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**Cover Photograph:** A one-eyed, Eastern Gray Squirrel in the Boston Public Garden, eating while clinging to a tree with its back paws. Photograph © Christine Vlahos.

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# Habitat Suitability and Eastern Gray Squirrel Abundance in the Boston Public Garden

Jon-Luc Jarboe[1] and Lauren Nolfo-Clements[2]*

**Abstract** - We examined the abundance of Eastern Gray Squirrels in the Boston Public Garden. Additionally, we used habitat suitability index (HSI) modeling and calculated available energy produced by a subset of the trees within the Garden. We estimated a population of 112 squirrels requiring $4.01 \times 10^6$ Kcal annually, which was fulfilled by the estimated $2.07 \times 10^7$ Kcal produced by the Garden's trees. According to the HSI model, the habitat quality of the park was 74%. However, the average tree Diameter at Breast Height (DBH) was much lower than the preferred size for these squirrels. We concluded that average tree DBH may be a limiting factor for this squirrel population.

## Introduction

Despite hundreds of people observing the species every day, especially during warm weather, very little data are available on the population of *Sciurus carolinensis* Gmelin (Eastern Gray Squirrels, referred to as squirrels throughout) inhabiting the Boston Public Garden (hereafter, Garden). The squirrels were originally brought into the city as pets and then populations were released into the Boston Common (hereafter, Common) during the mid-1800s (Benson 2013). During this time period, squirrels also began to disperse to areas like the Mount Auburn Cemetery and the Granary Burial Ground (Benson 2013). The former eventually became a refuge for Boston squirrels as the population in the Common was extirpated despite the city providing food, nest boxes, and general care for the squirrels (Benson 2013). While the causes of the population collapse are not fully known, there are some possible explanations such as the lack of suitable habitat, the lack of necessary winter food trees, and/or increased human activity.

Within heavily human-altered habitats like urban environments, habituated squirrels may not only serve as amusement for visitors, but also as a widespread test case for understanding how urban habitats impact species' behavior and evolution (Parker and Nilon 2008, 2012; Parker et al. 2014). Unlike their rural conspecifics, squirrels in urban environments exhibit specific adaptive behaviors that have allowed them to survive in an environment with less favorable food, lower habitat quality, and higher competition for resources (Bowers and Breland 1996, Parker and Nilon 2008). For example, before the squirrels in the Common were extirpated in the 1800s, they were observed begging for food from humans (Benson 2013). While approaching a potential predator is generally considered a maladaptive trait, in this context, it may have allowed for increased population densities as humans supplied a wealth of supplemented food. Once squirrels from rural areas surrounding Boston eventually reestablished populations in areas like the Common following their extirpation, they began to display the begging behaviors exhibited by previous populations, despite not being related to the original released squirrels (Benson 2013).

For squirrels to survive in an urban environment, individuals require food not just to meet daily metabolic requirements but also sufficient resources to cache for winter months when

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food is less abundant (McPherson and Nilon 1987). During warmer months, urban squirrels can forage for a variety of foods such as fruits, bark, seeds, etc., but these naturally occurring foods may be limited to seeds exclusively during the winter months (McPherson and Nilon 1987).

Parks may maintain their squirrel populations by not only planting general food trees, but also preferred trees like *Quercus* spp. L. (Oak), *Carya* spp. Nutt. (Hickory), *Juglans* spp. L. (Walnut), *Pinus* spp. (Pine), *Acer* spp. L. (Maple), and *Betula* spp. L. (Beech) as well as supplemental food trees like *Picea* spp. A. Dietr. (Spruce) and *Cornus* spp. L. (Dogwood) whose seeds are durable and may be cached and consumed during the winter (Sundaram et al. 2017). Historical records indicate that urban squirrel populations were desirable and that their feeding was previously encouraged (Benson 2013). At present, the squirrels are still a valued inhabitant of urban parks; however, managers generally discourage the feeding of wildlife and do not actively maintain the habitat for squirrels (R. Wood Boston Parks and Recreation and B. Mulcahy Friends of the Boston Public Garden, pers. comm.).

