

Inventory of Mammals: 2012-2018

Lands of Willard and Carolyn Jackson

Cornwall, Addison County, Vermont

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Executive Summary

- Mammal inventories were conducted on the lands of Willard and Carolyn Jackson in Cornwall, Vermont.
- Inventories of small mammals – predominantly nocturnal rodents and a large-bodied shrew – were conducted by live trapping for one evening each during the fall 2012-2016 and again 2018 by the students of Biology 302.
- In 2018, all captured individuals identified as either deer mouse or white-footed mouse (*Peromyscus maniculatus* or *P. leucopus*) had a tissue sample taken to allow for positive identification based on known genetic differences.
- Also in 2018, two wildlife cameras were placed on trails suspected to be used by large mammals.
- Trapping and genetic analysis indicated that *Peromyscus leucopus* (white-footed mouse) is the most common and widespread nocturnal small mammal on the Jackson Estate, being found in large numbers in every plant community type inventoried and in every year.
- Robust but likely smaller or more spatially restricted populations of *Glaucomys volans* (southern flying squirrel) and *Zapus hudsonius* (meadow jumping mouse) are also present, with flying squirrels in every forested plant community type and meadow jumping mice almost exclusively in open fields near standing water.
- Less can be said for certain about other species: *Blarina brevicauda* (short-tailed shrew) was widespread, but its apparent low numbers could have been the result how sensitive the triggers on the traps were set, and low numbers of *Tamiasciurus hudsonicus* (red squirrel) and *Tamias striatus* (eastern chipmunk) trapped are likely due to their activity during the day rather than the night.
- The other species observed – *Peromyscus maniculatus*, *Microtus pennsylvanicus* (meadow vole), *Glaucomys sabrinus* (northern flying squirrel), and *Napaeozapus insignis* (woodland jumping mouse) – are likely to be genuinely uncommon on the Jackson Estate.
- Camera traps also recorded the presence of five additional species: *Odocoileus virginianus* (white-tailed deer), *Sciurus carolinensis* (eastern gray squirrel), *Canis latrans* (coyote), *Didelphis virginiana* (opossum), and cottontail rabbit (*Sylvilagus*) (presumably the eastern cottontail [*S. floridanus*] rather than the much rarer and likely Vermont-extirpated *S. transitionalis*).

Introduction and Methods

This report summarizes the findings of mammal inventories on the lands of Willard and Carolyn Jackson (hereafter referred to as the Jackson Estate). Details about these lands are provided in detail in Lapin (2011). Mammal inventories were conducted each Fall from 2012 to 2016 and again in 2018 by students enrolled in the Middlebury College class Biology 302 (Vertebrate Natural History). Two inventory methods were used: live trapping and camera trapping.

Live trapping.—Live trapping was conducted during one evening each Fall (2012: evening of 29 September to morning of 30 September; 2013: 28-29 September; 2014: 27-28 September; 2015: 3-4 October; 2016: 1-2 October; 2018: 29-30 September). An inventory was not conducted in 2017 because the class was not offered that year.

Live trapping exclusively targeted small terrestrial mammals – primarily nocturnal rodents and one large-bodied species of soricomorph (short-tailed shrew) and was distributed non-systematically across years among the plant communities described by Lapin (Table 1). Effort varied across years primarily as a function of the number of students in each class. Sherman folding aluminum live traps (dimensions) were used. The majority of traps were placed on the ground. In some plant communities, a smaller number of traps were placed on platforms attached to trees approximately six feet above the ground. Each trap was baited with rolled oats and peanut butter and supplied with 6-10 cotton balls that could provide insulation to any captured animal. Traps were set in the late afternoon, checked at sunset to free any day-active animals that were captured, and then retrieved the following morning at sunrise. All trapping was done with approved protocols from the Middlebury College Institutional Animal Care and Use Committee.

Table 1. The number of traps set each year on the ground (G) and on arboreal platforms (A) in each plant community surveyed for small mammals.

