

Small Mammals of the Guthrie-Bancroft Farm - Year 12
Colby Hill Ecological Project, Lincoln and Bristol, Vermont
2016 Final Report

Summary

Small mammals were sampled from ecosystems 1, 6, 14 and 20 on the Guthrie-Bancroft parcel on Colby Hill, Lincoln between July 15 – August 7, 2016. A total of 266 captures from 948 trap nights were recorded with overall trap success at 28.1%. At least 9 different species of small mammals were captured considering the two *Peromyscus* species could not be morphologically identified. Two *Peromyscus sp.* were sequenced and identified as *P. leucopus* based on Cytochrome *b*. No new species were detected this year. *Peromyscus sp.* and *Myodes gapperi* were the most abundant small mammals making up 91% of the all the captures.

Introduction

2016 is the 12th year of small mammal sampling in Colby Hill since 2000 with regular annual sampling since 2011. Ecosystems (ES) 14 and 20 have been monitored for 12 years while ES 1 and 6 have been monitored for 11 years. Long-term studies can yield valuable information on ecological processes that are slow to manifest, rare phenomena, processes that show annual variability and other complex processes that require large amounts of observational data (Franklin 1989). Population cycles that may occur in small mammals can only be observed by monitoring a site for multiple years (Krebs and Myers 1974; Korpimäki and Krebs 1996; Hörnfeldt 2004). Over the last 16 years, the small mammal surveys for the Colby Hill Ecological project has yielded valuable data that will contribute to the state-wide small mammal project (Kilpatrick and Benoit 2011).

Materials and Methods

79 traps (70 Sherman and 9 pitfall) were set in each sampled ecosystem (ES1, ES6, ES14, and ES20; Fig. 1). The 70 Sherman live traps were set in two trap lines (A and B) of 35 traps each. The traps were set for three consecutive nights resulting in 237 total trap nights at each ES. The traps were baited with “old fashioned” oatmeal.

Field work was carried out under the guidelines from the American Society of Mammalogists (Sikes et al. 2011, Wilson et al. 1996). Each captured individual was sexed, weighed, aged (placed in categories: juvenile, subadult, or adult), assessed for reproductive status and inspected for presence of ectoparasites. *Peromyscus* Individuals were marked with a rodent ear punch (National Band & Tag Company, Newport, KY) to identify recaptures.

Several individuals (including the ones that perished in the traps overnight) of *Peromyscus sp.* (n=8), *Myodes gapperi* (n=4), *Microtus pennsylvanicus* (n=1), *Napaeozapus insignis*, *Tamias striatus* (n=3), *Tamiasciurus hudsonicus* (n=1), *Blarina brevicauda* (n=3), *Sorex cinereus* (n=1), and *Mustela erminea* (n=1) were kept as voucher specimens. These specimens are permanently preserved in the Zadock Thompson Natural History Collection (ZTNHC) of the University of Vermont.

DNA was extracted from three specimens of *Peromyscus* collected in the summer of 2016 from the following localities at the Colby Hill, Guthrie-Bancroft Parcel ES6 (n=3). The first third segment of the mitochondrial Cytochrome *b* gene was amplified and sequenced to differentiate between the *Peromyscus* spp. Readable sequences were obtained for 2 extractions and the resulting sequences were aligned against reference sequences of *Peromyscus leucopus* (DQ000483) and *Peromyscus maniculatus* (JF489123) taken from GenBank.

Results and Discussion

In 2016, we made 266 captures in total out of 948 trapnights, which translates into 28.1% trap success rate (Table 1). This year's trap success rate was almost double of last years (13.3%) and slightly higher than the overall trap success (23.1%) (Table 2). We had the most success trapping in hardwood forests of ecosystems 1 and 6 with trap success at 38.0% and 40.5% respectively (Table 1). No new species were detected in 2016 (Fig. 2). We detected 9 species in the four ESs with the highest diversity (number of species detected) observed in Ecosystem (ES) 1 and 20 with 6 species (Table 1). *Blarina brevicauda*, *Myodes gapperi*, and *Peromyscus* sp. were captured in all ESs, whereas *Microtus pennsylvanicus*, *Mustela erminea*, *Sorex cinereus*, and *Tamiasciurus hudsonicus* were only captured in a single ES (Table 1). The two *Peromyscus* spp., that we were able to sequence, were identified as *P. leucopus* (Table 3).