Interestingly, the Habitat Suitability Index (HSI) model for Gray Squirrels developed by McPherson and Nilon (1987) focused on an area maintained in a similar way—an urban cemetery where wildlife was valued but the vegetation was not maintained in a way that encouraged or deterred any particular species. According to the HSI model for these squirrels, there must be access to sufficient nests sites and/or tree cavities to maintain a population in addition to at least ten preferred food tree species and more than five supplemental species (McPherson and Nilon 1987). In order for an area to support persistent squirrel populations, these food trees must provide both immediate and cacheable food sources in addition to providing suitable habitat. Squirrels can utilize several resting locations and can survive in small trees, buildings, and homes, but rarely can large populations persist under suboptimal conditions with few larger trees (Williamson 1983). Thus, the HSI model for these squirrels focuses on the average tree diameter, the average diameter of preferred food species, the percent canopy closure, the number of preferred food species, and the number of supplemental food species (Table 2).

Like all habitat suitability models, this squirrel HSI model aims to quantify the quality of a habitat for a particular species. While the primary goal of McPherson and Nilon's (1987) model was to assist with the incorporation of squirrel habitat requirements into the management and planning of cemeteries and other urban natural areas, the model can also be effective in assessing the quality of existing habitat. In this capacity, the model can be used to project which factors are limiting the population of the squirrels in a target area.

Squirrels prefer mature forests with large trees (average diameter at breast height (DBH) greater than about 45-50 cm) and at least half the habitat being enclosed by tree canopy (McComb 1984, McPherson and Nilon 1987, Tounzen et al. 2012). Mature trees are favored because larger trees can accommodate many nesting sites for large populations both in the form of tree cavities and leaf nests (Koprowski 1994, McPherson and Nilon 1987). In urban environments, high squirrel population densities have also been observed in locations with lower average tree DBHs (e.g., between 25 and 40 cm DBH), provided that the trees are a mix of preferred food producing species that are continuously maintained for decades, such as those found in cemeteries and in parks (McPherson and Nilon 1987).

While the squirrels' habitat preferences are well characterized, it is unclear whether the Garden habitat is suitable to sustain squirrel populations or if improvements are required for the long-term viability of the population. It is likewise unknown whether food availability or habitat quality, or a combination of these factors, is a limiting factor for the squirrel population in the Garden. To answer this question, the abundance of squirrels within the Garden was determined through weekly counting of individuals, and the Garden's trees were measured to determine general food availability and nesting suitability.

## Methods

### Study Area

The Garden was originally marshlands located near the Common, which were drained and converted into lawn when the area was bought and developed by the city in 1859 for horticultural purposes and for tourism (Boston Landmarks Commission 1977). At ~9.7 ha, the Garden is surrounded by streets (Beacon Street to the north, Boylston Street to the south, Charles Street to the east, and Arlington Street to the west; Fig. 1; 42°21'14°N, 71°04'13°W). Due to the city's plan to focus on horticulture and botany, the Garden's landscape is composed of various species of flowering and non-flowering trees, such as *Ulmus* spp. L. (Elms), Oaks, *Salix* spp. L. (Willows), and *Malus* spp. Mill. (Crabapples) that line the borders of the garden and are spread through the park. Additionally, there are beds filled with flowers during warmer months, expanses of turf grass, and a prominent large pond in the center of the garden (Boston Landmarks Commission 1977).

The climate of Boston, Massachusetts, USA is temperate with marked seasonality. The average annual temperature is ~ 11°C with winter low temperatures averaging ~ -7 °C and summer high temperatures averaging ~ 25°C with annual precipitation of ~1072 mm in the form of both rain and snow distributed relatively evenly across seasons (NOAA 2021).

### Data Collection

For the squirrel abundance and canopy coverage estimates, the Garden was split into four quadrants of approximately equal size to differentiate between sections and to allow for maximum visibility for squirrel abundance assessment (Fig. 1). This study was conducted September 2019 – January 2020.