Community	2012		2013		2014		2015		2016		2018	
	G	A	G	A	G	A	G	A	G	A	G	A
Clayplain Forest	25	5	30	5	56	10	50	14	25	5	30	5
Transition Hardwood Limestone Forest	40	10	30	5	28	5	40	20	26	8	60	10
Mesic Maple-Ash-Hickory-Oak Forest	40	10	30	5	56	10	40	20	50	10	60	10
Conifer Plantation	40	10	30	5	28	10	24	7	25	5	30	5
Shrublands and Early Successional Forest	20	5	55	10	28	0	0	0	25	5	0	0
Recently Abandoned Beaver Pond (aka Beaver Meadow)	0	0	30	0	0	0	0	0	0	0	0	0
Fields and Forest Edge (near standing water)	20	5	30	5	66	5	60	0	25	0	0	0
Fields and Forest Edge (away from standing water)	45	5	20	5	66	0	60	0	25	0	60	10

Ten species of mammal, primarily in the order Rodentia (rodents) but also including one species in the order Soricomorpha (shrews and moles), were captured at least once: *Blarina brevicauda* (short-tailed shrew), *Peromyscus maniculatus* (deer mouse), *P. leucopus* (white-footed mouse), *Microtus pennsylvanicus* (meadow vole), *Napaeozapus insignis* (woodland jumping mouse), *Zapus hudsonius* (meadow jumping mouse), *Glaucomys volans* (southern flying squirrel), *G. sabrinus* (northern flying squirrel), *Tamiasciurus hudsonicus* (red squirrel or tree squirrel) and *Tamias striatus* (eastern chipmunk).

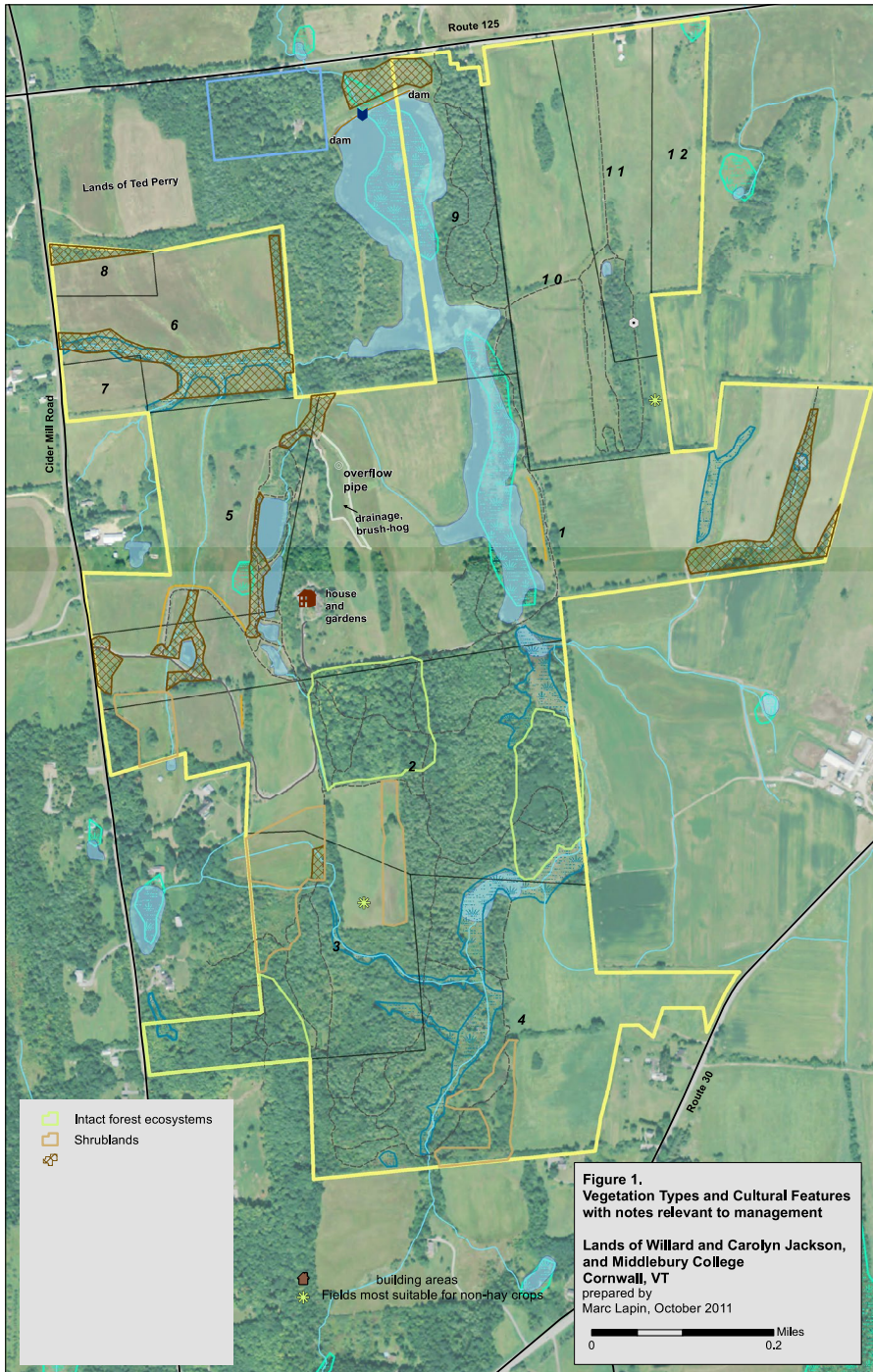
All individuals captured were identified to species, with the exception of *Peromyscus maniculatus* (deer mouse) and *P. leucopus* (white-footed mouse) from 2012-2016. These two species cannot be reliably distinguished from each other based on external morphology, and therefore they were only identified to genus (referred hereafter as the species *Peromyscus spp.*). In 2018, in collaboration with Dr. David Allen (Biology Department, Middlebury College) we collected a single tissue sample from an ear for each *Peromyscus* captured for subsequent genetic analysis. The details of this method are not described in this report but can be obtained from Dr. Allen. After identification, each individual was released.

