Population and Home Range Survey of Southern Flying Squirrels at Brookhaven National Laboratory

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Abstract

Population and Home Range Survey of Southern Flying Squirrels at Brookhaven National Laboratory Bradley Buckallew (Presbyterian College, Clinton, SC 29325) Jennifer Higbie (Brookhaven National Laboratory, Upton, NY 11973).

Southern flying squirrels, small, nocturnal mammals that are abundant along the eastern seaboard of the United States, play an important role in the ecosystem distributing the seeds of various plants and trees while feeding, and are an important prey animal for nighttime predators. This study has determined the presence of southern flying squirrels on Brookhaven National Laboratory's property. To capture the squirrels, two methods were used. PVC sections were cut and mounted 2.85 meters high in trees to simulate day hides. These were checked regularly for occupancy, but failed to produce results. In the wake of the PVC's failure, Sherman traps were mounted on trees at a height of about 1.7 m and baited in the evening and checked the subsequent morning with four trap nights per week. Along with these two trapping methods, horizontally mounted PVC was used at the same height of the traps to check for presence. Motion cameras were also used to obtain images of the squirrels interacting with the traps and PVC. Throughout the course of the investigation, 38 captures were made between the Sherman traps and a small mammal study also occurring in the same area. Standard mammal measurements were taken for each southern flying squirrel and 16 of the individuals were ear-tagged. Five of these were later recaptured and their average movement was 69.2 m per day. The average measurements for the squirrels at BNL were within 10% of measurements from other studies, except the weights, which were higher. This difference might be attributed to the lack of precision in the hanging scales used for this investigation. The images from the motion cameras indicate that the squirrels were active between 8:30 PM and 11:30 PM and in a variety of temperatures. The failure of the PVC hides is most likely due to the abundance of natural shelter available. Unfortunately not enough data was collected for a population estimate or a complete home range. Future studies in the next two years will accumulate more data throughout Brookhaven National Laboratory's property, allowing for a population estimate. Future studies will also include using radio collars to tract the southern flying squirrels, resulting in home range data.

Introduction

One of the common small mammals, but often overlooked in New York, is the southern flying squirrel. The completely nocturnal nature of this creature prevents it from being spotted by the casual observer. Even though it is not often seen, the southern flying squirrel is quite prevalent in New York and through out its range, which extends from the eastern seaboard as far west as the Mississippi River. It ranges from Maine to Florida and even has pockets as far south as Central America [5].

The southern flying squirrel cannot fly as its name implies, but instead glides from tree to tree using a skin membrane call a patagium. This membrane extends from the wrist of the forelimb to the ankle of the leg, providing a large surface area for air resistance. By controlling the tension of the patagium and using its tail, the squirrel is able to direct the course of its glide without bumping into anything.

The diet of the southern flying squirrel varies greatly, from insects to fungus, but their main food supply comes from nuts and acorns. These come from hardwood trees such as oaks and hickories. The squirrels store nuts and acorns in vast quantities during the fall in preparation for winter. The squirrels reside in holes that can often be found in snags or in trees that have received the attentions of a woodpecker. During the summer, when the temperatures are higher, the squirrels also build outside nests in the limbs of trees, but during the winter the squirrels stay inside warmer holes, often gathering in numbers for the added warmth [1].

Southern flying squirrels have two breeding seasons a year, once from February to March and a second time from June to July. Individual females often only participate in one season per year unless they are particularly healthy. The gestation period is forty

days and the average litter is three to four. The young are born completely dependent, but are out on their own by the time the female gives birth to the next litter [1].

The population number of southern flying squirrels at Brookhaven National Laboratory (BNL) has never been calculated or studied. The purpose of this study is to determine the presence of flying squirrels on the property and determine their relative population.

The study area is a plot of 170 acres on the east side of the property noted in figure 1. It is mostly composed of successional farm field and mixed oak forest with portions of planted white pine.