The most common small mammal species (*B. brevicauda*, *M. gapperi*, *Napaeozapus insignis*, and *Peromyscus* sp.) show marked annual variation in abundance (Fig. 3). The year 2016 is the record for the number of *Peromyscus* sp. caught (187). *Peromyscus* sp. were especially abundant in ES 1 and 6 (Table 1). However, the number of captures of *B. brevicauda*, and *N. insignis* has been comparatively low over the past 4 years. The relatively dry summer may have contributed to the lower abundance of shrews. Small mammal populations tend to fluctuate on a year to year basis. Long-term studies in northern Europe and Arctic tundra of voles and lemmings have shown 3 to 5 year cycles in population rise and fall while most famously the snowshoe hares in North America display 9 to 10 year population cycles (Hansson and Henttonen 1988; Keith 1990; Stenseth and Ims 1993; Norrdahl 1995; Korpimäki and Krebs 1996; Stenseth 1999; Krebs et al. 2001; Korpimäki et al. 2005). Environmental factors along with population density, resource availability, and predation pressure can drive population fluctuations on a year to year basis.

In terms of microhabitat variables, most small mammals were caught less than 1m from a log, less than 2m from a tree, and preferred areas with high canopy cover (>75%) (Fig. 5). The meadow vole (*Microtus pennsylvanicus*) was the only small mammal that was regularly captured in areas with canopy cover less than 50%. Most rodents were captured in areas with some amount of woody debris (>10%) and herbaceous cover (>10%). Shrews (especially *Blarina brevicauda*) preferred habitats with high leaf cover (>50%) (Fig. 5). ES 20, with the beaver pond meadow and a nearby rock wall, was very different in terms for high rock and grass cover along with low canopy and leaf cover.

Literature Cited

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Table 1. Trapping effort and small mammal captures in 2016 at the Guthrie-Bancroft Farm for the four Ecosystems (ES 1, 6, 14 and 20) surveyed.

Ecosystem (ES) No.	1	6	14	20	Totals
ES Definition:	well-drained mesic red oak hardwood forest	seepy terrain rich northern hardwood forest	poorly drained spruce-fir northern hardwood forest	alder swamp/sedge meadow edge of former beaver pond	
No. of nights trapped	3	3	3	3	12
No. of Traps	79	79	79	79	316
Trapnights	237	237	237	237	948
Shrews & Moles					
<i>Blarina brevicauda</i>	1	1	1	2	4
<i>Sorex fumeus</i>					
<i>Sorex cinereus</i>		1			1
<i>Sorex palustris</i>					
<i>Parascalops breweri</i>					
Rodents					
<i>Peromyscus sp.</i>	74	78	20	15	187
<i>Napaeozapus insignis</i>	2		1	3	6
<i>Zapus hudsonius</i>					
<i>Microtus pennsylvanicus</i>				6	6
<i>Microtus pinetorum</i>					
<i>Myodes gapperi</i>	10	14	14	17	55
<i>Synaptomys cooperi</i>					
<i>Tamias striatus</i>	2	2			4
<i>Tamiasciurus hudsonicus</i>	1				1
<i>Glaucomys volans</i>					
Carnivores					
<i>Mustela erminea</i>				1	1
No. of Species	6	5	4	6	9
No. of Captures	90	96	36	44	266
Trap Success (%)	38.0	40.5	15.2	18.6	28.1

Table 2. Trapping effort and small mammal captures from 2000 to 2016 at the Guthrie-Bancroft Farm. Species with asterisk refer to rare or difficult (*Glaucomys volans*) to trap small mammals.

Year:	2000	2001	2002	2005	2006	2007	2011	2012	2013	2014	2015	2016	Total
No. of nights trapped	9	11	12	12	12	12	12	12	12	12	12	12	140
Trapnights	372	332	591	744	765	744	855	948	948	948	948	948	9143
Shrews & Moles													
<i>Blarina brevicauda</i>	8	23	18	22	14	24	28	20	1	13	1	5	177
<i>Sorex fumeus</i>	2	0	0	1	1	3	0	8	6	2	0	0	23
<i>Sorex cinereus</i>	1	1	10	9	10	10	4	1	0	1	0	1	48
<i>Sorex palustris*</i>	0	0	0	0	0	0	1	0	0	1	0	0	2
<i>Parascalops breweri</i>	0	0	0	0	0	1	0	0	0	0	0	0	1
Rodents													
<i>Peromyscus sp.</i>	45	76	63	70	84	119	69	122	21	174	95	187	1125
<i>Napaeozapus insignis</i>	1	3	4	19	3	47	6	18	4	12	3	6	126
<i>Zapus hudsonius</i>	3	0	0	4	3	3	0	0	0	4	0	0	17
<i>Microtus pennsylvanicus</i>	3	4	3	23	1	3	3	18	1	9	5	6	79
<i>Microtus pinetorum*</i>	0	0	0	0	1	0	0	0	0	0	0	0	1
<i>Myodes gapperi</i>	17	20	18	95	81	68	52	39	14	41	19	55	519
<i>Synaptomys cooperi*</i>	0	0	0	1	0	0	0	1	0	0	0	0	2
<i>Tamias striatus</i>	0	1	2	1	4	8	8	6	0	11	2	4	47
<i>Tamiasciurus hudsonicus</i>	0	1	0	0	0	2	1	0	0	0	1	1	6
<i>Glaucomys volans*</i>	0	0	1	0	0	0	0	0	0	0	0	0	1
Carnivores													
<i>Mustela sp.</i>	0	0	1	1	4	2	2	3	0	0	0	1	14
Total Captures	80	129	120	246	206	290	174	236	47	268	126	266	2188
Species	8	8	9	11	11	12	10	10	6	10	7	9	16
Cumulative Species	8	10	12	13	14	15	16	16	16	16	16	16	16
Trap success (%)	21.5	38.9	20.3	33.1	26.9	39.0	20.4	24.9	5.0	28.3	13.3	28.1	23.9

