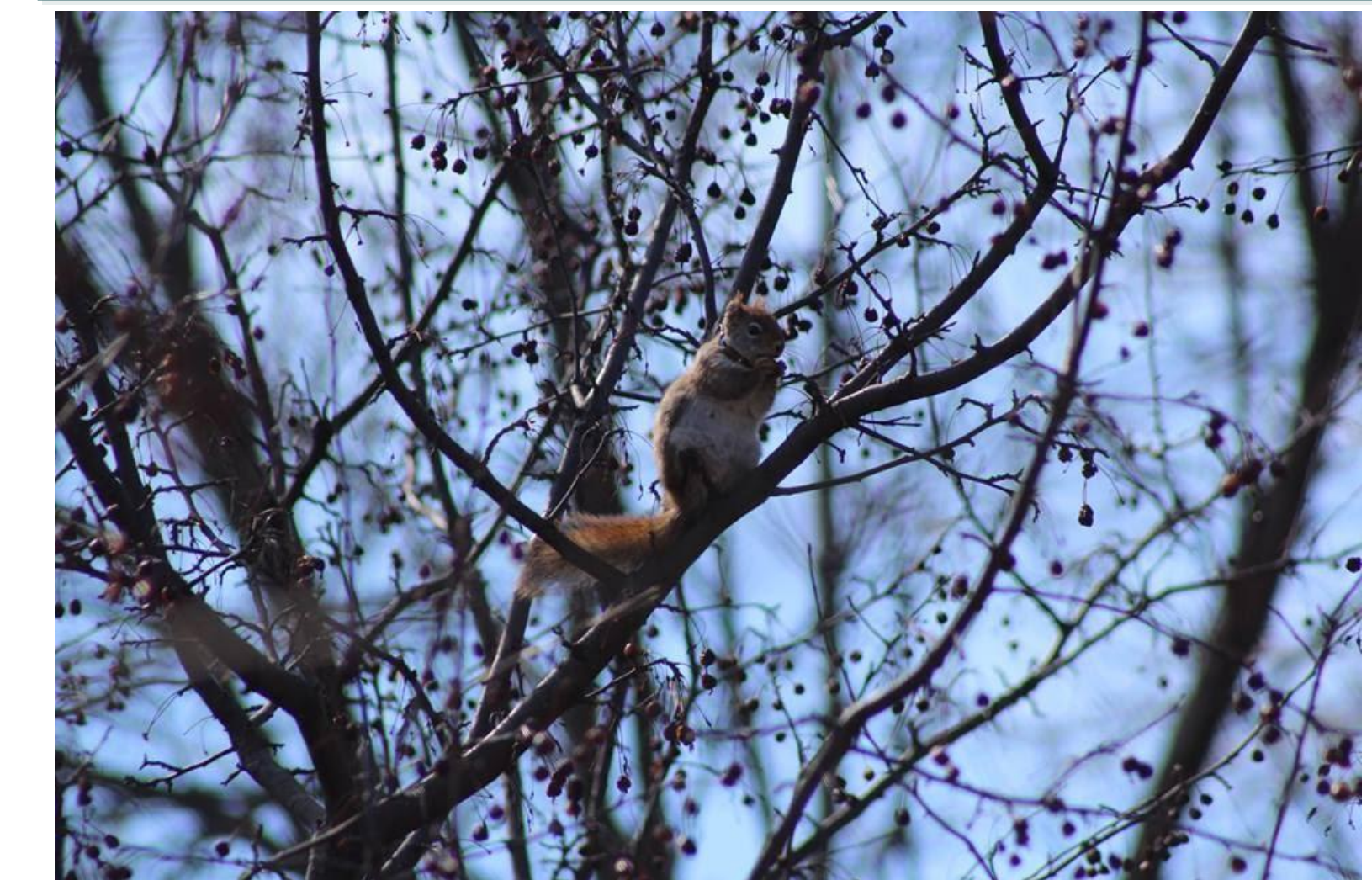


Figure 5. A radio collared red squirrel in deciduous tree.