Camera trapping.—Camera trapping was carried out only in 2018. Two wildlife cameras (Bushnell) were placed along maintained forested trails on the southeast side of the estate from 12 to 29 September. Cameras were attached approximately 0.7 m above the ground to trees immediately adjacent to trails and facing outward toward the trail. Both cameras were motion activated and used infrared lighting, so photographs were taken day or night whenever the camera detected motion on the trails.

Results: live trapping in plant communities

Although many small mammal species were broadly distributed across the Jackson Estate, each plant community type (Table 1) showed unique patterns of presence and abundance. Trapping was carried out in eight different plant community types (Table 1). These follow the designations given in Lapin (2011), with the exception of the Field. In this report, Field is further subdivided into those near standing water (adjacent to the southern end of the pond) and those away from it (Figure 1) in order to more accurately investigate the habitat association of *Zapus hudsonius*.

Figure 1. Plant community types on the Jackson Estate (from Lapin 2011).



Clayplain Forest.—Despite the great ecological significance of the oak clayplain forest from the perspective of plant structural complexity and age, it showed very low diversity and evenness among mammals species. Of the eleven species ever captured on the Jackson Estate, only three were found in this plant community type: *Peromyscus spp.*, *Glaucomys volans*, and

Tamias striatus (Table 2). And of these three, *Peromyscus spp.* was by far the most abundant, comprising 91% (58 of 64) of all animals caught, and individual *Peromyscus* were captured each year, albeit in fluctuating numbers. Captures of *Peromyscus spp.* occurred disproportionately on the ground (96%) although ground traps were only 83% of those set there. Overall rate of capture was 28% (60 of 216) on the ground and 9% (4 of 44) on arboreal platforms.

Table 2. The number of individuals of each species captured in **Clayplain Forest** in traps on the ground (G) or on arboreal platforms (A). A number captured of “0” indicates no captures even though traps were set. Species shaded in grey were trapped at least once in this community type over the six years of trapping.