Table 3. Cytochrome *b* alignment from 2 *Peromyscus* spp. from Ecosystem 6. Polymorphic bases distinguishing *P. leucopus* (DQ000483) from *P. maniculatus* (JF489123) denoted by asterisks (*). Specimens 1F-SLK and 2M-AEW currently reside in the Zadock Thompson Natural History Collection at the University of Vermont.

		50
DQ000483	ATGACAAACATCCGAAAAAACACCCACTACTTAAAATTATCAATGAATC	
JF489123	ATGACAAACATCCGAAAAAACACCCATTAATTAATAATCATCAATGAATC	
1F-SLK	ATGACAAACATCCGAAAAAACACCCACTACTTAAAATTATCAATGAATC	
2M-AEW	ATGACAAACATCCGAAAAAACACCCACTACTTAAAATTATTAATGAATC	
	* * * *	
		100
DQ000483	CTTCATTGATCTCCCAACCCCATCTAACATCTCATCATGATGAAACTTCG	
JF489123	CTTCATTGATCTCCCANCCCCATCCAATATNTCATCATGATGAAACTTCG	
1F-SLK	CTTCATTGATCTCCCAACCCCATCCAATATCTCATCATGATGAAACTTCG	
2M-AEW	CTTCATNGATCTCCCAACCCCATCCAATATCTCATCATGANGAAACTTCG	
	* *	
		150
DQ000483	GATCCTTACTTGGACTGTGCCTAGTAATTCAAATTTTAACTGGCCTATTC	
JF489123	GATCCCTACTTGGAGTATGCCTAATAATTCAAATTTCTAACAGGCTTATTT	
1F-SLK	GATCCTTACTTGGACTGTGCCTAGTAANNNAATTTTAACTGGCCTATTC	
2M-AEW	GATCCTTNCTTGGACTGTGCCTAGTAANTCAAATTTTAACTGGCCTATTC	
	* * * * *	
		200
DQ000483	TTAGCCATACTACACATCAGACACAACACTACAGCATTCTCATCCGTAAC	
JF489123	CTAGCCATACTACACATCAGACACAACACTACAGCATTCTCATCAGTAAC	
1F-SLK	TTAGCCATACTANNNTNNNANNNNNNNTNNANNNTCTCATCCGTAAC	
2M-AEW	TTAGCCAGACTACACATNNNNNNNNNNNNNNNNNNNNNNNGNNTANC	
	*	
		250
DQ000483	ACATATCTGCCGAGACGTAAACTACGGATGACTAATCCGATATATACACG	
JF489123	ACACATCTGCCGAGACGTCAACTACGGCTGACTTATCCGATATATACACG	
1F-SLK	ACATATCTGCCGAGACGTAAACTACGGATGACTAATCCNATATATACACG	
2M-AEW	NNNTNTNNGCNGAGACGTNNNCTACGNANGNCTAATCCNATATNTNCNNN	
	*	
		300
DQ000483	CAAACGGAGCCTCAATATTCTTTATCTGCTTATTCCTGCACGTAGGACGA	
JF489123	CAAACGGAGCCTCAATATTCTTCATCTGCTTATTCCTTCATGTAGGACGA	
1F-SLK	CAAACGGAGNNNNNNNNNNNNNNNNNNNNNNNGNACGTAGGACGA	
2M-AEW	CAANC GGAGNNNNNNNNNNNNNNNNNNNNNNNGTNNNGGNNNNNNNAA	

