

Assessing Habitat Suitability for Squirrels on Campus

by

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Introduction

Squirrels are frequent residents on college campuses throughout the United States and are often beloved by students. In 2013, *The Huffington Post* identified the “colleges most obsessed with squirrels” and described campus squirrel clubs, squirrel festivals, squirrel encounters recorded in university archives, and types of squirrel-related sightings promising to bring exam success (Kingkade, 2013). Numerous schools such as the University of Maryland, the University of South Carolina, and Malone University have created Twitter accounts to honor these campus mascots. At the same time, squirrels may be less welcomed by campus maintenance officials. Some squirrels can nest in buildings and interfere with airflow from heating and cooling units, chew internet cables, and destroy gutters.

Two of the primary factors that influence squirrel abundance are seasonal food availability (oftentimes associated with the prevalence of mature trees) and the presence of predators. In the eastern United States, squirrels have two breeding seasons, and thus, two periods of increased activity; the first during the winter (December to February) and the second in late spring/summer (May to July; Ohio Department of Natural Resources, *n.d.*). In many cases, what squirrels prefer to collect and cache in the fall and winter is different from what they prefer to eat in the spring (Table 1). Another important factor in assessing squirrel populations on a college campus is the presence of predators, such as red-tailed hawks (*Buteo jamaicensis*). Red-tailed hawks are opportunistic hunters and often eat fox squirrels (*Sciurus niger*) and gray squirrels (*Sciurus carolinensis*). Red-tailed hawks can nest in a variety of environments, including urban-suburban areas (Morrison *et al.*, 2016; Stout *et al.*, 2006). Desirable hunting areas contain isolated perching trees ranging from 12.5–18.3 meters (Leyhe & Ritchison, 2004) and an abundance of prey. These conditions are oftentimes present at college campuses given typical campus management plans that encourage the growth of mature trees in a park-like fashion (Table 2). In many cases, squirrels are also habituated to humans on college campuses and may exhibit very little fear response.

Is your campus particularly suitable for squirrels? Imagine that your university administrators ask you this question and name you the chair of a “squirrel task force.” They are unsure whether to manage your campus in a way that would bolster the squirrel populations or in a way to reduce squirrel populations. Your directive is to identify ways that your campus grounds department could manage campus for either objective. Complete the following steps to answer their questions.

Steps

1. As a class, access an aerial map of your campus and identify eight campus zones (or another number of zones identified by your instructor) to be surveyed. Then divide into eight groups. Each group will survey one campus zone.
2. Determine the approximate area of your zone in square meters (excluding buildings). (*Note:* record your answers for Steps 2–5 on the “Campus Habitat Suitability Data Sheet.”)

3. Record the number and species of all trees in your zone.
4. According to Table 1, what percentage of the trees in your zone are commonly used for food by squirrels? Identify the percentage of trees used in winter by squirrels and the percentage of trees used in spring by squirrels.
5. Of the trees identified as food sources for squirrels, estimate the height of each tree using the triangle estimation method (see Figure 1, next page) and determine its maturity status using Table 2.
6. Conduct a 30-minute squirrel survey in your campus zone and count how many gray squirrels (smaller, gray body with white belly and tail fringes; all black individuals can be present in local populations) and fox squirrels (larger and heavier-bodied, orange-gray body with orange-yellow belly and tail fringes) you see. Record your squirrel data, any additional observations you make about squirrel foraging behavior, and any additional behavioral observations that you make while conducting your survey on the “Campus Squirrel Survey Data Sheet.”
7. Return to class and complete the “Squirrel Task Force Follow-up Questions.”

Table 1. The most common tree-related food sources of gray and fox squirrels, by season (Nixon *et al.*, 1968; Smith & Follmer, 1972; Reichard, 1976).

<i>Winter</i>	<i>Spring</i>
White oak/bur oak acorns	Red maple buds/samaras
Red oak/pin oak/black oak acorns	Silver maple buds/samaras
Beechnuts	Sugar maple buds/flowers
Butternuts	Elm buds
Black walnuts	Beech buds
Hickory nuts	Bur oak buds
Hornbeam nuts	Willow catkins
Buckeye nuts	Cottonwood catkins
Horse chestnuts	Hackberry flowers
Crab apples	Dogwood buds/drupes
American holly berries	Hickory buds
Conifer shoots and cones	Ash buds
Mulberry berries	Tulip tree samaras
	Horse chestnut buds
	Sweetgum seeds
	Bradford pear flowers
	Crab apple flowers

Table 2. Average mature heights of trees (Ohio Department of Natural Resources) commonly found on college campuses in the eastern United States.