Species	2012		2013		2014		2015		2016		2018	
	G	A	G	A	G	A	G	A	G	A	G	A
<i>Number of traps set</i>	25	5	30	5	56	10	50	14	25	5	30	5
<i>Blarina brevicauda</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Peromyscus spp.</i>	11	1	2	0	14	1	9	0	13	0	7	0
<i>Microtus pennsylvanicus</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Napaeozapus insignis</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Zapus hudsonius</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Glaucomys volans</i>	0	0	0	0	0	0	0	0	2	2	1	0
<i>Glaucomys sabrinus</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Tamiasciurus hudsonicus</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Tamias striatus</i>	1	0	0	0	0	0	0	0	0	0	0	0

Transition Hardwood Limestone Forest.—This plant community type shows a similar patterns of small mammal diversity and evenness as does the clayplain forest. Four species were captured at least once – *Peromyscus spp.*, *Glaucomys volans*, *Tamias striatus*, and *Blarina brevicauda* – although *Peromyscus* alone accounted for 94% (67 of 71) captures (Table 3). Only one animal, a single *G. volans*, was captured in an arboreal trap despite the fact that 20% of all traps (58 of 282) were set there. Overall rate of capture was 31% (70 of 224) on the ground and 2% (1 of 58) on arboreal platforms.

Table 3. The number of individuals of each species captured in **Transition Hardwood Limestone Forest**. A number captured of “0” indicates no captures even though traps were set. Species shaded in grey were trapped at least once in this community type over the six years of trapping.

Species	2012		2013		2014		2015		2016		2018	
	G	A	G	A	G	A	G	A	G	A	G	A
<i>Number of traps set</i>	40	10	30	5	28	5	40	20	26	8	60	10
<i>Blarina brevicauda</i>	1	0	0	0	0	0	0	0	0	0	0	0
<i>Peromyscus spp.</i>	22	0	5	0	7	0	3	0	13	0	17	0
<i>Microtus pennsylvanicus</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Napaeozapus insignis</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Zapus hudsonius</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Glaucomys volans</i>	0	0	0	0	0	0	0	0	1	0	0	1
<i>Glaucomys sabrinus</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Tamiasciurus hudsonicus</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Tamias striatus</i>	1	0	0	0	0	0	0	0	0	0	0	0

Mesic Maple-Ash-Hickory-Oak Forest.—This plant community type differs from both the clayplain and transition forests primarily in containing both the northern and southern species of flying squirrels (Table 4). Otherwise, the pattern of diversity and evenness is broadly similar: a preponderance of *Peromyscus spp.* (89% of captures, 76 of 85) and disproportionately captured on the ground (96% [73 of 76 *Peromyscus* captured] compared to only 81% [276 of 341] of the traps placed there. Overall rate of capture was 28% (78 of 276) on the ground and 11% (7 of 65) on arboreal platforms.

Table 4. The number of individuals of each species captured in **Mesic Maple-Ash-Hickory-Oak Forest**. A number captured of “0” indicates no captures even though traps were set. Species shaded in grey were trapped at least once in this community type over the six years of trapping.

Species	2012		2013		2014		2015		2016		2018	
	G	A	G	A	G	A	G	A	G	A	G	A
<i>Number of traps set</i>	40	10	30	5	56	10	40	20	50	10	60	10
<i>Blarina brevicauda</i>	0	0	2	0	2	0	0	0	0	0	0	0
<i>Peromyscus spp.</i>	12	0	1	0	17	1	5	0	13	1	25	1
<i>Microtus pennsylvanicus</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Napaeozapus insignis</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Zapus hudsonius</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Glaucomys volans</i>	0	1	0	0	0	0	0	1	0	1	1	0
<i>Glaucomys sabrinus</i>	0	1	0	0	0	0	0	0	0	0	0	0
<i>Tamiasciurus hudsonicus</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Tamias striatus</i>	0	0	0	0	0	0	0	0	0	0	0	0

Conifer Plantation.—As in the previous plant communities described, the conifer forest stands are primarily inhabited by *Peromyscus spp.*, with 74% (35 of 47) of all captures (Table 5).

Capture success is intermittent, however, occurring in four of the six years. Other species captured here are *Blarina brevicauda* (6 individuals but only in two of six years), *Glaucomys volans* (5, in four of six years, and in both ground and arboreal traps), and *Tamiasciurus hudsonicus* (1, in only one year). Overall rate of capture was 24% (43 of 277) on the ground and 9% (4 of 42) on arboreal platforms.