*Squirrel abundance assessment.* Due to limitations set by the Boston Parks and Recreation Department, mark and recapture, tagging, and other invasive methods were not

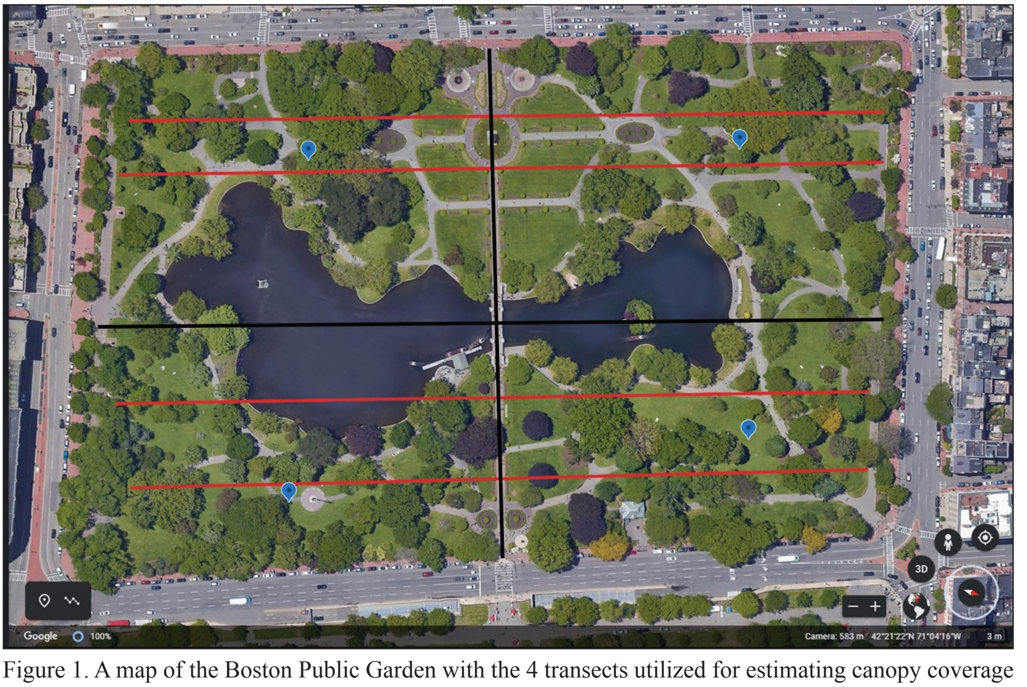


Figure 1. A map of the Boston Public Garden with the 4 transects utilized for estimating canopy coverage indicated in red, the quadrants divided by black lines, and their centers used for squirrel abundance observations indicated by blue circles. Map courtesy of Google Earth.

permitted for this study due to their potential negative impact on park visitors. To assess the abundance of the squirrels in the Garden, we modified the procedure described by Parker and Nilon (2008) as follows.

An area within the center of each quadrant was selected to allow for maximum visibility of the quadrant by a single observer (Fig. 1). The area of each quadrant was 2-2.5 ha, and the furthest distance from the observation point to the edge of a quadrant was ~150 m. Using binoculars, the observer stood in the center and rotated 360°, counting the number of squirrels and estimating the distance between the observer and any individual squirrel. To estimate distances, we measured the distance between the observation point and various landmarks such as statues, benches, etc. All measurements were rounded to the nearest meter. For higher densities of squirrels, the abundance was first counted, and then the distance away from the observer was estimated to prevent overcounting squirrels due to animal movement.

After a full rotation of counting or ~8 min, the observer would move to the next quadrant and begin counting again until all four quadrants had been observed. This procedure was repeated weekly at different times of the day such as during the morning (9-11 am), mid-day (11-2pm), and afternoon (2-4pm). The different time intervals accounted for changes in animal activity and visibility throughout the day as some periods, such as before dusk, are preferred by the species for feeding (McPherson and Nilon 1987). We repeated our observations 12 times September – December 2019.

*Tree DBH measurements***.** Seed traps and similar devices would be impractical to document the annual caloric output from trees in the Garden given the likelihood of visitor disturbance. Therefore, to estimate the number of kilocalories (Kcal) provided by seeds and fruit from the trees in the Garden, the equations presented by Greene and Johnson (1994) were used in conjunction with the DBH for each tree within each quadrant (see the "statistical analyses" subsection).