Materials and Methods

The first approach involved 76 two-foot sections of 2-inch diameter PVC. These were cut and installed as day hides for the squirrels. The idea for this came from several bird research projects which used PVC for nest boxes, but attracted southern flying squirrels as well as the birds. 50 of the sections were left smooth on the inside, but the remaining 26 were scored on the inside to roughen it up. This was done because the ability of the squirrels to grip the inside of the PVC had come into question due to a past study using PVC for artificial treefrog habitat which had problems with flying squirrels entering their PVC and drowning because they were unable to climb back out [2]. Each of the sections was then capped on the top end to reduce light emission. Using Geographic Information System (GIS), a grid of fifty locations was created over the assigned study area. A Global Positioning System (GPS) was then used to locate these points in the field. Once the location had been found, the PVC sections were mounted vertically to the nearest tree around a height of 2.85 meters and their exact location was

taken with the GPS. The height was chosen based on multiple studies which showed that a trap height of 3 m was successful [4,7]. The hides were lowered to 2.85 m because it was deemed that the 12-foot telescopic ladder used was more stable at this height and safety was a concern. The sections were mounted using a 2-inch circular bracket that was secured onto the tree with a 2-inch lag screw. The PVC was then inserted into the bracket and held secure by a bolt and wing nut. At each of the 50 locations, a smooth section of PVC was mounted, while the 26 roughened sections were mounted evenly throughout, adjacent to the smooth sections as shown in figure 2. Tree species, overstory, understory, circumference and facing were taken for each location. The circumference was then later converted into the diameter at breast height (DBH). The PVC sections were checked periodically throughout the study to monitor for inhabitance.

After the day hides failed to produce any results during the first two weeks, the decision was made to use Sherman traps to capture the flying squirrels, as they have been shown to be successful in many studies [3,6,7]. The first week, ten Sherman traps were placed in an area that had shown signs of southern flying squirrel activity. The circular brackets used to mount the PVC sections were modified to fit the rectangular shape of the Sherman traps using a vise. The brackets were then mounted onto the tree in the same way as the day hides and once the trap had been placed inside, zip ties were used to secure the trap in the bracket, shown in figure 3. Care had to be taken to ensure that the external pressure from the bracket did not prevent the Sherman trap from fully closing. Unlike the day hides, the Sherman traps were mounted at about 1.6 m high, following the examples of past studies [3,6]. Success in the first week lead to an expansion of the project to 30 Sherman traps. In the successive weeks, six locations were chosen for

trapping, with five Sherman traps per location. The Sherman traps were mounted on random trees surrounding the location and a GPS was used to mark the site of each individual trap. The chosen locations mirrored the sites of mounted PVC to ensure that the entire study area was covered throughout the course of the investigation. Overstory, understory, circumference and facing were taken at each trap along with tree species. The traps were installed at the beginning of each week and removed at the end of the week with four trap nights in between. The traps were baited with a mixture of peanut butter and oats. The traps were checked early each morning to reduce the amount of time each squirrel spent in the trap. Captured squirrels were ear-tagged, weighed and measured for total length, tail length and hindfoot length. If the squirrel was a recapture, the tag number was noted along with weight.

In the latter part of the study, some of the PVC hides were modified to determine if the squirrels disliked the PVC itself or if they simply did not need the hides. Ten of the PVC sections were shortened to one foot in length. The shortened length made the tubes more manageable, but was long enough to prevent raccoons and other animals from reaching in and taking the bait. The cap remained on one end of the tube, leaving only one entrance. These tubes were then mounted to trees horizontally about 1.6 meters high in the same fashion as the hides. The location of the tubes was the same as the Sherman traps each week, with some of the tubes mounted on the same tree as the trap, evident in figure 4, and others mounted to separate trees. The tubes were baited and the presence or absence of the bait denoted if a squirrel had visited. Two motion cameras were used to capture images of the squirrels interacting with the traps and PVC.

Cores were taken from a subset of trees that the Sherman traps were mounted on. These cores were examined with a field microscope and the age of the tree was noted.

Results

The PVC day hides were observed a total of 570 trap nights over the course of 9 weeks with no signs of use throughout the investigation.