350

DQ000483 GGAATATACTACGGATCCTACACATTCAAAGAAACATGAAACATTGGAGT
JF489123 GGAATATATTATGGATCATAACATTCANAGAGACATGAAACATTGGAGT
1F-SLK GGAATNNNCTACGGATCCTACACATTCAAAGAAACATGAAACNTTGGAGT
2M-AEW NNNNCNNNNNNCTCCNNNNNNNNNNNNNNNANNANNNNNNNNNNNNNNNNNN

* * *

400

DQ000483 AGTACTCCTATTTGCCGTAATAGCAACAGCATTTCATAGGGTATGTACTCC
JF489123 TGTACTATTATTTGCTGTAATAGCAACAGCATTTCATAGGGTATGTACTTC
1F-SLK AGTGCTCCNATTTGCCGTAATANNAACAGCNTTCNTNNGNNNNGNACTCC
2M-AEW NNNNNNNNNNNCCCCNNNNNNNNNGGGNNNNNNNNNNNNNGGGGGNNNANN

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Figure 1. Traplines (dotted lines) and pitfall trap (dots) locations for the four ecosystems (ES 1, 6, 14 and 20) plotted for the Guthrie-Bancroft land in Google Maps.

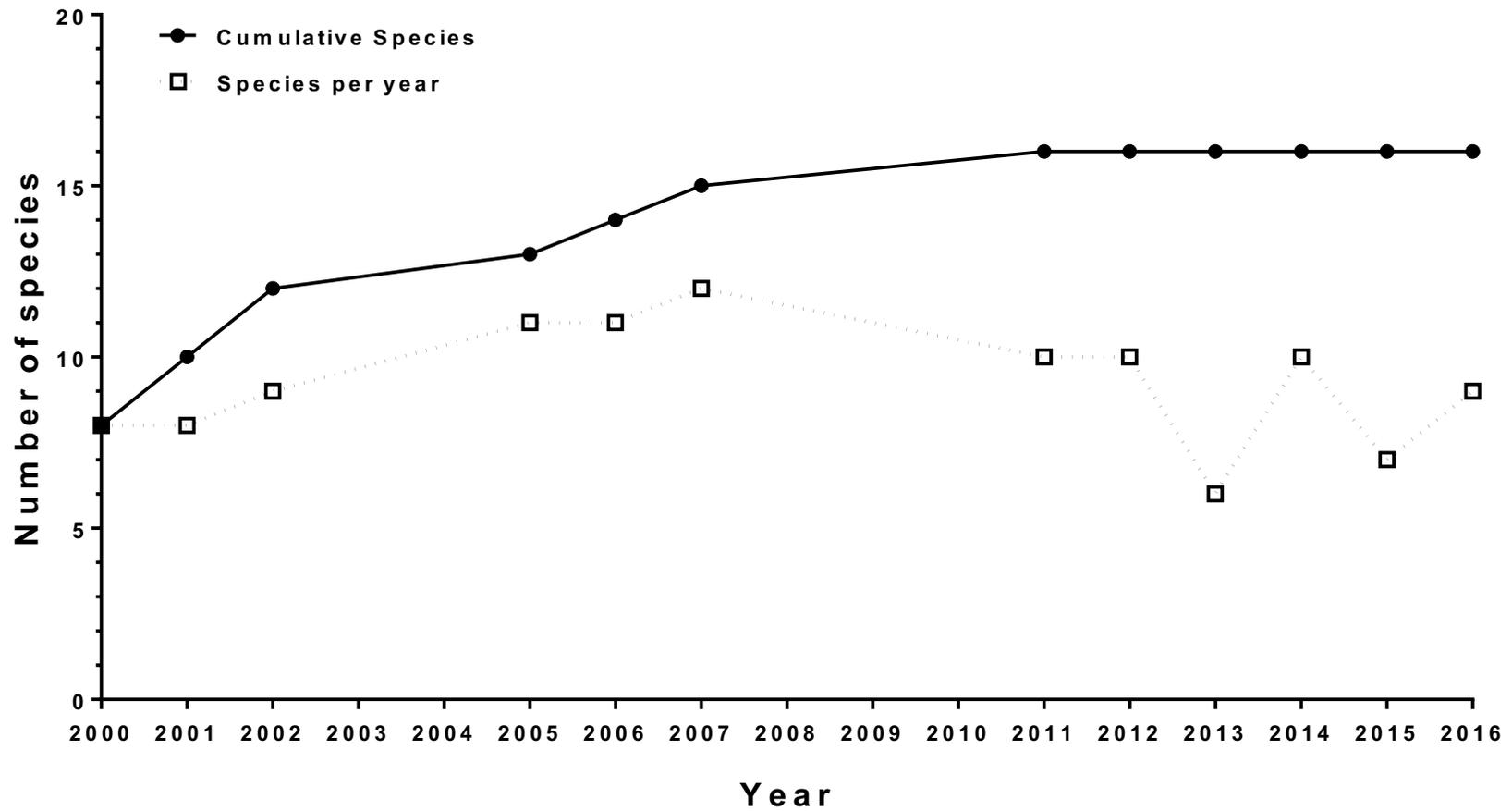


Figure 2. Cumulative and annual number of species detected in the four Ecosystems (ES 1, 6, 14 and 20) surveyed at the Guthrie-Bancroft Farm.

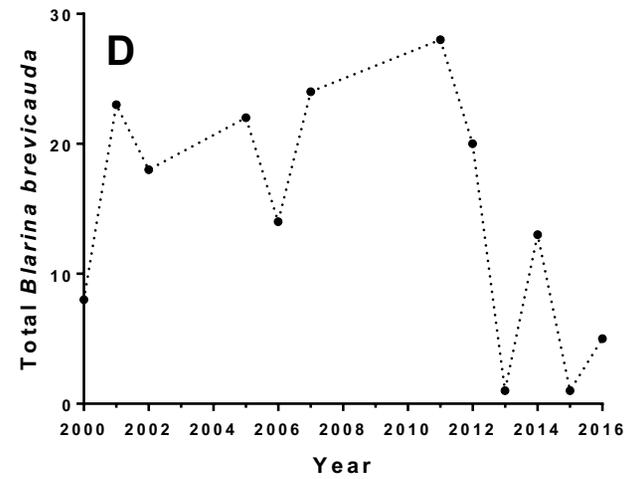
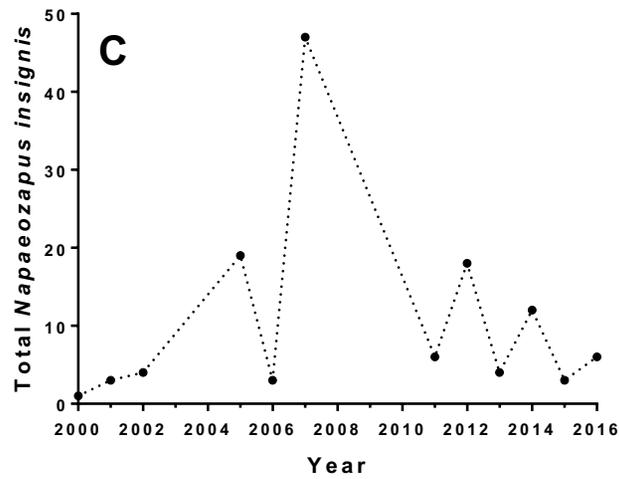
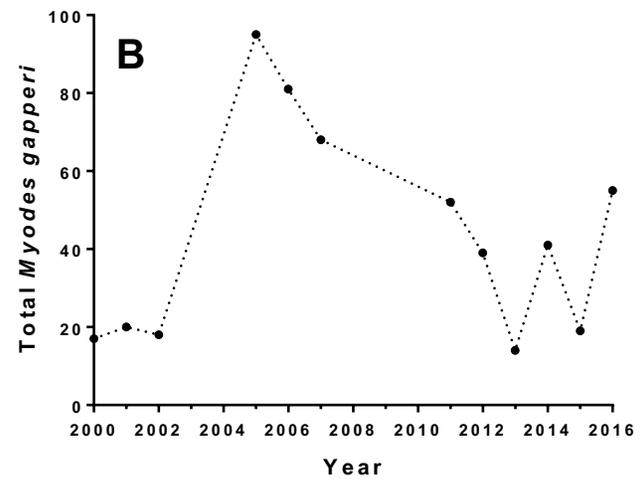
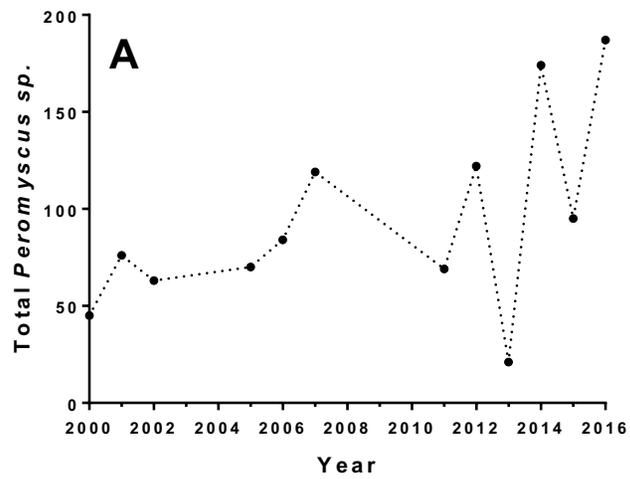


Figure 3. Total Annual captures of common small mammal species at the Guthrie Bancroft Farm: (A) *Peromyscus sp.*; (B) *Myodes gapperi*; (C) *Napaeozapus insignis*; and (D) *Blarina brevicauda*.