To get an accurate estimate of the naturally occurring food and potential nesting habitat provided by the trees in the Garden, the DBH of each tree was measured using forestry measuring tape. Identification of trees was aided by the use of a map provided by the Friends of the Boston Public Garden and the Boston Parks and Recreation Department. For the purpose of energy calculation, we distinguished between trees that were preferred or supplemental food species for squirrels. If there was a split in the trunk below 2 m, both trunks were measured and their DBHs summed; if there was a significant burl or buttress at chest level, DBH was measured above or below the obstruction.

*Canopy coverage estimates***.** We used CanopyApp, a smartphone app, to measure the canopy coverage of a given area before the leaves fell (September–October). The app took a photo at ground level, and the observer was directed to select the amount of foliage included on a photo. The app compared the area covered by foliage against a hundred square grid to determine the percentage of canopy coverage. Dividing the Garden, once again, into 4 quadrants, an observer walked 4 transects on a compass bearing, recording the canopy coverage every 20 meters across the width of the Garden (Fig.1). The observer followed the transect line until they encountered a pond, fountain, or paved area with a monument, which they would walk past or around and continue on the other side of the obstruction until they reached the end of the transect (closest point that is within the tree line and less than 20 m from the fence or street). After a transect was finished, the observer would move to the next one until a canopy coverage estimate was calculated for all 4 transects. We set transects at variable distances apart to avoid main thoroughfares, major monuments, and fountains (Fig. 1). Squirrels did not frequent these areas, and we wanted to minimize our impact on the visitor experience at the Garden.

**Statistical Analyses**

To determine squirrel abundance, we used the following equation from Parker and Nilon (2008):

$$P = \frac{AZ}{(v)\pi Sy^\wedge 2}$$

P represents the squirrel abundance for an individual quadrant, A is the total area of the quadrant ($m^2$), Z is the total number of squirrels observed, v is percentage of quadrant visible (100% was used as an estimate for each quadrant), S is the number of observation periods, and y is the average distance between each individual squirrel and the observer. We summed the abundance estimates from each quadrant to calculate a total for the Garden.

To ensure that squirrel counts were not impacted by changing visibility due to seasonality, we ran t-tests for each quadrant, comparing counts made before and after leaf fall (September–October versus November–December). We also performed an ANOVA to test for differences in squirrel abundance between quadrants.

To estimate the energy (measured in Kcal) provided by the trees in the Garden, the following equations were used in conjunction with the measured tree DBHs (Greene and Johnson 1994):

$$m_L = 113000 * BA^{0.855}$$
$$m_F = 0.037 {m_L}^{1.08}$$

$m_L$ represented the estimated leaf mass of each tree as calculated from the basal area of the tree (BA). The BA can be calculated from the DBH in $cm^2$ using this equation:

$$BA = \frac{\pi(DBH/2)^2}{1000}$$

$m_F$ represents the total fruit mass (seeds and fruit) produced by the trees in a quadrant as calculated from the estimated total leaf mass of the quadrant. In order to calculate the total Kcal produced by each tree species in the Garden, we used the following equation:

$$K = gN\ (m_f / a_f)$$

K represents the total Kcal produced by a given tree species, g is the Kcal per gram per seed from the literature, N is the total number of individuals of that tree species in the Garden, and $a_f$ is the average seed mass from the literature. The value of K for all tree species for which data were available were summed in order to estimate the total number of Kcal produced by trees in the Garden annually. The masses of individual seeds and the number of Kcal per seed for species present in the Garden were obtained from the literature (Andronie et al. 2019, Demir and Kalyoncu 2003, Dridi 2019, Garrison and Augspurger 1983 Greene and Johnson 1993, Grodziński and Sawicka-Kapusta 1970, Hewitt 1998, Hulme and Borelli 1999, Inman 1997, Kaliniewicz et al. 2018, Kollas et al. 2012, Krahulcova et al. 2017, Major 2002, Meiners 2005, Sundaram et al. 2015).

To estimate the annual caloric requirements for the squirrels, we used an energy requirement estimate of 100 Kcal per day per squirrel based on Knee (1983). This may be an underestimate of squirrel caloric needs as it does not take into account the increased energy required for reproduction and at low ambient temperatures. Using this number, we multiplied the Kcal needs per squirrel by the estimated number of squirrels by the days in the year (365) to get an estimate of the total Kcal required by all the squirrels in the Garden annually.