Table 5. The number of individuals of each species captured in **Conifer Plantation**. A number captured of “0” indicates no captures even though traps were set. Species shaded in grey were trapped at least once in this community type over the six years of trapping.

Species	2012		2013		2014		2015		2016		2018	
	G	A	G	A	G	A	G	A	G	A	G	A
<i>Number of traps set</i>	40	10	30	5	28	10	24	7	25	5	30	5
<i>Blarina brevicauda</i>	0	0	0	0	0	0	0	0	5	0	1	0
<i>Peromyscus spp.</i>	12	0	0	0	4	0	0	0	11	1	7	0
<i>Microtus pennsylvanicus</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Napaeozapus insignis</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Zapus hudsonius</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Glaucomys volans</i>	0	1	0	0	0	1	0	0	2	0	0	1
<i>Glaucomys sabrinus</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>Tamiasciurus hudsonicus</i>	1	0	0	0	0	0	0	0	0	0	0	0
<i>Tamias striatus</i>	0	0	0	0	0	0	0	0	0	0	0	0

Shrublands and Early Successional Forest.—Because of low apparent diversity, this community type was only inventoried in four of six years, and arboreal traps were set in only three of those years. Of all of the forest community types inventoried, this one has the lowest diversity and apparent abundance (Table 6). Only two species – *Peromyscus spp.* and *Blarina brevicauda* – were ever captured there, and all but one individual were *Peromyscus* (95%, 20 of 21). Overall rate of capture was 15% (19 of 128) on the ground and 10% (2 of 20) on arboreal platforms.

Table 6. The number of individuals of each species captured in **Shrublands and Early Successional Forest**. A number captured of “0” indicates no captures even though traps were set. A number captured of “---” indicates no traps were set and therefore no captures were possible. Species shaded in grey were trapped at least once in this community type over the six years of trapping.

Species	2012		2013		2014		2015		2016		2018	
	G	A	G	A	G	A	G	A	G	A	G	A
<i>Number of traps set</i>	20	5	55	10	28	0	0	0	25	5	0	0
<i>Blarina brevicauda</i>	0	0	0	0	0	---	---	---	1	0	---	---
<i>Peromyscus spp.</i>	5	0	1	0	5	---	---	---	7	2	---	---
<i>Microtus pennsylvanicus</i>	0	0	0	0	0	---	---	---	0	0	---	---
<i>Napaeozapus insignis</i>	0	0	0	0	0	---	---	---	0	0	---	---
<i>Zapus hudsonius</i>	0	0	0	0	0	---	---	---	0	0	---	---
<i>Glaucomys volans</i>	0	0	0	0	0	---	---	---	0	0	---	---
<i>Glaucomys sabrinus</i>	0	0	0	0	0	---	---	---	0	0	---	---
<i>Tamiasciurus hudsonicus</i>	0	0	0	0	0	---	---	---	0	0	---	---
<i>Tamias striatus</i>	0	0	0	0	0	---	---	---	0	0	---	---

Recently Abandoned Beaver Pond.—This plant community type was only inventoried in one year (2013; Table 1) and no animals were captured. Based on this limited survey, nothing can be said about the potential small mammal inhabitants of this plant community type.

Fields and Forest Edge (near standing water).—These grassy field adjacent to the south end of the pond as well as the trees on the ecotonal edge of the small forested stand nearby are considered a separate plant community for the purposes of this inventory. This plant community has the greatest species richness, including *Peromyscus spp.* (54%, 21 of 39 captures) and *Zapus hudsonius* (26%, 10 of 39). *Microtus pennsylvanicus*, *Napaeozapus insignis*, and *Blarina brevicauda* were each captured infrequently and in small numbers (Table 7). Contributing to the numbers of *Peromyscus* captured were the three years (2012-2014) when platform traps were placed on trees at the field/forest ecotone, where 14% (3 of 21) of their total count was captured. Overall rate of capture was 17% (36 of 201) on the ground and 20% (3 of 15) on arboreal platforms.

Table 7. The number of individuals of each species captured in **Fields and Forest Edge (near standing water)**. A number captured of “0” indicates no captures even though traps were set. A number captured of “---” indicates no traps were set and therefore no captures were possible. Species shaded in grey were trapped at least once in this community type over the six years of trapping.

