

# Abundance and Distribution of Shrews and Other Small Mammals in the Chattahoochee National Forest of Georgia

**William M. Ford<sup>1</sup>**, *Daniel B. Warnell School of Forest Resources, University of Georgia, Athens, GA 30602-2152*

**Joshua Laerm**, *Museum of Natural History, University of Georgia, Athens, GA 30602*

**Daniel C. Weinand**, *Museum of Natural History, University of Georgia, Athens, GA 30602*

**Katherine G. Barker**, *Daniel B. Warnell School of Forest Resources, University of Georgia, Athens, GA 30602-2152*

---

*Abstract:* We conducted extensive pitfall trapping surveys for soricids in the Blue Ridge and upper Piedmont portions of the Chattahoochee National Forest in northern Georgia from 3 July 1993 to 3 January 1994. In 76,103 trapnights, we collected 1,456 specimens representing 15 species. Survey efforts resulted in establishing the southernmost North American collection localities for *Sorex cinereus*, *S. fumeus*, *S. hoyi*, *Clethrionomys gapperi*, and *Peromyscus maniculatus*. *Sorex cinereus* and *C. gapperi* are restricted to high elevation, mesic forest communities in the Blue Ridge, while *S. longirostris*, *Cryptotis parva*, *Reithrodontomys humulis*, and *Peromyscus leucopus* are restricted to the Upper Piedmont and lower elevations in the Blue Ridge. We report the first record of *Cryptotis parva* and new records of *S. longirostris* from the Blue Ridge. *Sorex fumeus* and *Blarina brevicauda* are widespread and abundant throughout the Blue Ridge and the Upper Piedmont. *Sorex hoyi*, never abundant, is widely distributed in the Blue Ridge. Basic information concerning distributions and relative abundance of these small mammals should be valuable data to land managers in the Southern Appalachians and Upper Piedmont of Georgia and surrounding states.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 48:310-320

---

Pursuant to the "New Perspectives" program of the USDA Forest Service, a greater emphasis on ecosystem management and the conservation of biodiversity is being asked of land managers in the national forest system (Sharitz et

<sup>1</sup> Present address: USDA Forest Service, Southern Forest Experiment Station, P.O. Box 710, New Ellenton, SC 29809.

al. 1992). The Southern Appalachian Mountains contain the highest level of biodiversity in the eastern United States, yet this region is one of the least understood, particularly with respect to many non-game species of wildlife. For example, several species of small mammals more typical of northern boreal regions (i.e., *Sorex cinereus*, *S. hoyi*, *Clethrionomys gapperi*) are known from only a few isolated localities in and just north of the Chattahoochee National Forest (CNF) in Georgia (Wharton and White 1967, Wharton 1968).

Distributional information of other small mammal species such as *Peromyscus maniculatus* and *Napeozapus insignis* in the area of CNF are anecdotal at best (Golley 1962, Wharton 1978). To assess the relative distribution and abundance of small mammals, particularly the poorly known soricids (shrews) on the CNF, we undertook an intensive six-month pitfall trapping survey of the Blue Ridge and Upper Piedmont portions of the CNF.

We thank S. Castleberry, K. Cochran, E. Darracq, A. Menzel, B. Moore, B. O'Connell, and J. Rodrigue for their assistance in performing fieldwork. The cooperation of the personnel of the U.S. Forest Service, especially J. Wentworth, is greatly appreciated. We also thank P. Hale for his review of this manuscript. This study was funded through a cooperative agreement between the University of Georgia Museum of Natural History and the U.S. Forest Service.