The Sherman traps resulted in 31 captures over 480 trap nights, a success rate of 6.46%. In addition, seven more captures were made in a separate small mammal survey that utilized Sherman traps placed on the ground. These squirrels were processed in the same manner as the squirrels captured in the tree mounted Sherman traps. The average weight of these individuals was 72.3 grams, while the average total length and tail length were 21.4 cm and 8.97 cm respectively. The hindfoot length was mistaken for each individual as the result of a misunderstanding and as such the data is not viable. Evident in figure 5, captures were made throughout the study area, but one area in particular resulted in a high number of captures. This area was located north of Brookhaven Avenue and was between PVC traps 39 and 28, shown in figure 1.

Scarlet oaks were vastly preferred to other tree species, with 22 captures coming from scarlet oaks, 4 from white oaks, 4 from pitch pines, and 1 from hickory (Figure 6). While only 22.5% of the traps were mounted on scarlet oaks, they accounted for 61.1% of the captures. The forestry data concurs with this trend, with 12 of the captures coming from a scarlet oak heath forest and 12 coming from a red maple scarlet oak mesic heath forest. Of the remaining captures, 7 occurred in pitch pine white oak forest, 4 in planted white pines, 2 in pitch pine mixed oak-heath forest and 1 in red maple blackgum wet

forest. Unfortunately, problems encountered using the tree corer prevented enough data from being gathered to determine if tree age was a factor in capture success.

Of the captured squirrels, 16 individuals were successfully tagged. Five of these individuals were later recaptured. Using GIS, the recapture locations were marked and the distance between them were calculated, shown in figure 7. The data showed the squirrels are capable of significant movement, with tag 9 moving 376 m in just one day, while tag 14 moved 900+ m over the course of 11 days. The map also indicates that some squirrels stay in the same vicinity, with tag 14 moving just 9.8 m one night and tag 8 being caught in the same location three nights in a row, though this might be due to the individual learning that the traps were a source of food. The average distances tag numbers 8, 9, 11, 14 and 87 travelled per day were 50.5 m, 104.6 m, 12.4 m, 78.6 m and 109.1 m respectively.

Horizontally mounted PVC sections had a success rate of 5.88, with 68 trap nights and 4 confirmations of presence.

The motion cameras successfully took images of flying squirrel activity five nights. Based on the time of the images, the most active time for the flying squirrels was from 8:30 pm to 11:30 pm since all of the encounters took place within this time period. The cameras also showed the squirrels to be active in a variety of temperatures, ranging from 14.4 to 21 degrees Celsius.

Discussion

The lack of success from the vertically mounted PVC seems to suggest that either the flying squirrels dislike PVC or that they have no need for the structure itself. Since the squirrels willing entered the horizontally mounted PVC to retrieve the bait, it seems

that the second explanation is the most likely. The area tested at BNL contained a plethora of snags and cavities, so the squirrels already had an abundance of hiding and living space. The squirrels simply had no need for the artificial PVC hides and therefore did not use them.

The total length and tail length of the individuals captured were within 10% of similar measurements made on squirrels from Indiana and Florida [2]. The average weight differed by 14.8% and 39% respectively. This could be due to different population characteristics caused by climate. The southern flying squirrels found further north could weigh more to account for the colder temperatures. This discrepancy could also be due to the use of multiple scales in this study, which may have not been perfectly calibrated.

The capture success of the scarlet oaks and of areas with high concentrations of oaks is most likely due to the southern flying squirrels' diet. Since their primary food source is acorns and nuts, it makes sense that the squirrels would forage in areas that have a high oak concentration. The success of the scarlet oak in particular maybe linked to the completion of its acorn development, which coincided with the time frame of this study.

The horizontally mounted PVC has been shown to be a successful method of detecting the presence of southern flying squirrels. This method is relatively fast and easy and does not endanger the animal at all, making it a good, but limited choice for presence and absence studies.

Due to cold nights and heavy rainfall, three squirrels were found deceased from hypothermia early in the study. To help prevent this from happening in the latter part of the study, changes were made. The traps were checked earlier in the morning and if

heavy rainfall and low temperatures were predicted overnight the traps were not opened that evening. One squirrel was found deceased having been pinned by the door of the Sherman trap while trying to escape and another squirrel had to be put down because of injuries sustained from being pinned by the trap. From the positions of the squirrels, the accidents seemed to be happening after the squirrels had entered and triggered the traps. The squirrels had evidently pulled the door to the trap back open and had managed to get caught while trying to pull their body through the opening. While the squirrels did not sustain injures from entering the trap, the possibility was present and to lessen the chance of this happening, the sensitivity of the traps were lowered, meaning that the squirrels had to enter further into the trap before the door was triggered.