Other observations, such as the abundance of overwinter food trees, supplemental food trees, average canopy coverage, and average tree DBH, were calculated and compared with the HSI recommended habitat suitable conditions presented by McPherson and Nilon (1987). We also compared the DBHs of trees across the 4 quadrants of the Garden using a one-way ANOVA to assess habitat heterogeneity. Data analyses were performed using Microsoft Excel and the XL Miner Analysis ToolPak Add-on for Google Sheets.

## Results

We estimated the total population of squirrels to be 112 individuals (Table 1). There were no differences in squirrel counts for each quadrant before and after leaf fall (Quad 1: $t(9) = 1.14$, $P = 0.28$; Quad 2: $t(9) = -0.69$, $P=0.51$; Quad 3: $t(9) = 1.05$, $P = 0.32$; Quad 4:$t(9) = 0.10$, $P = 0.92$). There was a significant difference between squirrel abundances observed in the quadrants, with quadrant 2 having the highest average count of 38 and quadrant 1 with the lowest at 20 ($F(3,44) = 13.315$, $P<0.001$).

We measured a total of 387 trees, of which 141 were of known preferred or supplemental food species as indicated by the McPherson and Nilon (1987) HSI model (Appendix). The average DBH of measured trees was 19.7 cm (s.d. ± 12.1). The trees in all 4 quadrants were of similar size ($F (3,387) = 0.393$, $P = 0.76$). The canopy coverage of the Garden during September and October 2019 was 40-55%, which is within the preferred range of 40-60% for this species.

The Garden had an HSI score of 74%. We compared the DBHs of the trees across the Garden to the preferences given in the HSI model (Table 2). The relatively smaller average DBH of the trees decreased the habitat quality of the Garden resulting in a cover suitability score of 30%, making it the limiting factor in comparison to the food suitability (Table 2).

Based upon the estimated squirrel abundance of 112 individuals and the average daily energy requirement per squirrel of 100 Kcal obtained from Knee (1983), the total estimated Kcal required by the squirrels annually was found to be $4.01 \times 10^6$ kcal. The total amount of fruit produced annually (g), individual seed mass per tree species (g), the kcal per seed, and number of trees per species in the Garden were then used to find the total amount of Kcal produced in the Garden by the preferred food species. Based solely upon species for which seed masses and kcal values were available, we estimate the trees in the Garden produce $2.07 \times 10^7$ kcal annually (Appendix).

## Discussion

In addition to estimating the abundance of squirrels, we sought to determine whether habitat suitability or food availability (or both or neither) represented a limitation on the population of the squirrels in the Garden. Using the HSI model developed by McPherson and Nilon (1987), we calculated an HSI score of 74% for the Garden. The preferred and supplemental food trees' DBHs, abundance, and canopy closure percentage were satisfac-

Table 1. The average distances, observed, and estimated abundances of Eastern Gray Squirrels in the Boston Public Garden September 2019-January 2020 ± 1 standard error.

| Quadrant | Average Distance (m) | Observed Average Squirrel Abundance | Estimated Average Squirrel Abundance |
|---|---|---|---|
| 1 | 27 ± 0.9 | 20 ± 1.6 | 16 |
| 2 | 27 ± 0.7 | 38 ± 2.6 | 36 |
| 3 | 23 ± 0.7 | 28 ± 2.3 | 36 |
| 4 | 28 ± 0.7 | 26 ± 1.7 | 24 |
| Total | | 112 | 112 |

tory according to this model. However, the average tree DBH for the Garden was smaller than what is considered ideal for the squirrels (Garden: ~20 cm, preferred: 45.7+ cm). Tree size may be a possible limiting factor in the availability of nesting sites in the form of cavities and locations for leaf nests.