## Methods

Pitfall trap surveys were conducted throughout the Blue Ridge Physiographic province and Upper Piedmont province portion of the CNF between 3 July 1993 to 3 January 1994. Pitfall trapping represents the best technique for the collection of soricids (Prince 1941, Macleod and Lethiecq 1963, Wolfe and Esher 1981, Handley and Kalko 1993, Kirkland and Sheppard 1994). We established 44 pitfall trapline transects throughout the Blue Ridge and 6 in the Upper Piedmont portion of the CNF (Appendix A). At each trapline transect, 20 946-cm<sup>3</sup> plastic containers were placed at or below ground level adjacent to forest floor debris, such as fallen logs, stumps, rocks, etc. Trapline transects generally were run either parallel to a stream or drain or directly along a contour. Pitfalls were spaced at approximately 10-m intervals. Pitfall cups were filled 1/5 of their volume with 10% formalin. Traps were checked on a biweekly basis. Specimens were removed and preserved in alcohol for subsequent reproductive and food habits analysis. Standard body measurements were taken and skulls were prepared for confirmation of species identifications. All specimens were deposited in the mammal collection of the University of Georgia Museum of Natural History. Elevation, aspect, and general forest community type were noted for each trapline. Aspect values were assigned based on the orientation of each trapline with southwest-facing sites at 0 (the most xeric aspect), west and south at 0.5, northwest and southeast at 1.0, north and east at 1.5, and northeast at 2.0. Although all traplines remained open for a minimum of 60 days, total time of trapping among sites varied.

Elevations of the 44 mountain traplines ranged from approximately 700 to

1,400 m. Forty-one of the 44 traplines were in older, mature forest stands with ages generally in excess of 60 years. Of the 41 sites, 15 were occupied by mesic forest communities consisting of cover hardwoods or northern hardwood types such as yellow-poplar (*Liriodendron tulipifera*), yellow-poplar/white oak (*Quercus alba*)/northern red oak (*Q. rubra*), and buckeye (*Aesculus octandra*)/black birch (*Betula lenta*)/Maple (*Acer* spp.). Generally, these cove communities were characterized by open midstories and abundant and diverse plant groundstories. At some of the mesic sites at higher elevations, a thick rhododendron (*Rhododendron maximum*) midstory was more abundant than on lower slopes. Twenty pitfall sites were in drier mixed oak types consisting of white oak/northern red oak/hickory (*Carya* spp.), chestnut oak (*Q. prinus*)/scarlet oak (*Q. coccinea*), and white pine (*Pinus strobus*)/upland hardwood. These sites were generally characterized by abundant midstory shrub growth such as mountain laurel (*Kalmia latifolia*) and blueberry (*Vaccinium* spp.). Six sites had streamside communities dominated by overstories of eastern hemlock (*Tsuga canadensis*) and thick midstories of rhododendron. Two sites were 10- to 15-year-old pole stage cove hardwood stands dominated by yellow-poplar, and 1 site was in a newly regenerated white pine/upland hardwood stand (clearcut) less than 3 years beyond establishment.

Elevations of the Upper Piedmont sites ranged from approximately 245 m to 460 m. Vegetational communities at 4 of the Upper Piedmont sites were primarily mixed oak and shortleaf pine (*Pinus echinata*) and loblolly pine (*P. taeda*), with some mountain laurel in sheltered ravines and along watercourses. Of these 4 sites, 1 was a newly regenerated area (clearcut) less than 2 years beyond establishment planted, with loblolly pine. Two of the Upper Piedmont sites located along Big Panther Creek in Stephens County, although at the lowest of elevations we sampled, were characterized by montane plant communities more similar to the Blue Ridge to the north (Radford and Martin 1975) with abundant eastern hemlock and rhododendron. In addition to reporting trap success and small mammal species composition for the various habitats sampled, we performed Pearson-product moment correlations between numbers caught per 1,000 trapnights and elevation and aspect values for 43 of 44 Blue Ridge sites and all Upper Piedmont sites in order to better define habitat preferences.

## Results

We accumulated a total of 69,150 trapnights on the Blue Ridge portion of the CNF. A total of 1,418 specimens representing 14 species and 1 *Peromyscus* category were collected (Table 1). The 5 Upper Piedmont sites accounted for 6,953 trapnights with 38 specimens representing 6 species collected (Table 2).

Of species collected only in the Blue Ridge portion of the CNF, numbers of *S. cinereus*, *C. gapperi*, and *Peromyscus maniculatus* caught per 1,000 trapnights were positively correlated with elevation ( $r = 0.51$ ,  $P = 0.0005$ ,  $N = 43$ ;

**Table 1.** Habitat types, total trapnights, and numbers collected by individual species for an intensive pitfall trapping survey in the Blue Ridge portion of the Chattahoochee National Forest, Georgia, 3 July 1993–3 January 1994.

