Radio telemetry and home range analysis of Southern Flying Squirrels at Brookhaven National Laboratory

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Squirrel release after collaring


Squirrel 130


Courtney with Radio Telemetry Equipment

Abstract

Wildlife and environmental studies are essential for the protection and management of natural resources at Brookhaven National Laboratory. Beginning in 2010, a three year consecutive study was conducted during the summer months to determine the average home range and nighttime movements of Southern Flying Squirrels. These small, nocturnal mammals (*Glaucomys volans*) play a vital role in forest health and ecology. Individuals were captured in Sherman small mammal traps, fitted with an ear tag and radio collared. Over the following weeks, the squirrels were tracked with radio telemetry equipment. Locations were recorded in a Trimble GPS and analyzed in a Geographic Information System (GIS) program. Average home range, movements and additional statistics were compiled and compared for 26 individuals. Male home ranges were found to be larger than female home ranges. This data will be compared to other regions to determine variation in home range size.

Results

The average home range of squirrels successfully tracked (more than 1 week) in 2010 was 3.34 ha, 5.59 ha in 2011, and 5.41 ha in 2012. The average home range of all the adult males was 7.46 ha and the average home range of males successfully tracked was 8.69 ha. The average home range of all the adult females was 2.10 ha and the average home range of females successfully tracked was 2.81 ha. The average home range of all the juvenile males was 3.35 ha and the average home range of juvenile males successfully tracked was 3.77 ha. The largest home range was 12.86 ha and belonged to a male squirrel. The largest home range belonging to a female squirrel was 6.12 ha. Average home ranges can be seen in Figure 1. Statistics for individual squirrels can be found in Figure 2. Distribution of home ranges around the laboratory site can be seen in Figure 3.


Securing collar


Squirrel 580


Recording Trap Data

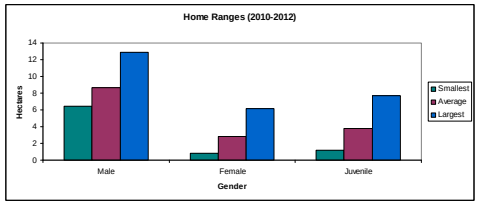

Figure1. Home Range Statistics

Introduction

Southern Flying Squirrels are small nocturnal mammals that inhabit forests from Maine to Florida and as far west as the Mississippi River [2]. These squirrels have a physical structure called a patagium, which consists of two layers of skin surrounding a thin layer of muscle that extend from forelimb to hind-limb. This allows them to glide from tree to tree with ease and makes them appear to be "flying". They have been known to glide to a maximum of 45 meters [4]. Observing the behavior of Southern Flying Squirrels is difficult because of their habitat and nocturnal lifestyle, since they spend daytime hours roosting in tree cavities and nest and the nighttime hours foraging for food. They forage in both tree canopies and on the forest floor.

In 2009, trapping was done to determine the presence and distribution of this species around the Brookhaven National Laboratory site. Over the next three summers, 26 squirrels were fitted with radio collars (6 collars in 2010, 9 collars in 2011 and 11 collars in 2012) and tracked for 10 weeks. The overall movements of these individuals were analyzed to determine their home range and habitat they used, as well as their general activity. These average home ranges were compiled and will be compared with previous studies from other regions to determine correlations in home range size between the different habitats.