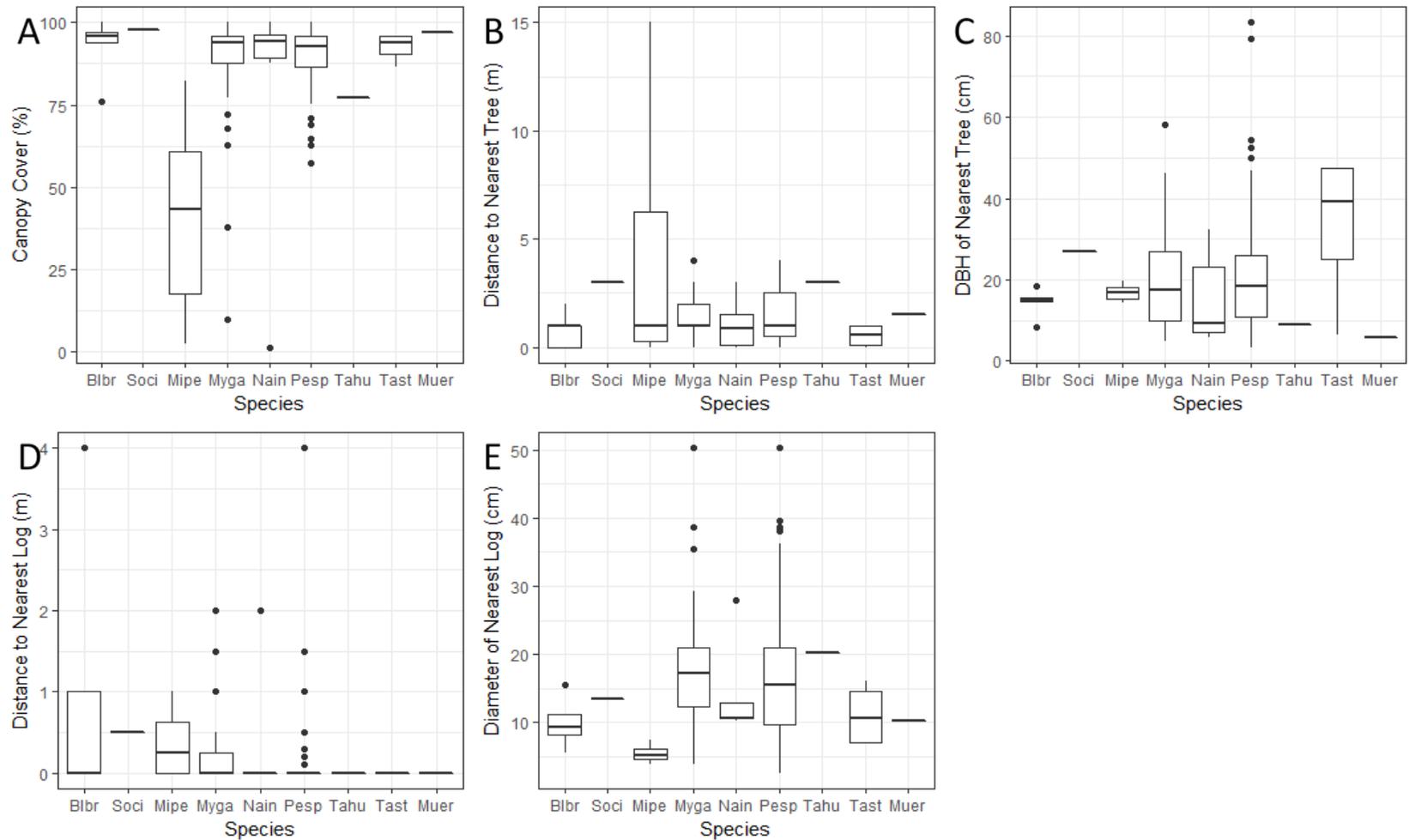


Figure 4. Boxplots of habitat variables relative to capture locations: (A) Percent canopy cover; (B) Distance to nearest tree (m); (C) Diameter at breast height of the nearest tree (cm); (D) Distance to nearest log (m); and (E) Diameter of nearest log (cm) by species. Black dots indicate outliers. Blbr – *Blarina brevicauda*, Soci – *Sorex cinereus*, Mipe – *Microtus pennsylvanicus*, Myga – *Myodes gapperi*, Nain – *Napaeozapus insignis*, Pesp – *Peromyscus* sp., Tahu – *Tamiasciurus hudsonicus*, Tast – *Tamias striatus*, and Muer – *Mustela erminea*.