Species	Habitat type <sup>a</sup>					Total 69,150
	Mesic 23,110 <sup>b</sup>	Mixed 31,667	Stream 10,239	Pole 2,580	Regen 1,554	
<i>Blarina brevicauda</i>	89	108	27	6	5	235
<i>Cryptotis parva</i>	0	1	0	0	0	1
<i>Sorex cinereus</i>	77	50	25	5	0	157
<i>Sorex fumeus</i>	306	266	181	36	13	802
<i>Sorex hoyi</i>	25	30	4	1	8	68
<i>Sorex longirostris</i>	2	6	1	0	4	13
<i>Scalopus aquaticus</i>	0	2	0	0	0	2
<i>Clethrionomys gapperi</i>	13	2	1	0	0	16
<i>Microtus pinetorum</i>	0	3	0	0	1	4
<i>Napaeozapus insignis</i>	5	9	9	0	1	24
<i>Peromyscus leucopus</i>	7	21	3	0	1	32
<i>Peromyscus maniculatus</i>	17	12	14	0	0	43
Unknown <i>Peromyscus</i>	4	0	2	0	0	6
<i>Ochrotomys nuttalli</i>	2	6	2	2	2	14
<i>Tamias striatus</i>	0	1	0	0	0	1
Total individuals by habitat type	547	517	269	50	35	1,418
Total number of species by habitat type	11	14	11	5	8	

<sup>a</sup>Habitat types are as follows: cove and northern hardwood forest types (mesic), mixed oak types (mixed), streamside hemlock/rhododendron (stream), pole-staged cove hardwoods (pole), and newly regenerated white pine/upland hardwood site (regen).

<sup>b</sup>Trapnights per habitat type.

**Table 2.** Habitat types, total trapnights, and numbers collected by individual species for an intensive pitfall trapping survey in the Upper Piedmont portion of the Chattahoochee National Forest, Georgia, 3 July 1993–3 January 1994.

Species	Habitat Type <sup>a</sup>			Total 6,953
	Mixed 3,480 <sup>b</sup>	Regen 1,280	Montane 2,193	
<i>Blarina brevicauda</i>	3	0	5	8
<i>Cryptotis parva</i>	0	7	0	7
<i>Sorex fumeus</i>	0	0	3	3
<i>Sorex longirostris</i>	5	1	3	9
<i>Peromyscus leucopus</i>	0	2	1	3
<i>Reithrodontomys humulis</i>	0	8	0	8
Total number of individuals by habitat type	8	18	12	38
Total number of species by habitat type	2	4	4	

<sup>a</sup>Habitat types are as follows: Piedmont mixed oak/pine types (mixed), newly regenerated pine site (regen), Big Panther Creek sites with Southern Appalachian vegetative communities (montane).

<sup>b</sup>Trapnights per habitat type.

$r = 0.47$ ,  $P = 0.0013$ ,  $N = 43$ ; and  $r = 0.38$ ,  $P = 0.0110$ ,  $N = 43$ , respectively). Of species caught in both the Blue Ridge and Upper Piedmont, numbers of *S. fumeus* and *B. brevicauda* caught per 1,000 trapnights showed positive correlations with elevation ( $r = 0.45$ ,  $P = 0.0013$ ,  $N = 49$  and  $r = 0.34$ ,  $P = 0.0179$ ,  $N = 49$ ) and numbers of *S. longirostris*, *C. parva*, and *R. humulis* caught per 1,000 trapnights showed negative correlations with elevation ( $r = -0.49$ ,  $P = 0.0001$ ,  $N = 49$ ;  $r = -0.29$ ,  $P = 0.0447$ ,  $N = 49$ ; and  $r = -0.28$ ,  $P = 0.0485$ ,  $N = 49$ , respectively). Site aspect values were poorly correlated with most species. However, numbers of *S. hoyi* and *Microtus pinetorum* caught per 1,000 trapnights approached significance with a negative correlations with mesic aspects ( $r = -0.25$ ,  $P = 0.0961$ ,  $N = 43$  and  $r = -0.39$ ,  $P = 0.0092$ ,  $N = 43$ ).