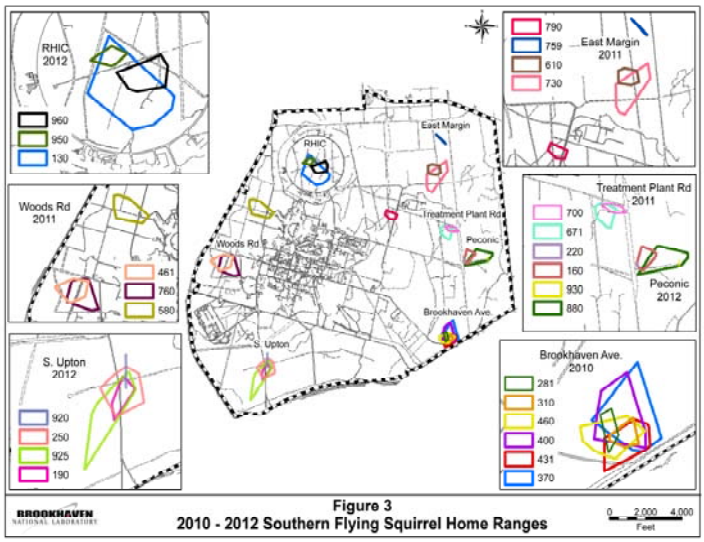

Figure 3
2010 - 2012 Southern Flying Squirrel Home Ranges

Year	Frequency	Gender	Time Tracked	Home Range (Hectares)	Largest movement (feet)	Time Elapse of Largest Movement
2010	281	Female	4 days	n/a	156.1	19 hrs 20 min
	310	Female	37 days	0.83	104	21 min
	370	Juvenile Male	35 days	5.28	182	1 hr
	400	Juvenile Male	36 days	4.25	162.1	50 min
	431	Juvenile Male	18 days	2.41	209.3	56 min
	460	Juvenile Male	35 days	3.94	226.1	42 min
2011	461	Female	38 days	6.12	152.18	35 min
	760	Male	38 days	8.32	279.78	2 hrs 06 min
	580	Juvenile Male	31 days	7.68	150.35	39 min
	700	Juvenile Male	38 days	1.21	245.36	1 hr
	671	Female	38 days	2.99	129.77	48 min
	730	Male	22 days	9.68	542.48	2 hrs 05 min
	610	Juvenile Male	15 days	3.13	135.48	53 min
	790	Female	2 days	1.93	190.99	3 hrs
	759	Male	4 days	0.008	162.91	24 hrs
2012	190	Juvenile Male	65 days	2.22	385.85	40 min
	920	Female	13 days	0.05	738.12	4 days 6 hrs
	250	Male	64 days	6.46	379.26	34 min
	220	Juvenile Male	6 days	0.006	104.41	23 hrs
	160	Female	58 days	2.32	373.17	23 hrs
	930	Female	19 days	0.02	155.79	25 hrs 32 min
	880	Male	57 days	6.59	1055.31	32 min
	950	Female	53 days	1.07	443.36	72 min
	960	Female	57 days	3.53	841.12	66 min
	130	Male	53 days	24.56	1149.19	61 min
	925	Male	44 days	8.21	362.2	29 min

Figure 2. Individual Statistics of each Collared Squirrel

Materials and Methods

Sherman small mammal traps were set up in various locations around the laboratory site. These were baited and opened in the late afternoon and checked early the following morning. If a trap contained a squirrel, it was taken down and brought back to the road to make processing easier. The squirrels were anesthetized with isoflurane to make them easier to handle and decrease their amount of stress. Measurements and genetic samples were collected after the squirrel was ear tagged and fitted with an ATS model M1420 radio collar. When they were fully recovered from the anesthesia, they were released near the tree where they were captured.

Over the following ten weeks, each squirrel was tracked using a 3- Element Yagi antenna and R-1000 Telemetry receiver (Communication Specialist, Inc). Locations were pinpointed during the day to the exact tree and triangulation methods were used at night. GPS locations were recorded using a Trimble Geo XT 2008 series with ArcPad 8.0. ArcGIS ArcInfo 9.2 was used to plot and analyze all locations and movements. The points were organized for each frequency by date and time in order to provide a concise calendar of daily and hourly movements. Hawth's tools were used to create paths between each location by date and time for each squirrel separately. A minimum convex polygon was formed to estimate a home range and show distribution of every squirrel around the site. Analysis on home range size, average movement, largest movement overall and largest movement in a single night were conducted. These results were used to compare each squirrel by general location, gender, age and vegetation type.

Discussion and Conclusion

The size of the home ranges of squirrels found onsite fell within the range of 2.45 ha for males and 1.95 ha for females to 16.03 ha for males and 5.88 ha for females as reported in previous published studies [1, 3]. Squirrel 130 had an original home range of 24.56 ha, but when the outlying points were removed his home range was 12.86, which falls within the parameters of previous studies. These outliers could be due to inaccuracies with the headings or signal strengths when the points are estimated in the GIS. These could also be due to stressors, such as predators, that cause a large movement from their average home range. Large movements such as these have been observed in both 2011 and 2012. This data will be looked at further with a more accurate plotting system to determine if the discrepancies make a significant difference.

The average home ranges developed during 2011 and 2012 are larger than those found in 2010. This can be due to the fact that adult males had not been tracked during 2010. More juvenile squirrels were tracked in 2010 because a young family group had been caught in the same area and collared. The distribution of squirrels during the following summers was more widespread and the variation in age and gender provided a more balanced average. There was not a correlation between the amount of time a squirrel was tracked and the home range size. Many collars were unable to be used for their guaranteed life span due to predation and collar failure.

Special attention was paid to whether there was a maximum width of a road or firebreak that a squirrel's home range would not cross. Distance did not seem to inhibit crossing of the major roadways on the laboratory property, but other factors such as power lines and possible human interference possibly stopped the animals from crossing. The availability of a diverse food source may provide smaller home ranges because the squirrel does not need to forage in a larger area. This as not been seen, as home range sizes in diverse and homogenous vegetation types are similar in size.

The compiled data for the last three summers provide an overall average of home ranges for the laboratory site. This data will be compared to home ranges of Southern Flying Squirrels in other areas and regions, as described in previous published studies. Comparisons between the various regions will determine if there are prominent differences in island ecology and biogeography.

References

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