The total annual daily energy requirement for the Garden squirrel population was estimated to be 4.01 x$10^6$ Kcal, while the total annual energy produced by the preferred and supplemental food trees in the Garden was estimated at 2.07x$10^7$ Kcal. However, it is important to note that this estimate only includes the limited number of species for which we were able to locate seed calorie and mass data from the literature. Consequently, this is likely a low estimate of the energy produced by the trees in the Garden. We also utilized a daily energy

Table 2. The HSI or Habitat Suitability Index used to evaluate Eastern Gray Squirrel habitat in the Boston Public Garden from Parker and Nilon (2008). Numbers in **bold** are calculated from data collected in the Garden.

| Characteristic | | Possible Score |
|---|---|---|
| I. Winter Food | | |
| A. | Average tree diameter of preferred food plant species (cm dbh) | |
| 1. | > 25.0 | 10 |
| 2. | 15.1-25.0 | 7-9 |
| 3. | 7.6-15.0 | 3-6 |
| 4. | <7.6 | 1-2 |
| B. | Percentage of Canopy Closure | |
| 1. | 40-60 | 5 |
| 2. | 60-70 or 30-40 | 2-4 |
| 3. | >70 or <30 | 1 |
| C. | Number of preferred food plant species | |
| 1. | More than 10 | 5 |
| 2. | 6-9 | 3-4 |
| 3. | 5 | 2 |
| 4. | Fewer than 5 | 1 |
| D. | Number of supplemental food plant species | |
| 1. | More than 5 | 5 |
| 2. | 3-5 | 3-4 |
| 3. | 2 | 2 |
| 4. | Fewer than 2 | 1 |
| II. Cover / Reproduction | | |
| A. | Average tree diameter (cm dbh) | |
| 1. | >45.7 | 10 |
| 2. | 38.1-45.7 | 8-9 |
| 3. | 25.4-38.0 | 6-7 |
| 4. | 15.0-25.3 | 2-5 |
| 5. | <15.0 | 1 |

need estimate of 100 Kcal per squirrel that was on the higher end of reported values since this species is known to significantly increase its metabolic rate in response to cold temperature (Ducharme et al. 1989, Knee 1983). Thus, the squirrel population did not appear to be limited by food availability. This would make the habitat suitability or more specifically, the lack of larger trees across the Garden, the limiting factor for the squirrel population.

Our data suggest that in order to maintain and perhaps increase the Garden squirrel population, the city of Boston and supporting organizations should remove and replace fewer trees from year to year. Generally, trees should be allowed to grow to DBHs larger than 25 cm to support the squirrel population. However, while this is an issue that should be focused on in terms of improving the habitat of the park for squirrels, it should be noted the habitat is of a high quality as indicated by the HSI. The preferred and supplemental food trees appear to provide more energy on an annual basis than the squirrels require.

Although we did not measure the energy provided by human-supplemented food, this is likely a significant source of additional calories for the Garden squirrel population. Behavioral observations of the Garden squirrels have revealed that, although individual squirrels may solicit human handouts, the time spent performing begging behaviors is much less than the time spent foraging, climbing, and caching (L. Nolfo-Clements, unpubl. data). Even so, squirrels can be very assertive in their begging behaviors, going so far as to climb the legs of observers and making attempts to pilfer food items from those eating on benches who are not aware of their presence (Nolfo-Clements, pers. observ.). We have observed the squirrels rejecting less desirable human handouts, such as bread and crackers, while appearing to prefer more nutrient dense items such as nuts and chocolate-based candy, as indicated by the duration and persistence of begging behaviors as well as the rapid consumption or caching of food items (Nolfo-Clements, pers. observ.).

Table 2. Continued.

| Characteristic | | Possible Score |
|---|---|---|
| HSI Calculation | | |
| 1. | Maximum Score | 35 |
| 2. | Actual Score | 8+5+5+5+3 = **26** |
| 3. | (2)/(1) x 100 | **HSI= 74%** |
| Limiting Factors | | |
| A. | Winter Food | |
| 1. | Maximum Score (A+B+C+D) | 25 |
| 2. | Actual Score (A+B+C+D) | **23** |
| 3. | (2)/(1) x 100 | **92% Food Suitability** |
| B. | Cover Reproduction | |
| 1. | Maximum Score: A | 10 |
| 2. | Actual Score: A | 3 |
| 3. | (2)/(1) x 100 | **30% Cover Suitability** |

Limiting factor is the lower suitability value.