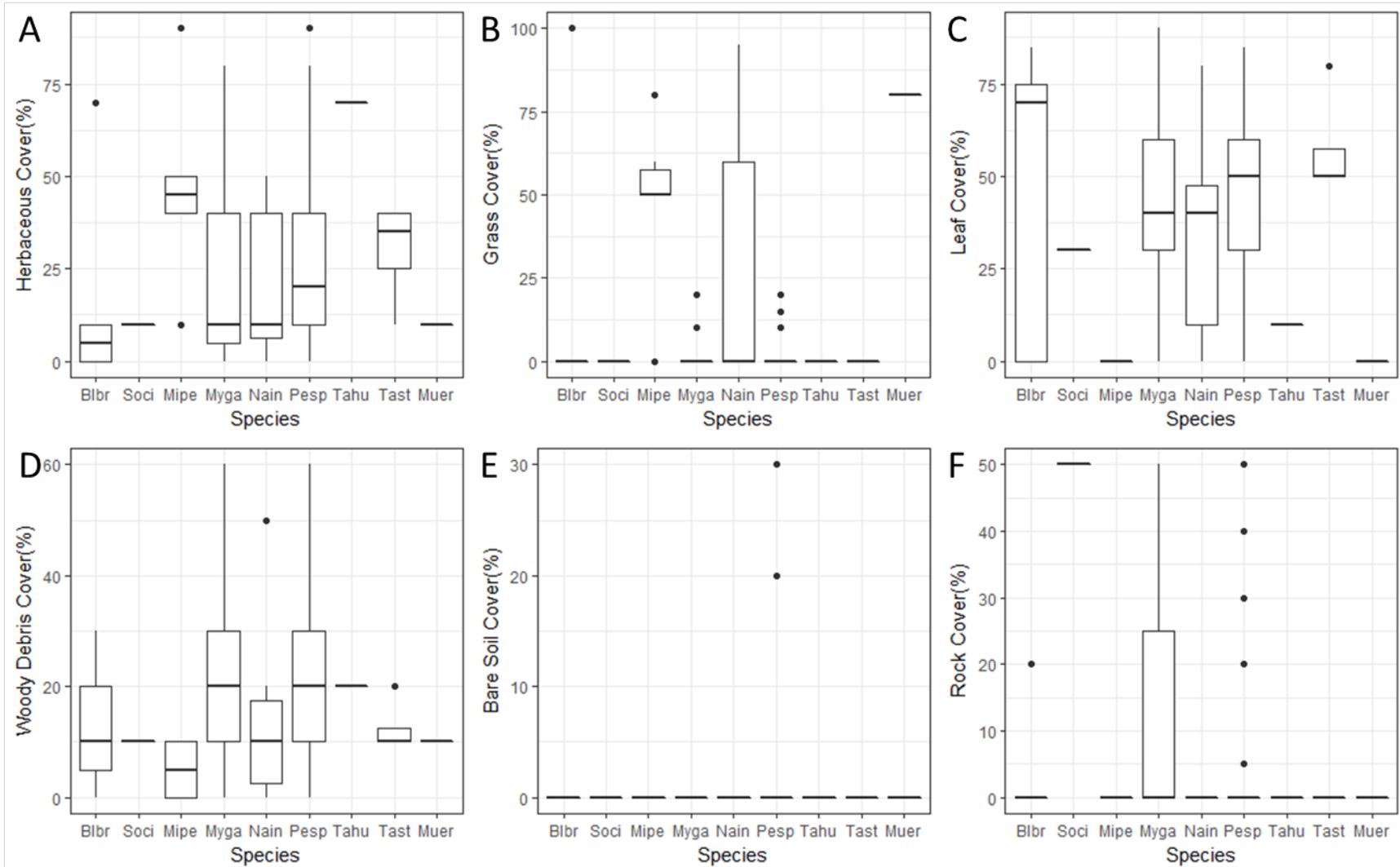


Figure 5. Boxplots of estimated percent ground cover within 1m² with capture locations at the center: (A) Herbaceous; (B) Grass; (C) Leaf; (D) Woody debris; (E) Bare soil; and (F) Rock by species. Black dots indicate outliers. Blbr – *Blarina brevicauda*, Soci – *Sorex cinereus*, Mipe – *Microtus pennsylvanicus*, Myga – *Myodes gapperi*, Nain - *Napaeozapus insignis*, Pesp – *Peromyscus* sp., Tahu – *Tamiasciurus hudsonicus*, Tast – *Tamias striatus*, and Muer – *Mustela erminea*.