The presence of southern flying squirrels has been proven on BNL property. Future studies will expand the project to the rest of BNL property and will further investigate their movements using radio collars.

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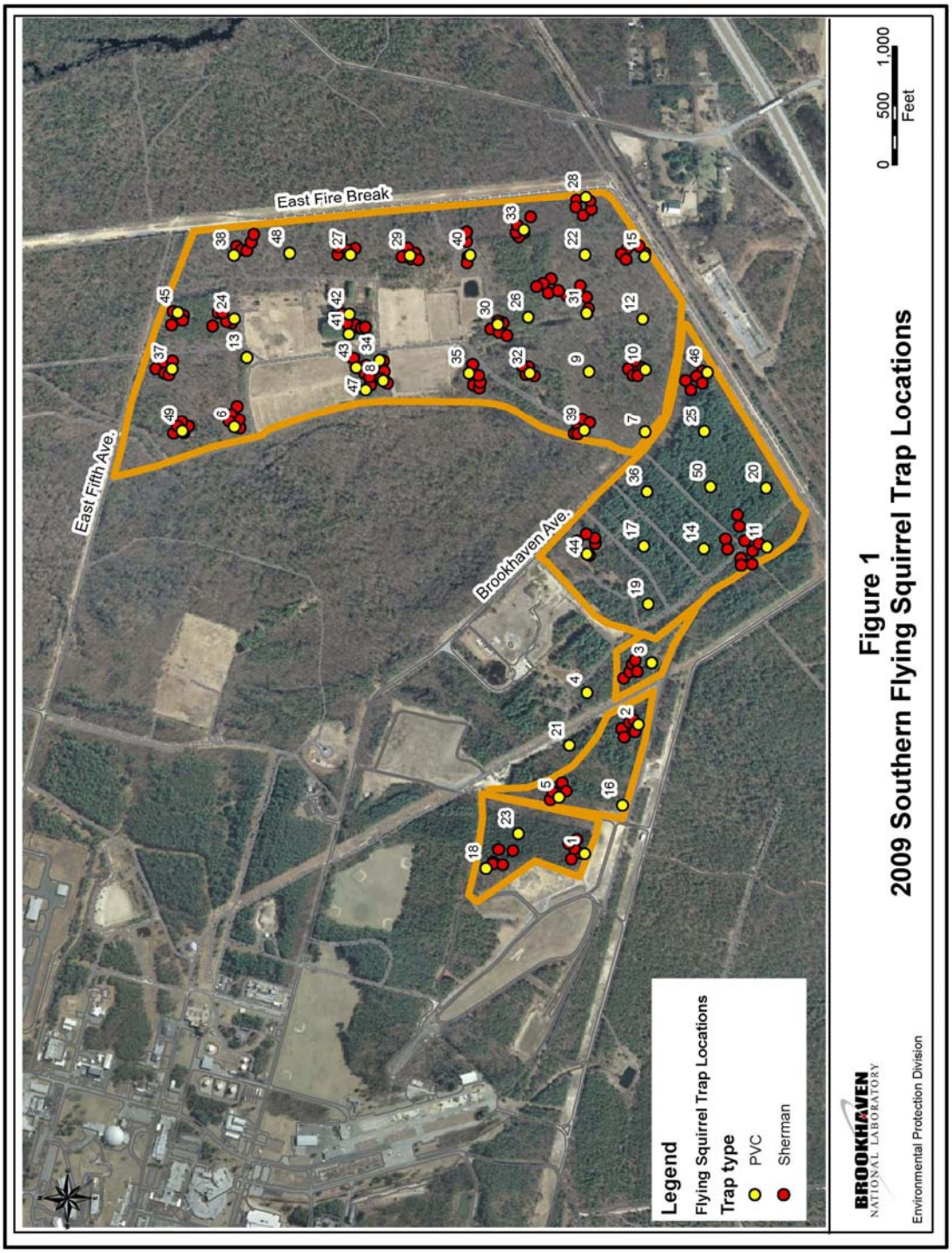