While the feeding of wildlife is discouraged by Boston Parks and Recreation and the Friends of the Boston Public Garden, it is common knowledge that a wildlife rehabilitator does provide nuts and water for the squirrels. The shells of these nuts, as well as receptacles for water, can be observed at the base of larger trees, especially adjacent to Boylston Street on the south side of the Garden (L. Nolfo-Clements, personal observation). Thus, while human-sourced supplementary feeding may make up a significant portion of the squirrels' caloric intake, our data indicate that the squirrel population has sufficient energy available to remain stable even in the absence of human handouts.

To better understand the factors that limit squirrel abundance in the Garden, future studies could focus on the variation in food available to squirrels. For example, we determined that the annual energy produced by trees in the Garden were enough to sustain the squirrel population, but some trees only produce seeds during specific times of the year. An analysis of the fruit and seeds available to squirrels across seasons should be undertaken. In addition, during the late winter and spring, low-lying lawn areas of the Garden are frequently saturated or under standing water due to snow melt, which impacts the squirrels' access to buried food (Wilson et al. 2019; L. Nolfo-Clements, unpubl. data). Those areas should be considered for regrading or backfilling. These factors may, in part, have influenced the observed differences in squirrel abundances across quadrants despite similar tree sizes and species compositions. Since the squirrels are seen as an integral characteristic of the Garden, enhancing the habitat and food available to them may allow managers to make a stronger case to end the feeding and habituation of the squirrels, allowing for the continuing enjoyment of these animals and their antics while reducing the chances for undesirable contact.

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Appendix. The abundance of preferred and supplemental food tree species for Eastern Gray Squirrels in the Boston Public Garden. An * indicates a species for which data on both individual seed mass and kcal per seed were available and thus was included in the total kcal available estimate.

| Tree Species | Common name | # of Trees |
|---|---|---|
| *Acer ginnala* Maxim. | Amur Maple | 3 |
| *Acer griseum* (Franch.) Pax | Paperbark Maple | 2 |
| *Acer nigrum* F. Michx. | Rock Maple* | 1 |
| *Acer palmatum* Thunb. | Japanese Maple | 3 |
| *Acer platanoides* L. | Norway Maple* | 7 |
| *Acer rubrum* L. | Red Maple | 3 |
| *Acer saccharum* Marsh. | Sugar Maple* | 1 |
| *Acer triflorum* Kom. | Three-Flowered Maple | 1 |
| *Aesculus hippocastanum* L. | Horse Chestnut* | 7 |
| *Aesculus x carnea* Hayne | Red Horse Chestnut | 2 |
| *Carya glabra* (Mill.) Sweet | Pignut Hickory* | 1 |
| *Cornus kousa* Hance | Japanese Dogwood | 8 |
| *Cornus mas* L. | Cornelian Cherry* | 3 |
| *Fagus grandifolia* Ehrh. | American Beech* | 1 |
| *Fagus sylvatica* L. | European Beech* | 12 |
| *Juglans nigra* L. | Black Walnut* | 1 |
| *Picea abies* (L.) Karst. | Norway Spruce* | 1 |
| *Pinus banksiana* Lamb. | Scrub Pine | 1 |
| *Pinus parviflora* Siebold & Zucc. | Japanese White Pine | 1 |
| *Pinus strobus* L. | Eastern White Pine | 12 |
| *Pinus sylvestris* L. | Scots Pine* | 1 |
| *Quercus acutissima* Carruth | Sawtooth Oak | 2 |
| *Quercus alba* L. | White Oak * | 1 |
| *Quercus coccinea x rubra* | Scarlet x Red Oak hybrid* | 1 |
| *Quercus macrocarpa* Michx. | Burr Oak* | 9 |
| *Quercus palustris* Munchh. | Pin Oak* | 3 |
| *Quercus rubra* L. | Northern Red Oak* | 5 |
| *Quercus robur* L. | English Oak* | 1 |
| *Ulmus americana* L. | American Elm | 8 |
| *Ulmus glabra* Huds. | Wych Elm* | 9 |
| *Ulmus hollandica* Mill. | Dutch Elm | 23 |
| *Ulmus procera* Salisb. | English Elm | 5 |
| *Ulmus pumila* L. | Siberian elm | 1 |
| *Ulmus thomasii* Sarg. | Rock Elm | 1 |
| TOTAL | | 141 |