

# Fall Den Site Selection of Southern Flying Squirrels in Schmeeckle Reserve

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## Abstract

Nine southern flying squirrels (*Glaucomys volans*) were trapped and radio collared in Schmeeckle Reserve during the fall 2004 and 2005. Exact den locations were taken three to four times weekly during periods of inactivity (1000-1600) from the time of capture through the length of transmitter battery life (40-60 days). Tree species, dbh (diameter at breast height), tree height, stage of decay, den height above the ground, entrance hole height and diameter, and direction of den entrance were recorded. Average dbh of all trees >10 cm within a 2 m radius circle were recorded and classified as either coniferous or deciduous. Percent shrub cover <3 m was measured with line intercept transects within the 2 m radius circle. Den sites were compared to 32 randomly selected sites within the study area. Mean (± SD) of height above the ground, entrance hole height and diameter were 3.7 ± 1.1 m, 17.4 ± 5.0 cm, and 15.1 ± 3.3 cm. Den tree dbh ( $p < 0.000$ ) and den tree species ( $X^2 = 0.013$ ) were found to be significant.

## Introduction

### Background

Little is known about southern flying squirrel (*G. volans*) denning behavior and preferences in the Upper Great Lakes Region. Previous studies have suggested that *G. volans* rely almost exclusively on trees cavities created by woodpeckers and larger tree squirrels in trees undergoing decay or following damage or disease (Carey et al. 1997, Engle et al. 1992). Thus, *G. volans* abundance relates to the abundance of nesting cavities as cavities provide shelter from inclement weather and from predators (Weigl 1978).

### Justification

Carey et al. (1997) recommended that testing hypotheses about dens may lead to the factors limiting *Glaucomys* spp., but because no qualitative data on denning behavior and dens has been reported, there would be great difficulty in designing an experiment to test hypotheses about dens as limiting factors.

### Study Objectives

In this study, I present radio telemetry data from fall 2004 and 2005 of eight *G. volans* in Schmeeckle Reserve to describe the types of dens used and the vegetative den site characteristics. The data provided by this study will allow for the designing of future experiments to test hypotheses exploring dens as a limiting factor for *G. volans* in Schmeeckle Reserve.

### Fig. 1



**Fig. 1 (left)** *G. volans* are grey on their dorsum and dorso-ventrally flattened tail and completely white ventrally. Total length is 21.1 to 25.7 cm, weight is 45-70 g.

**Fig. 2 (right)** Un-collared *G. volans* returning to den tree.

### Fig. 2



## Methods

### Live Trapping

Havahart (13 X 13 X 48 cm) were placed 30 m apart on lateral branched and wind fall trees. Trapping occurred from 6 October 2004 – 12 November 2004 and 21 September 2005 – 25 November 2005. Individuals were ear tagged and radio collared (M1440 Advanced Telemetry Systems, Isanti, Minnesota).

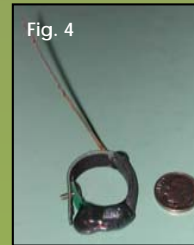
### Habitat Data Collection

Using a hand-held antennae, exact den locations were taken three to four times weekly during *G. volans* periods of inactivity (1000-1600) from the time of capture through the length of transmitter battery life (40-60 days). Den trees were evaluated on the basis of tree species, dbh, tree height, and stages of decay (Maser et al. 1979). Den hole entrances were evaluated on the basis of height above the ground, entrance hole height and diameter, and direction of den entrance. Average dbh of all trees >10 cm within a 2 m radius circle were recorded, averaged, and classified as either coniferous or deciduous. Within the 2 m radius circle along 3 parallel 4 m transects placed east to west percent shrub cover <3 m was measured with line intercept transects to determine percent shrub cover (Higgins et al. 1994). Den sites were compared to 32 randomly selected sites within the study area. Trees were counted as den sites if an individual during a period of inactivity was located within the tree using radio telemetry.



**Fig. 3 (left)** Adult female *G. volans* during anesthesia recovery period after having been fitted with radio transmitter and ear tag.