## Discussion

Our six-month trapping effort succeeded in providing much new distributional information for small mammals in the southern Appalachians in general and the CNF in particular. Some of the specimens represent the southernmost species collection records in North America. These include *C. gapperi* on the northwestern slopes of Tray Mountain north of Tray Gap in Towns County, *S. cinereus* on the southeastern slopes of Tray Mountain south of Tray Gap in White County, *P. maniculatus* in the Canada Creek watershed of southwestern Union County, and *S. fumeus* and *S. hoyi* south of Nimblewill Gap in Dawson County, at the end of the Blue Ridge.

Throughout the Blue Ridge in Georgia, *S. fumeus*, collected at all 44 mountain sites and *B. brevicauda*, collected at 40 of 44 mountain sites, may be ubiquitous in all habitats and at all elevations. Both species also were present in our Upper Piedmont samples, although *S. fumeus* was taken only at the lower elevation, yet botanically montane, traplines in the Big Panther Creek area of Stephens County.

As recently as 1980, *Sorex hoyi* was thought to be one of the rarest mammals in North America (Diersing 1980, Handley et al. 1980), and it was known in Georgia only from 1 collection locality in the Blue Ridge. We collected *S. hoyi* from throughout the Blue Ridge except at 4 sites on the Rabun Bald Massif in extreme northeastern Rabun County. These 4 sites, all between 915 and 1,370 m, accounted for 50% of all the *S. cinereus* collected during our study. Because *S. cinereus* and *S. hoyi* are similar in size and both are thought to be habitat generalists (Kirkland 1991), *S. cinereus* may competitively exclude *S. hoyi* following the species-assembly rule proposed by Kirkland (1991) and Fox and Kirkland (*in press*) and suggested by the research of Churchfield (1980) and Feldhammer et al. (1993). Although we collected *S. hoyi* from all habitat types, most were taken in the drier, mixed oak communities at mid-elevations. The 8 specimens collected from our white pine/upland hardwood clearcut site are consistent with other records of *S. hoyi* from the Southeast (Mengak et al. 1987, Feldhammer et al. 1993). A more detailed analysis of the distribution and habi-

tat associations of *S. hoyi* in Georgia is provided by Laerm et al. (*in press*). Prior to this study, *S. longirostris*, the third of the small bodied long-tailed shrews present on the CNF, was known from a single specimen from 690 m near Young Harris in Towns County. Though not common, our collection records indicate it to be widely distributed throughout the Blue Ridge at elevations below 800 m. Similarly, our record of *C. parva* from the Canada Creek watershed is the first record of this species in the Blue Ridge of Georgia.

A strong positive correlation with elevation is not surprising for *S. cinereus* since it is considered to be a high-elevation, boreal species. While boreal forest communities such as spruce-fir (*Picea* spp.-*Abies* spp.) do not exist in Georgia, several of the higher ranges contain small amounts of mesic forest communities with distinctly northern affinities, similar to the northern hardwood types of the Central and Northern Appalachians (Wharton 1978). Eighty-five percent of our collections of *S. cinereus* were taken at sites above 1,000 m in elevation, mostly in the Rabun Bald Massif and the Tray Mountain Massif. Of the 21 *S. cinereus* taken below the 1,000 m elevation, 20 were from Burnt Cabin Branch in Towns County, a narrow, sheltered watercourse in the Savannah River Watershed which drains south from relatively high elevations in the Nantahala National Forest in North Carolina. We did not find *S. cinereus* at our survey sites in the western portions of the Blue Ridge such as the Cohutta area of Murray and Gilmer Counties or the Rich Mountain area of Gilmer County. While both areas contain some peaks over 1,200 m, high elevation zones are less frequent and more isolated than in the CNF to the east along the main spine of the Appalachians.

