# Field and Molecular Survey of Northern and Southern Flying Squirrels in Northern New York

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## Abstract

In northern New York, there are 2 sympatric species of flying squirrel, the northern (*Glaucomys sabrinus*) and southern (*Glaucomys volans*). Recent research suggests that the boundaries between the northern and the southern flying squirrels have been shifting northward, in part due to climate change affecting resource availability. As a result, northern New York would now be the southern terminus for northern, and the northern terminus for the southern flying squirrels. The goal of our research is to develop a molecular survey of the two species that can be compared to morphological measurements made in the field to better confirm species in our area. As weather permits, we are establishing an arboreally mounted trapline and recovering scat, hair, and other tissue samples for DNA extraction, polymerization chain reaction (PCR), and restriction digests to determine species. The molecular assay has been optimized; however the harsh winter has limited our trapping success for tissue collection in the field. Determining frequency of capture will assist in predicting where the boundary of these species lies in Clinton County.

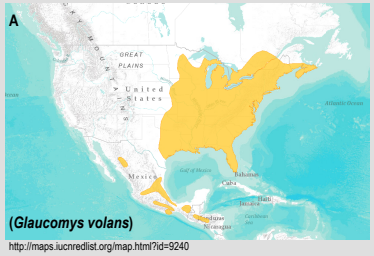
## Goal

To determine the frequency of capture of each flying squirrel species in our region in order to best predict range expansion.

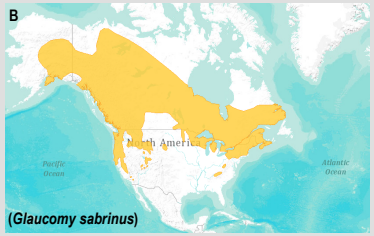
## Hypothesis

Due to climate change, the northern and southern flying squirrel species are shifting their range boundaries. As a result, Plattsburgh, New York is situated at the northern border of the southern flying squirrel and at the southern border of the northern flying squirrel ranges. We predict that the majority of the flying squirrels surveyed in our area will be southern flying squirrels.

## Distribution Maps




http://maps.iucnredlist.org/map.html?id=9240




http://maps.iucnredlist.org/map.html?id=39553

**Fig. 1. A)** Southern flying squirrel, **B)** Northern flying squirrel

## Species-Specific Morphological Differences

**Color**:

- More gray than the northern flying squirrel, with darker sides
- Underparts are mostly pale white, occasionally creamy, with belly hairs that are white to the base
- Toes in the winter are usually white

**Average Measurements:**

**Total length**: 221 mm
**Tail length:** 100 mm
**Hind foot length:** 3 mm
**Weight:** 52 g

(*Glaucomys volans*)

**Fig 2.** Southern flying squirrel
www.dnr.state.md.us

**Color:**

- More brown pelage than the southern flying squirrel, ranging from light tan to rusty brown
- Underparts are mostly white, with belly hair gray at the base, occasionally white throughout

**Average Measurements:**

**Total length**: 276 mm
**Tail length**: 126 mm
**Hind foot length**: 3.6 mm
**Weight**: 70 g

(*Glaucomys sabrinus*)

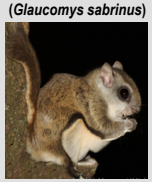


**Fig. 3.** Northern flying squirrel
www.nwf.org

**Generalities (Lavers et al. 2006):**

*G. sabrinus*→ Mass> 80g, no tails <= 90mm, hind foot length> 35mm
*G. volans*→ No tails> 90 mm

## Site Description

**Rugar Woods, Plattsburgh, New York** (Fig. 4)
**(44°41'2"N 73°28'22"W)**

- Mixed forest habitat dominated by white pine (*Pinus strobus*), northern white cedar (*Thuja occidentalis*), red maple (*Acer rubrum*), hop hornbeam (*Ostrya virginiana*), big-toothed aspen (*Populus grandidentata*), and white ash (*Fraxinus americana*)
- Numerous ephemeral ponds, intersecting stream, bordering the Saranac River