**Fig. 4 (right)** *G. volans* radio transmitter collar weighing 2.9 g.



## Results

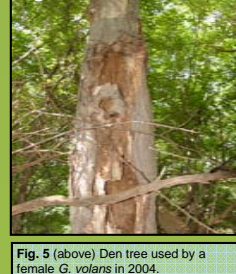
- Two adult females and one adult male *G. volans* were monitored during the fall of 2004. 15 different den sites were used.
- Two adult females, two adult males, and one juvenile male *G. volans* were monitored during the fall of 2005. 23 sites were used of which three were used the previous year.
- Den tree species ( $X^2 = 0.013$ ) and den tree dbh ( $p < 0.000$ ) were found to be significant (Table 1 and Table 2).
- Mean (± SD) of height above the ground, entrance hole height and diameter were 3.7 ± 1.1 m, 17.4 ± 5.0 cm, and 15.1 ± 3.3 cm (Table 2).
- Direction of den entrance was not significantly different from theoretical availability for the goodness-of-fit analyses ( $X^2 = 6.5$ ).

**Table 1.**  $X^2$  cross-tabulation analyses (use vs. availability) for tree species at den sites and random sites in Schmeeckle Reserve, Portage County, WI, 2004-2005.

Tree Species	Den Tree	Random Tree
White Pine	4	15
Oak	15	4
Aspen	6	6
Maple	8	7
Red Pine	2	11

$X^2 = 0.013$

### Fig. 5



**Fig. 5 (above)** Den tree used by a female *G. volans* in 2004.

**Table 2.** Mean, standard deviation, and independent sample t-tests for den sites and random sites in Schmeeckle Reserve, Portage County, WI, 2004-2005.

Den Tree Variable	Den Site (SD)	Random Site (SD)	p-value
dbh (cm)	29.5 (5.4)	23.1 (7.3)	<0.000
Height (m)	16 (4.0)	15.3 (4.5)	0.475
Decay Stage	2.2 (1.0)	2.1 (1.2)	0.693
Entrance Height Above Ground (m)	3.7 (1.1)	---	---
Entrance Hole Height (cm)	17.4 (5.0)	---	---
Entrance Hole Diameter (cm)	15.1 (3.3)	---	---
Average Coniferous dbh (cm)	9.3 (10.2)	10.8 (8.7)	0.523
Average Deciduous dbh (cm)	21.0 (5.2)	19.6 (4.8)	0.249
Average Total dbh (cm)	30.3 (11.8)	30.3 (10.0)	0.985
% Shrub Cover	19.3 (22.1)	24.4 (22.5)	0.357

## Conclusions

As indicated by the results *G. volans* selection of den site tree species are significantly different from what is available within the study area. Although not statically tested, *G. volans* appears to be selecting oak while avoiding both red and white pine. Previous studies have indicated a strong preference for deciduous trees by *G. volans* for general habitat use. Thus, increased use for den sites is plausible as *G. volans* relies on mast produced by deciduous species as a major food source. (Sonenshine et al. 1979, Weigl 1978) (Table 1). However a correlation between dbh and species should be conducted to ensure that *G. volans* is independently selecting for species and not for dbh.

In addition to tree species dbh was found to be significant (Table 2). This is congruent with previous studies conducted in Maryland where *G. volans* occupied cavities excavated by woodpeckers in snags greater than 20 cm dbh (Gilmore and Gates 1985). Although not statistically different the data indicated that perhaps large live trees with either disease or damage are more used than snags as indicated by our mean value of 2.2 (Table 2). Live trees may offer several advantages that snags are lacking such as extra protection from the weather and protection from predators due to overhead branches. However, due to our small sample size and the overall lack of snags within the study area further experimentation would be required to confirm this speculation.

No comparison was made between tree cavities characteristics available and those used by *G. volans* in this study, but it appears that smaller cavities located higher in trees are being occupied (Table 2). This may be a function of predator avoidance or competitive exclusion of other cavity nesting species as a function of body size.

As Carey et al. (1997) suggested denning behavior and selection could be the result of various complex aspects including social, energetic, predator and parasite avoidance, food, and cover, but further experimentation and research will be required to delineate the driving forces.

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