Two other species with distinctly northern affinities, *S. dispar* and *S. palustris*, were not collected during this study. However, in a related concurrent project, we collected a specimen of *S. dispar* in Macon County, North Carolina, northeast of Scaly Mountain at an elevation of approximately 1,100 m. This site is approximately 10 km north of the Georgia state line and CNF boundary. It is considered part of the Highlands Plateau which extends south into Georgia as the Rabun Bald massif (Fenneman 1938). *Sorex palustris* has been reported in the Fire's Creek area of the Nantahala National Forest in Clay County, North Carolina, about 25 km north of the Georgia stateline and CNF boundary and within the same Hiwasee River watershed as much of northern Towns County (Whitaker et al. 1975, Lee et al. 1982). A subsequent re-opening of the Burnt Cabin Branch trapline in Towns County yielded 1 specimen of *S. palustris* on 30 May 1994, the first record from Georgia (Laerm et al. 1995).

Although pitfalls almost exclusively target soricids, our length of trapping and number of trapsite locations allowed us to take, albeit in small numbers, species not normally collected in this manner. Of these, *C. gapperi*, *P. maniculatus*, and *Napeozapus insignis* have been previously known from only a few localities in the Blue Ridge Province (Golley 1962, Wharton and White 1967, Wharton 1978). Like *S. cinereus* these species, especially *C. gapperi*, represent a more northern fauna. Except for a specimen collected along Burnt Cabin Branch, all

*C. gapperi* were collected on Brasstown Bald, Rabun Bald, and Tray Mountain at elevations above 1,000 m. Never abundant, *P. maniculatus* appeared throughout the Blue Ridge province of the CNF at a variety of altitudes in mature mesic, mixed, and streamside forest communities. Our *N. insignis* came mostly from southeastern Union County in the Canada Creek watershed at mid-elevations of about 750–800 m in mature mesic, mixed, and streamside forest communities, and in the newly regenerated white pine/upland hardwood site. Other species collected in the Blue Ridge included *P. leucopus*, *Ochrotomys nuttalli*, 4 specimens of *Microtus pinetorum*, and a single specimen of *Tamias striatus*. *Peromyscus leucopus* was most common at lower elevations and in the drier mixed oak communities. At 6 sites, *P. leucopus* and *P. maniculatus* were sympatric. *Ochrotomys nuttalli* known to be widely distributed in the Blue Ridge (Golley 1962), was collected at both high and low elevations and in each of the habitat types we sampled.

Trap success at our Upper Piedmont sites was approximately 4 times less than at the Blue Ridge sites. Some species more commonly encountered in the Piedmont and Coastal Plain than in the Blue Ridge were present, e.g., *S. longirostris*, *C. parva*, and *Reithrodontomys humulis*. Although each of the Upper Piedmont sites we surveyed contained large amounts of ground debris and structure, past landuse practices such as frequent burning, cotton culture, and intensive livestock grazing may have contributed to the apparent lower relative abundance of small mammals.

With a more complete understanding of the distributions and abundance of small mammals, land managers should make more informed management decisions. Our study of small mammals indicates that several species are more widespread and abundant than previously thought on the CNF. However, due to scarcity of high elevation habitats on the CNF, species such as *S. cinereus* and *C. gapperi* should be monitored closely. Our current research examines relationships of long-term forest management activities and small mammal communities and is making more detailed analyses of small mammal community assemblages in the southern Appalachians.

## Literature Cited

- Churchfield, S. 1980. Subterranean foraging and burrow activity of the common shrew. *Acta Theriologica*. 25:451–459.
- Diersing, V. H. 1980. Systematics and evolutions of the pygmy shrew (subgenus *Microsorex*) of North America. *J. Mammal*. 61:76–101.
- Feldhammer, G. A., R. S. Klann, A. S. Gerard, and A. C. Driskell. 1993. Habitat partitioning, body size, and timing of parturition in pygmy shrews and associated soricids. *J. Mammal*. 74:403–411.
- Fenneman, N. M. 1938. *Physiography of the eastern United States*. McGraw-Hill Co., New York. 714pp.
- Fox, B. J. and G. L. Kirkland, Jr. *In press*. An assembly rule for functional groups applied to North American soricid communities. *J. Mammal*.