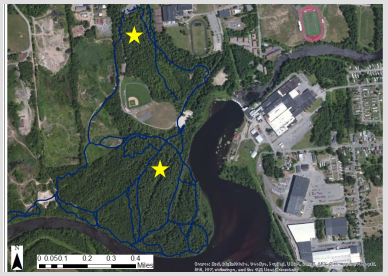


**Fig. 4.** Rugar Woods extent with trail system (stars denoting trap sites)

## Field Methodology

**Duration of study:** February - April 2014

- Sherman traps (N = 8) were bungee corded to trees at 1.37m above ground level (Fig. 5).
- Traps were prebaited with a mixture of peanut butter, cracked black-oil sunflower seeds, and apples. For bedding material cotton balls were added.
- The traps were then checked early in the morning to collect tissue samples and morphological measurements.
- Delay in snow melt and inconsistencies in weather have not supported a robust capture season. Trapping continues until the end of the semester.

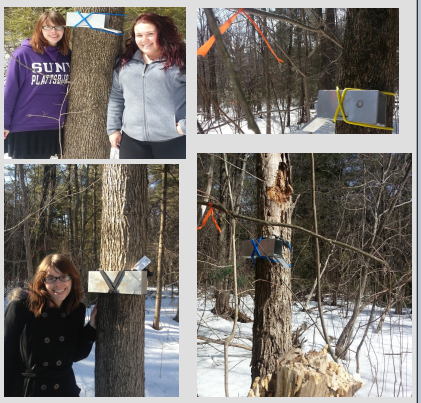


**Fig 5.** Trapline in Rugar woods with Alexis Waldron and Amanda Bliss

## Laboratory Methods and Results:

- Tissue (e.g., scat, hair, saliva) were collected from samples (taxidermy collection and live specimens)
- DNA was extracted from tissue using Qiagen tissue spin columns (Fig. 6).
- Polymerase Chain Reaction (PCR) was performed using primer sets:
(FWD) **L147224** 5' CGA AGC TTG ATA TGA AAA ACC ATC GTT G 3'
(REV) **H15915** 5' AAC TGC AGT CAT CTC CGG TTT ACA AGA C 3'
(Fig. 7)
- Restriction digests were performed on PCR products using the **RSA1 restriction enzyme** (Fig. 8)
- Splice sites on **southern flying squirrel** are at approximately:
**518 bps , 722 bps**

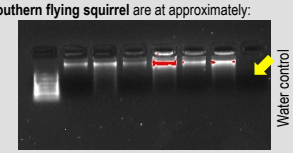



**Fig 6.** Agarose gel of DNA extraction product

## Results

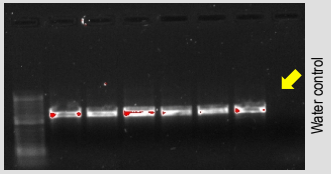



**Fig 7.** Agarose gel of PCR product

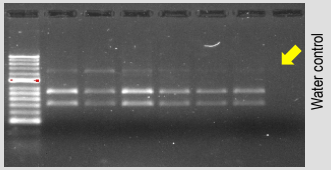



**Fig 8.** Agarose gel of restriction digest with RSA1 enzyme

- All taxidermy samples from the local campus collection were confirmed to be the southern species (*G. volans).*
- No animals were captured thus far in trapping sessions.

## Discussion and Future Directions

- Molecular methods have been optimized in this pilot survey.
→ We will continue to determine the optimal tissue for species identification.
- All taxidermied local flying squirrels were southern species; however they were labeled as northern on museum specimen Tags.
→ Likely we will be catching fewer northern flying squirrels as their range is expected to contract northward with warming temperatures.
- Trapping will continue throughout the summer and fall semester in the ENV430 Wildlife Ecology and Management course.
→ Flying squirrel species are important in dispersing seeds and spreading fungal spores within their community, thus we will continue to better understand their distribution as they play an important structuring role in the forest community.

## Acknowledgements

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## References

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