Figure 1
2009 Southern Flying Squirrel Trap Locations

Figure 2. Vertical PVC hides mounted to tree

Figure 3. Sherman trap mounted to tree

Figure 4. Sherman trap and horizontally mounted PVC with a southern flying squirrel entering Sherman trap

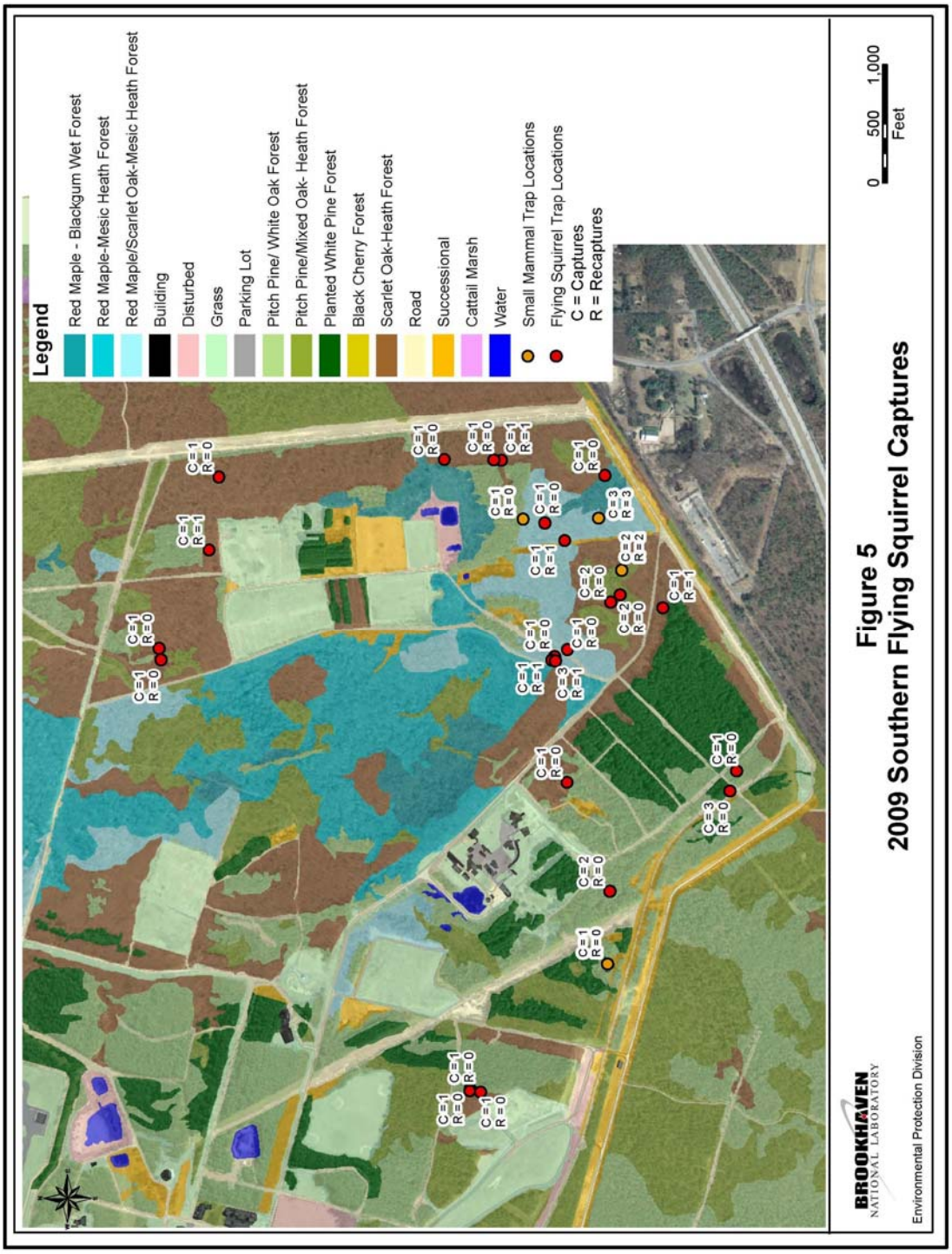

Figure 5
2009 Southern Flying Squirrel Captures