Species	2012		2013		2014		2015		2016		2018	
	G	A	G	A	G	A	G	A	G	A	G	A
<i>Number of traps set</i>	20	5	30	5	66	5	60	0	25	0	0	0
<i>Blarina brevicauda</i>	0	0	0	0	1	0	1	---	1	---	---	---
<i>Peromyscus spp.</i>	7	2	0	1	3	0	5	---	3	---	---	---
<i>Microtus pennsylvanicus</i>	0	0	0	0	0	0	1	---	2	---	---	---
<i>Napaeozapus insignis</i>	0	0	0	0	2	0	0	---	0	---	---	---
<i>Zapus hudsonius</i>	1	0	1	0	3	0	4	---	1	---	---	---
<i>Glaucomys volans</i>	0	0	0	0	0	0	0	---	0	---	---	---
<i>Glaucomys sabrinus</i>	0	0	0	0	0	0	0	---	0	---	---	---
<i>Tamiasciurus hudsonicus</i>	0	0	0	0	0	0	0	---	0	---	---	---
<i>Tamias striatus</i>	0	0	0	0	0	0	0	---	0	---	---	---

Fields and Forest Edge (away from standing water).—As with the fields near the pond, the fields in the more upland portion of the estate also showed high species richness, but once again dominated by *Peromyscus spp.* (83%, 59 of 71) (Table 8). The very large number of animals caught in this plant community was driven strongly by extremely high capture rates (over 50%) of *Peromyscus* in the last two years of inventories. The other four species were captured only irregularly and in low numbers. Overall rate of capture was 25% (68 of 276) on the ground and 15% (3 of 20) on arboreal platforms.

Table 8. The number of individuals of each species captured in **Fields and Forest Edge (away from standing water)**. A number captured of “0” indicates no captures even though traps were set. A number captured of “---” indicates no traps were set and therefore no captures were possible. Species shaded in grey were trapped at least once in this community type over the six years of trapping.

Species	2012		2013		2014		2015		2016		2018	
	G	A	G	A	G	A	G	A	G	A	G	A
<i>Number of traps set</i>	45	5	20	5	66	0	60	0	25	0	60	10
<i>Blarina brevicauda</i>	1	0	0	0	0	---	2	---	0	---	1	0
<i>Peromyscus spp.</i>	5	0	0	1	2	---	3	---	15	---	32	1
<i>Microtus pennsylvanicus</i>	4	0	0	0	1	---	0	---	0	---	0	0
<i>Napaeozapus insignis</i>	0	0	0	0	0	---	0	---	0	---	0	0
<i>Zapus hudsonius</i>	1	0	0	0	0	---	0	---	0	---	0	0
<i>Glaucomys volans</i>	0	0	0	0	1	---	1	---	0	---	0	0
<i>Glaucomys sabrinus</i>	0	0	0	0	0	---	0	---	0	---	0	0
<i>Tamiasciurus hudsonicus</i>	0	0	0	0	0	---	0	---	0	---	0	0
<i>Tamias striatus</i>	0	0	0	0	0	---	0	---	0	---	0	0

Overall summary.—With the exception of the abandoned beaver pond, the small mammals in each of these plant communities showed broad similarities.

- Each was predominantly and overwhelmingly occupied by *Peromyscus spp.*
- Although they were captured in lower numbers, each community other than the clayplain forest was home to *Blarina brevicauda*.
- Each was occupied by additional species that were infrequently caught – both within and across years.
- Each showed variation from year to year in number of species and number of captures, although there is no way to determine whether this variation is due to real ecological changes or differences in the skill levels among the students doing the trapping.
- No single plant community type contained all eleven of the species shown to occur throughout the estate. Each had its own complement of species.
- Despite the year-to-year variation, each had broadly similar rates of trapping success, ranging from 15% to 31% on the ground and from 2% to 20% on the arboreal platforms.