Tree Common Name	Scientific Name	Average Height (m)
Pin oak	<i>Quercus palustris</i>	21.3
Northern red oak	<i>Quercus rubra</i>	18.3
Black oak	<i>Quercus velutina</i>	18.3
Silver maple	<i>Acer saccharinum</i>	24.4
Sugar maple	<i>Acer saccharum</i>	24.4
Red maple	<i>Acer rubrum</i>	21.3
Norway maple	<i>Acer platanoides</i>	19.8
White spruce	<i>Picea glauca</i>	18.3
Colorado spruce	<i>Picea pungens</i>	15.2
White pine	<i>Pinus strobus</i>	24.4
Flowering crabapple	<i>Malus sylvestris</i>	10.7
Bradford pear	<i>Pyrus calleryana</i>	9.1
Flowering dogwood	<i>Cornus florida</i>	4.6
American holly	<i>Ilex opaca</i>	4.6
Sweetgum	<i>Liquidambar styraciflua</i>	9.1
Red mulberry	<i>Morus rubra</i>	18.3
American basswood	<i>Tilia americana</i>	24.4
Horse chestnut	<i>Aesculus hippocastanum</i>	18.3
Tuliptree	<i>Liriodendron tulipifera</i>	24.4
American elm	<i>Ulmus americana</i>	18.3

Triangle Estimation Method for Tree Height

1. Create a square of paper.
2. Fold paper into right triangle: one 90° and two 45° angles.
3. Hold paper up to eye (see Figure 1). The base should be parallel to ground, and the right angle should be opposite you.
4. Look up along the hypotenuse (long end) of triangle.
5. Adjust your distance from the tree until the point of the triangle matches the height of the tree.
6. Measure distance between you and the tree.
7. Measure the height of your eye from the ground.
8. Add these two measurements together.

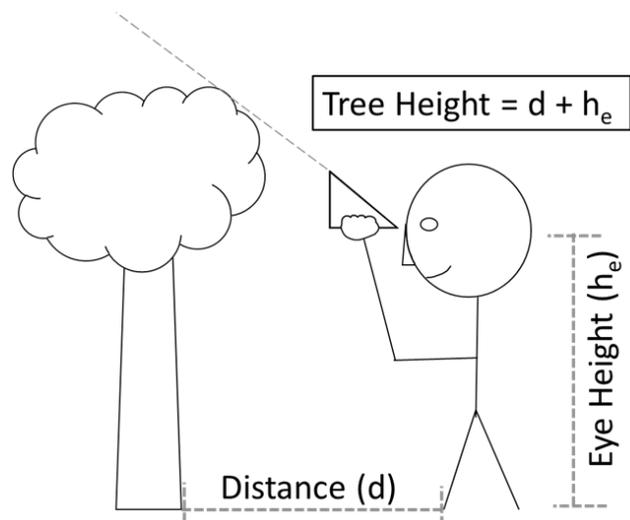


Figure 1. Tree height estimation. (Credit: Dr. Christopher Payne, Malone University, used with permission.)

Squirrel Task Force Follow-up Questions

1. Determine the number of squirrels per hectare in the campus zone that you surveyed. Combine fox and gray squirrel numbers for your analysis. (*Hint*: 10,000 square meters = 1 hectare.)
2. Hawks prefer open areas near their nests with isolated perching trees ranging from 12.5–18.3 meters. What percentage of trees within the zone that you surveyed provide suitable hunting perches for hawks?
3. Based on the data that your class has collected, predict whether the habitat suitability for squirrels on your campus would be “high,” “medium,” or “low,” and defend your answer.
4. Assume that in typical eastern deciduous forests, squirrel population densities are approximately five squirrels per hectare. How would the site conditions at your university (be sure to reference the data that you collected) compare to a typical forest? How do the squirrel populations compare? Explain.
5. What management recommendations would you give your administration to attempt to increase the number of squirrels on campus? What management recommendations would you give your administration to attempt to decrease the number of squirrels on campus?
6. Your admissions office, which is always looking for a marketing edge, informs you that a similar squirrel task force has been assembled at a rival university and they have recently completed a squirrel survey on their campus with 4.2, 5.7, 5.9, 6.2, 7.7, 6.2, 3.0, and 5.4 squirrels per hectare noted per zone. Calculate a mean and standard deviation of the number of squirrels per hectare for each university. Then perform a t-test to compare which university has a higher density of squirrels and generate a bar graph with standard deviation error bars to visually display differences. Summarize the results from your analysis in a paragraph that could be shared with your admissions office. Are there any outliers in your data or important caveats to consider when interpreting your data?
7. Your campus administrators are extremely pleased with the work of your squirrel task force and have asked you to continue your work and organize a community event to census the number of squirrels on your entire campus. Carefully read the article below from *The New York Times* about a community-based squirrel census project and then design a similar community-based project to census squirrels on your campus. How would you recruit volunteers? What would the challenges and benefits of a project like this be?
 - Newman, A. (October 6, 2018). Why count all the squirrels in Central Park? Why the heck not? *The New York Times*. <<https://www.nytimes.com/2018/10/06/nyregion/squirrels-central-park.html>>
 - The Squirrel Census. <<https://www.thesquirrelcensus.com/>>

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