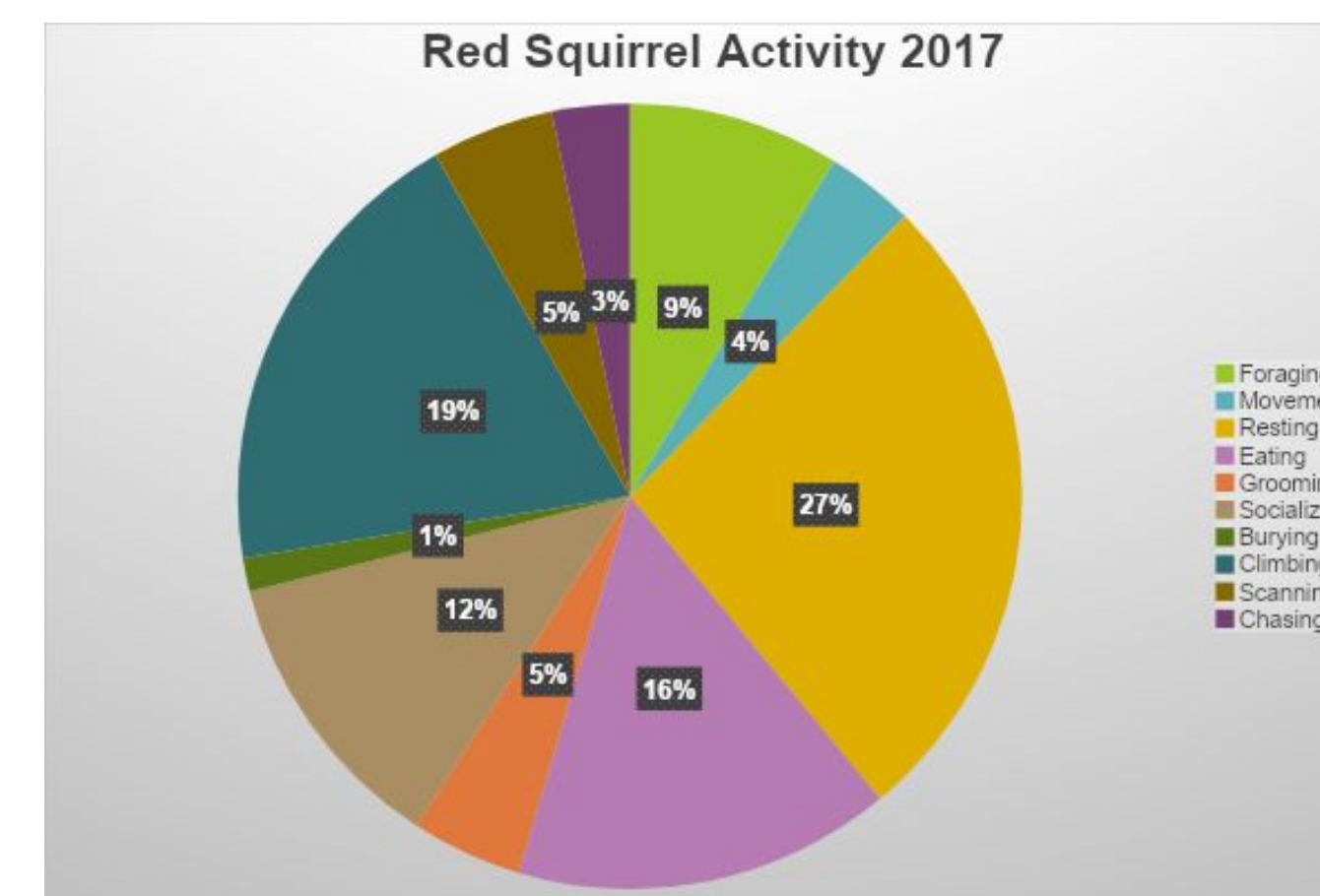
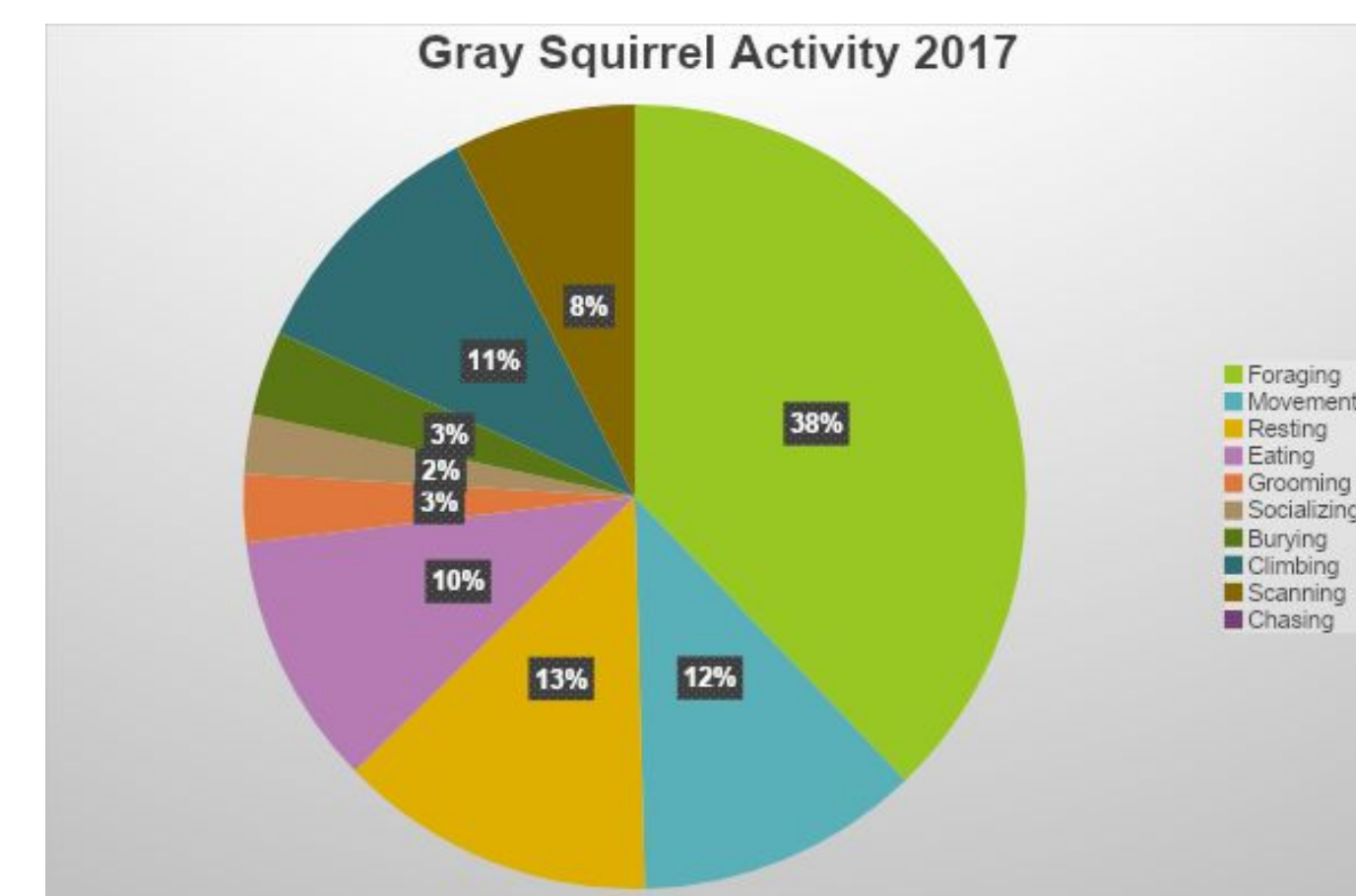
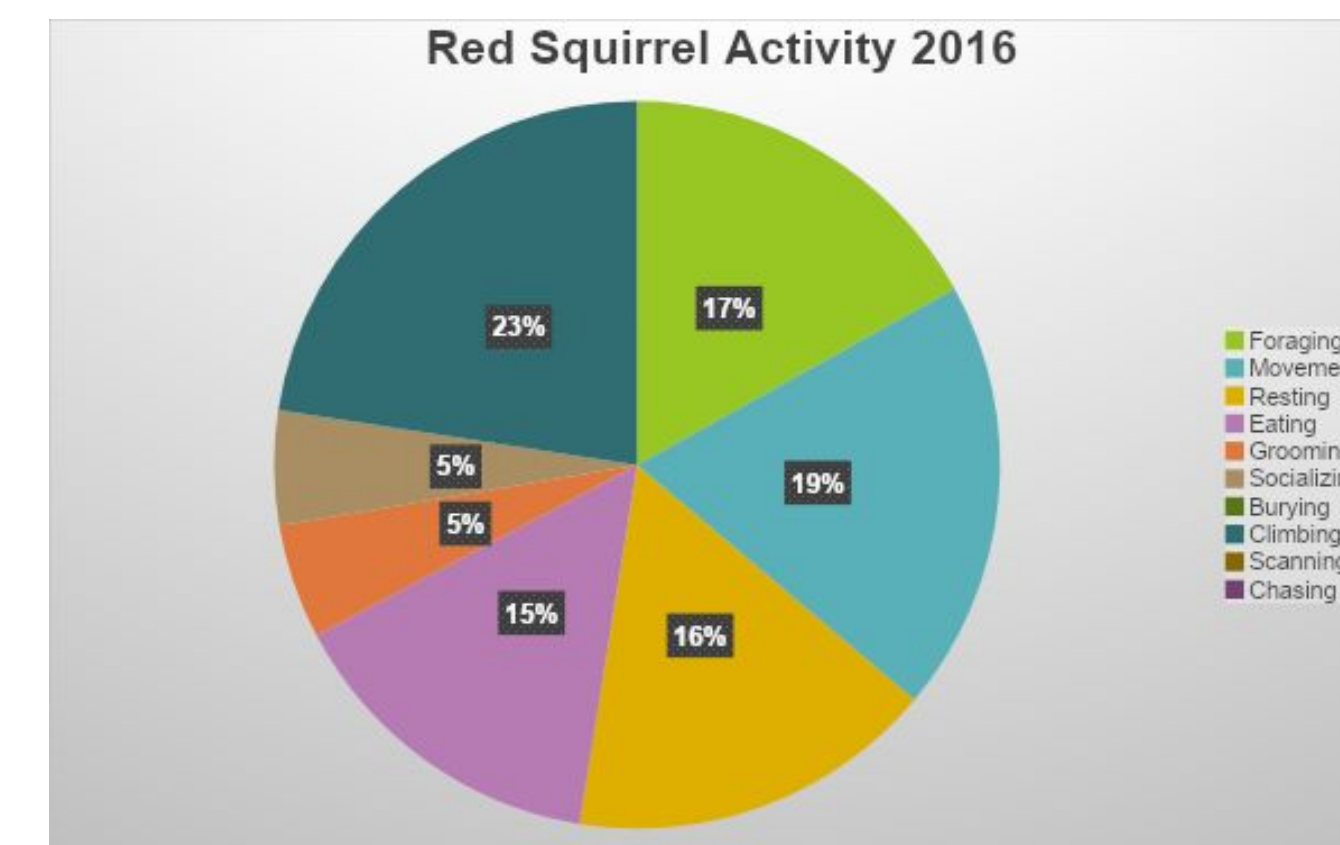
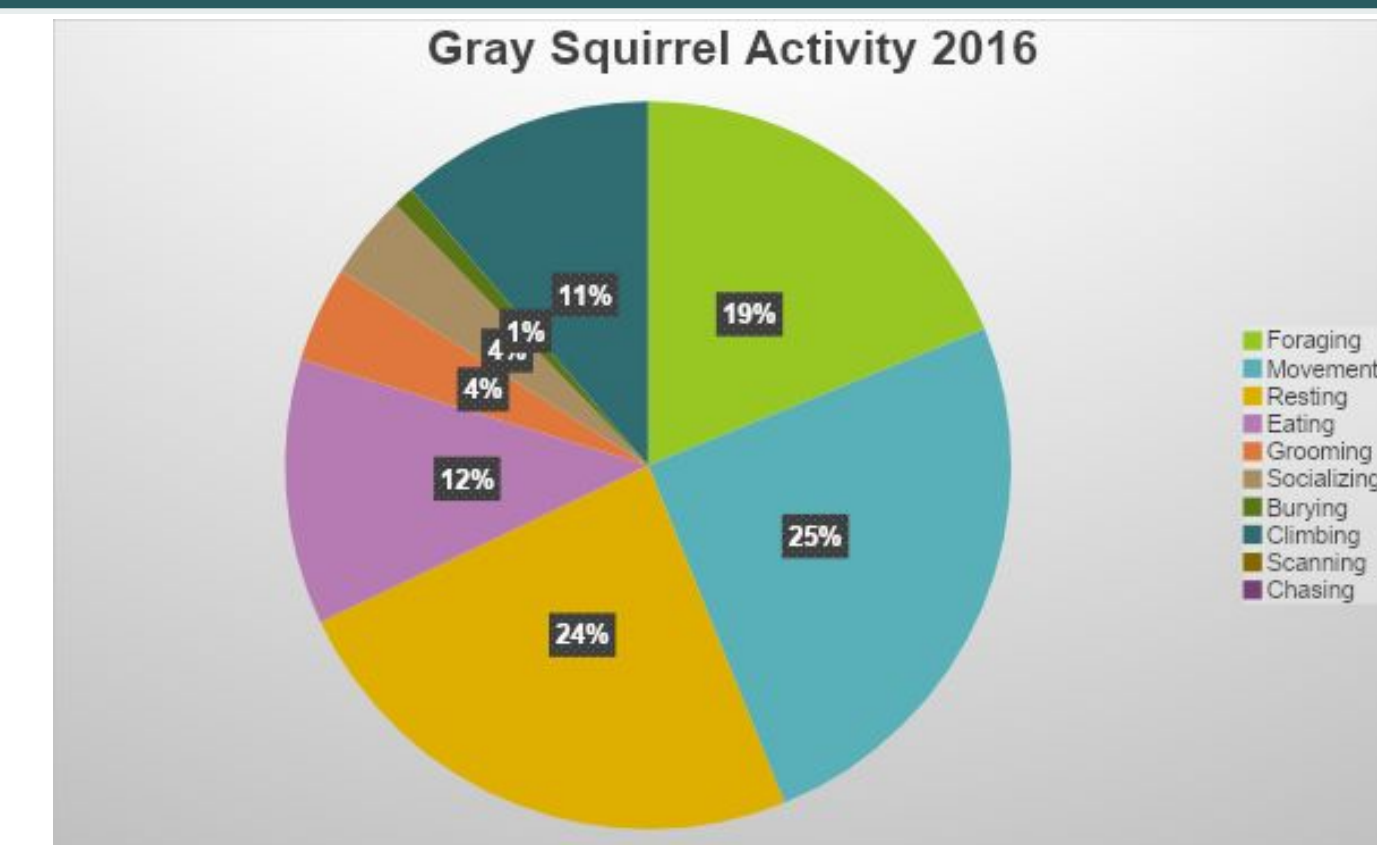


Figure 4. The pie graphs act as representations of the activity budget of the red and gray squirrels on an urban college campus. Clay Co., Minnesota. The top two graphs represent research collected in 2016. The gray squirrels spent most of their time moving (25%), resting (24%), and foraging (19%). The red squirrels spent a majority of their time climbing (23%), moving (19%), foraging (17%). The bottom two graphs represent research collected in 2017. The gray squirrels spent a majority of their time resting (27%) and climbing (19%).

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