On the other hand, differences among these communities are also apparent. Other than *Peromyscus spp.* and *Blarina*, the remaining species roughly segregated among community types based on the degree of openness of the habitat. Species more strongly associated with forests (*Glaucomys*, *Tamiasciurus*, and *Tamias*) were predominantly or exclusively found in the forested plant communities, and those more strongly associated with non-forested habitats (*Microtus* and *Zapus*) were exclusively found in the fields. Thus, a mix of forest and non-forest plant communities increased the species richness of mammals on the Jackson Estate.

Results: live trapping by species

Peromyscus spp.—As noted above, by far the most numerous and widespread of all the small mammals on the estate are those in the genus *Peromyscus*. They were present in every plant community type sampled (except for the beaver meadow formed by the recently abandoned beaver pond) and were always by far the most abundant species.

Prior to 2018, nothing can be said about differences in relative abundance and distribution of the two *Peromyscus* species in this genus (*maniculatus* and *leucopus*) present. In 2018, however, tissue samples were collected from each *Peromyscus* captured, and their species identity determined in the lab (Table 9).

Table 9. The number of *Peromyscus maniculatus* (P.m., deer mouse) and *P. leucopus* (P.l., white-footed mouse) in each plant community type inventoried in 2018.

Community	No. traps		P.m.		P.l.		Unknown		Total	
	G	A	G	A	G	G	G	A	G	A
Clayplain Forest	30	5	0	0	7	0	0	0	7	0
Transition Hardwood Limestone Forest	60	10	0	0	16	0	1	0	17	0
Mesic Maple-Ash-Hickory-Oak Forest	60	10	2	1	22	0	1	0	25	1
Conifer Plantation	30	5	0	0	7	0	0	0	7	0
Fields and Forest Edge	60	10	3	0	27	1	2	0	32	1

Based on these results, the following can be said with certainty:

- Both *P. maniculatus* and *P. leucopus* are present at this site.
- *P. leucopus* vastly outnumbers *P. maniculatus*. Eighty of the 90 *Peromyscus* captured were positively identified as *leucopus*. Of the remaining 10 individuals captured, only 6 were positively identified as *P. maniculatus*, while the remaining 4 remain unidentified. The predominance of *leucopus* at this low-elevation site agrees with the earlier findings of Parren and Capen (1985)
- *P. leucopus* is found in all plant community types inventoried in 2018.

Too few *P. maniculatus* were captured to say anything about their distribution among plant communities with certainty. Similarly, too few *Peromyscus* were caught in arboreal platform traps to identify any differences between the species with respect to potential vertical height separation, as has been reported by others (Anderson et al. 2000, Graves et al. 1988, Kamler et al. 1998).

***Blarina brevicauda* (short-tailed shrew).**—*Blarina* were caught infrequently and in low numbers in every plant community type other than the clayplain forest, suggesting that like *Peromyscus*, *Blarina* are widespread habitat generalists on the estate, and found exclusively on the ground. However, little should be inferred from their low rate of capture. *Blarina*, like all shrews, have a high metabolic rate and are at great risk of death if they remain in a trap overnight. Therefore, following our IACUC protocol, the triggers on our traps were set to be relatively insensitive to the weight of lighter-bodied *Blarina*, making it less likely that they would be caught.

***Glaucomys volans* and *sabrinus* (southern and northern flying squirrels).**—Flying squirrels were caught with great regularity across years and habitats. The presence of both species in the same location is noteworthy because, as their common names imply, they are broadly allopatric across North America. They are easily distinguished from each other by size and external traits, so their presence is certain. However, *G. volans* is clearly the more common of the two, having been caught 18 times compared the single capture of *sabrinus*. Given the well-known affinity of flying squirrels with forests, it is not surprising that they were found on the estate in each of the forest community types as well as on the field in traps set adjacent to the

forest ecotone. What *is* of note, however, is how often this arboreal species was caught in traps set on the ground (8 of 18 for *volans*).

Microtus pennsylvanicus (meadow vole).—The meadow vole was surprisingly rare on the estate given the amount of open fields maintained there and this species known affinity for open habitat. Over the six years of trapping, only eight individuals were captured, always in the fields but always in low numbers each year. Equally surprising was the lack of any apparent cycling of population size. This species is known elsewhere for the boom-and-bust character of its populations over 3- to 5-year intervals. However, *Microtus* on the estate show no evidence of any kind of cycle over the seven years of this study.