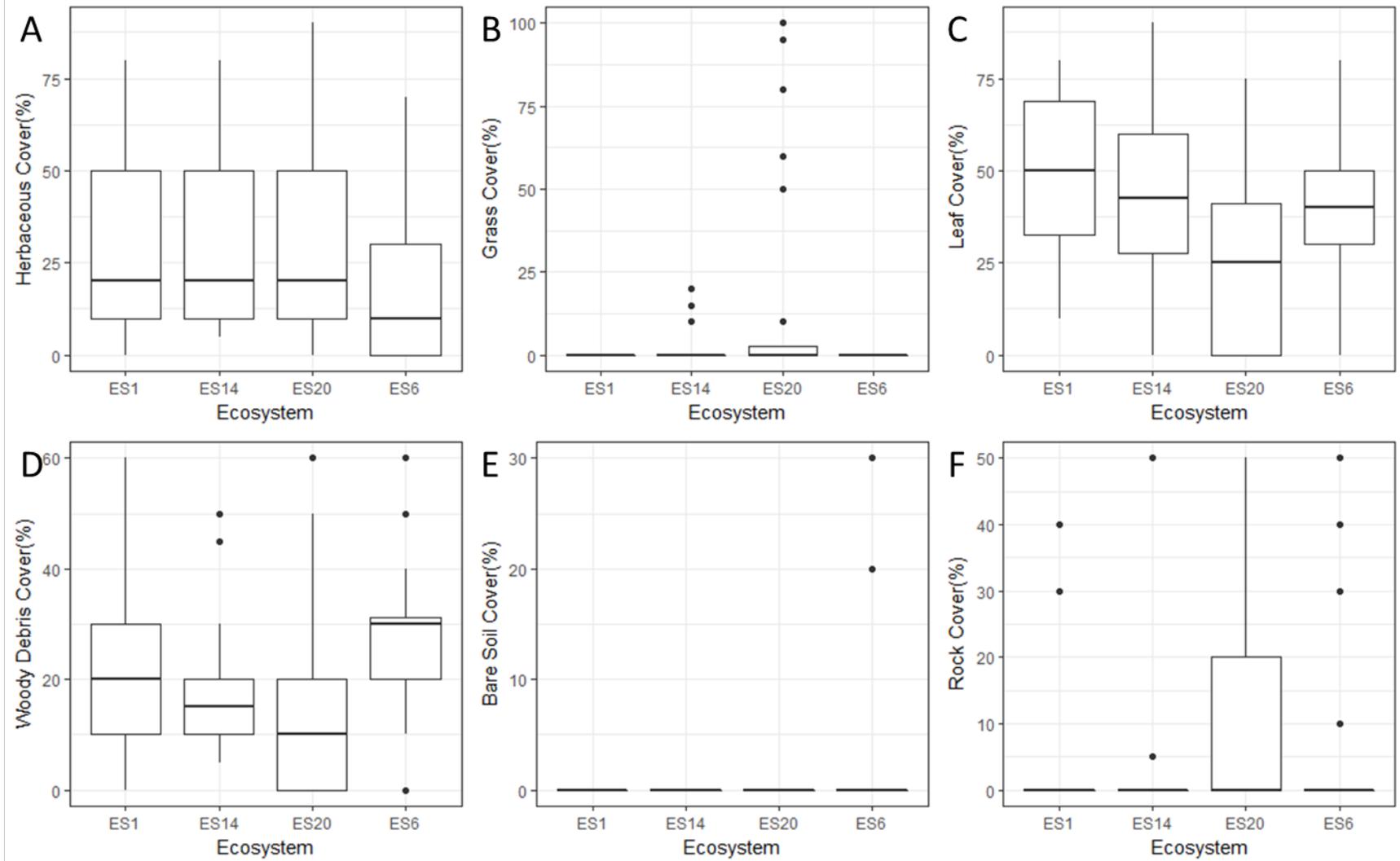


Figure 6. Boxplots for measured ground cover 1m² around capture locations (A) Herbaceous; (B) Grass; (C) Leaf; (D) Woody debris; (E) Bare soil; and (F) Rock. Black dots indicate outliers.