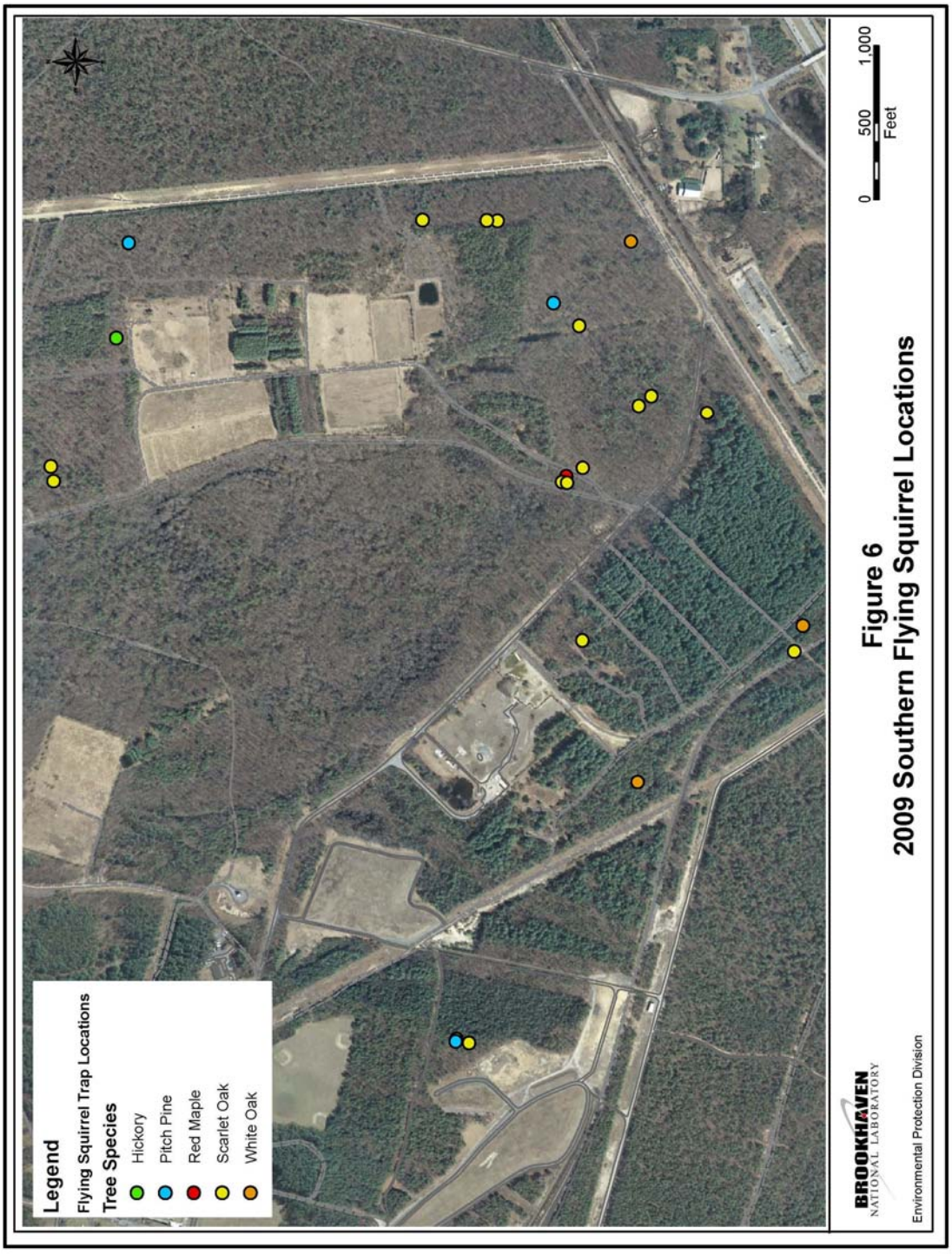

Figure 6
2009 Southern Flying Squirrel Locations

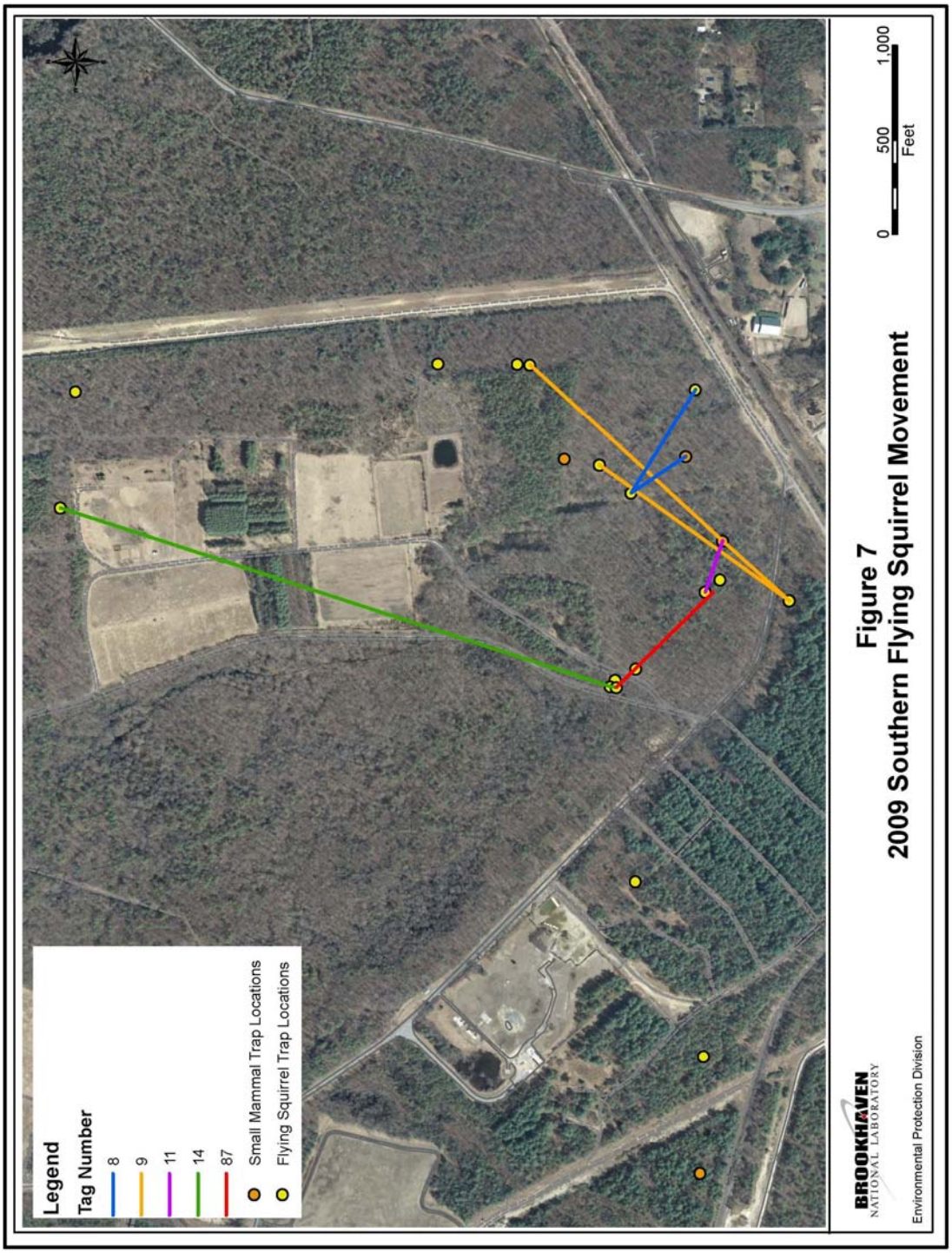

Figure 7
2009 Southern Flying Squirrel Movement