Zapus hudsonius and Napaeozapus insignis (meadow and woodland jumping mice).—Both of these species were caught exclusively in fields and along forested edges. Of the two, *Zapus* was far more common than *Napaeozapus*, comprising 10 of the 13 jumping mice captured, almost exclusively in the fields near the pond. Given the known affinity of *Zapus* for meadow-like habitat (as its common name implies) its relative abundance in fields as compared to forests here is not surprising. Further, its relative abundance in fields near water relative to fields away from water is also not surprising, given the known propensity of this species for swimming (Reid 2006). This demonstrated difference between fields near and far from water highlights the importance of considering the larger spatial context of specific plant communities when predicting what species will be present.

What *is* surprising, however, is the presence of *Napaeozapus* on the Jackson Estate at all, especially in field and edge habitat but never in any of the forested plant communities. As its common name suggests, *Napaeozapus* is strongly associated with woodland habitat, so its limited presence in fields without any observed presence in forests on the estate is not easily explained.

Tamiasciurus hudsonicus and Tamias striatus (tree squirrel and Eastern chipmunk).—Both of these species were caught infrequently, but nothing should be made of their apparent low numbers. Both are diurnal, and our methods were focused on capturing nocturnal mammals. Numerous observations of both species were made throughout the forested plant community types while we conducted our field work, and I believe they are common in appropriate habitat throughout the estate.

Overall summary.—Without question, *Peromyscus leucopus* is the most common and widespread nocturnal small mammal on the Jackson Estate. Robust but likely smaller or more spatially restricted populations of *Glaucomys volans* and *Zapus hudsonius*, are also present. Less can be said for certain about other species: *Blarina brevicauda* was widespread, but its apparent low numbers could have been the result how sensitive the triggers on the traps were set, and the low numbers of *Tamiasciurus hudsonicus* and *Tamias striatus* trapped are likely due to their activity during the day rather than the night. The other species observed – *Peromyscus maniculatus*, *Microtus pennsylvanicus*, *Glaucomys sabrinus*, and *Napaeozapus insignis* – are likely to be genuinely uncommon here.

It should be noted that we never caught any *Mus musculus* (house mouse) or *Rattus norvegicus* (Norway rat), two non-native species known to be present in Vermont and associated with human residences. Although we did not inventory immediately adjacent to the Jackson home or outbuildings, the absence of these species in any of our traps suggests they are not present – or at the very least are present in only very low numbers.

Other small mammal species known from the state and potentially captured by our methods if they were present include (a) *Myodes gapperi* (redback vole), a more montane species, (b) *Microtus chrotorrhinus* (rock vole), a rare montane species that is believed to specialize on talus slopes, (c) *Microtus pinetorum* (pine vole), a rare species about which little is known in Vermont, and (d) *Synaptomys borealis* and *S. cooperi* (northern and southern bog lemmings), which are restricted to bog habitats.

Results: camera trapping

In 2018, camera traps set over a two-week period recorded the presence of 5 additional mammal species. These include *Odocoileus virginianus* (white-tailed deer; Figure 2), *Sciurus carolinensis* (eastern gray squirrel; Figure 3), *Canis latrans* (coyote; Figure 4), and *Didelphis virginiana* (opossum; Figure 5). In addition, a cottontail rabbit (*Sylvilagus*) was observed, and is presumably the eastern cottontail (*S. floridanus*; Figure 6) rather than the much rarer and presumably Vermont-extirpated *S. transitionalis*.

Figure 2. *Odocoileus virginianus*, photographed 17 September 2018 on one of the eastern trails running north-south through the Jackson Estate.



Figure 3. *Sciurus carolinensis*, photographed 14 September 2018 on the trail to the clayplain forest.



Figure 4. *Canis latrans*, photographed 21 September 2018 on the trail to the clayplain Forest.



Figure 5. *Didelphis virginiana*, photographed 28 September 2018 on the trail to the clayplain forest.



Figure 6. *Sylvilagus* sp., presumably floridanus, photographed 21 September 2018 on the trail to the clayplain forest.



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