- Golley, F. B. 1962. *Mammals of Georgia*. Univ. Ga. Press, Athens. 218pp.
- Handley, C. O., Jr. and E. K. V. Kalko. 1993. A short history of pitfall trapping in America, with a review of methods currently used for small mammals. *Virginia J. Sci.* 44:19–26.
- , J. F. Pagels, and R. H. de Rageot. 1980. *Microsorex hoyi winnemana* Preble. Pages 545–547 in D. M. Linzey, ed. *Endangered and threatened plants and animals of Virginia*. Center for Environ. Studies, Va. Polytech. Inst. and State Univ., Blacksburg.
- Kirkland, G. L., Jr. 1991. Competition and coexistence in shrews (Insectivora: Soricidae). Pages 15–22 in J. S. Findley and T. L. Yates, eds. *The biology of the Soricidae*. Univ. N.M., Albuquerque.
- and P. K. Sheppard. 1994. Proposed standard protocol for pitfall sampling of small mammal communities. Pages 277–284 in J. F. Merritt, G. L. Kirkland, Jr. and R. K. Rose, eds. *Proceedings of the International Colloquium on the biology of the Soricidae*. Spec. Publ., Carnegie Museum Nat. Hist. Num. 1611.
- Laerm, J., W. M. Ford, and C. H. Wharton. 1995. First record of the water shrew (*Sorex palustris*) in Georgia, with comments on its distribution and status in the Southern Appalachians. *Brimleyana* 22:47–52.
- , ———, and D. C. Weinand. *In press*. Analysis of distribution and habitat associations of *Sorex hoyi winnemana* in Georgia and the southeastern United States. Fourth colloquium on Conserv. Mammals in the South-Central United States.
- Lee, D. S., J. B. Funderburg, and M. K. Clark. 1982. A distributional survey of North Carolina mammals. *Occas. Pap. N.C. Biol. Surv.* 1982:10.
- Macleod, C. F. and J. L. Lethiecq. 1963. A comparison of two trapping techniques for *Sorex cinereus*. *J. Mamm.* 68:384–387.
- Mengak, M. T., D. C. Guynn, Jr., J. K. Edwards, D. L. Sanders, and S. L. Miller. 1987. Abundance and distribution of shrews in western South Carolina. *Brimleyana* 13:63–66.
- Prince, L. A. 1941. Water traps capture the pygmy shrew (*Microsorex hoyi*) in abundance. *Can. Field Nat.* 55:72.
- Radford, A. E. and D. L. Martin. 1975. Potential ecological natural landmarks Piedmont region, eastern United States. *Dep. Botany, Univ. N.C., Chapel Hill.* 249pp.
- Sharitz, R. R., L. R. Boring, D. H. Van Lear, and J. E. Pinder. 1992. Integrating ecological concepts with natural resource management of southern forests. *Ecol. Appl.* 2:226–237.
- Wharton, C. H. 1968. First records of *Microsorex* and *Sorex cinereus* from Georgia. *J. Mammal.* 49:158.
- . 1978. The natural environments of Georgia. *Ga. Dep. Nat. Resour., Atlanta.* 227p.
- and J. J. White. 1967. The red-backed vole, *Clethrionomys gapperi*, in north Georgia. *J. Mammal.* 48:670–672.
- Whitaker, J. O., Jr., G. S. Jones, and D. D. Pascal, Jr. 1975. Notes on mammals of the Fire's Creek area, Nantahala Mountains, North Carolina, including their ectoparasites. *J. Elisha Mitchell Sci. Soc.* 91:13–17.
- Wolfe, J. L. and R. J. Esher. 1981. Relative abundance of the southeastern shrew. *J. Mammal.* 62:649–650.



Appendix A. Small mammal collection localities and site numbers with elevation and site type by physiographic province and county, Chattahoochee National Forest, Georgia, 3 July 1993–3 January 1994. *Sorex cinereus* = SOCI, *S. fumeus* = SOFU, *S. hoyi* = SOHO, *S. longirostris* = SOLO, *Blarina brevicauda* = BLBR, *Cryptotis parva* = CYPA, *Scalopus aquaticus* = SCAQ, *Clethrionomys gapperi* = CLGA, *Microtus pinetorum* = MIPI, *Napaeozapus insignis* = NAIN, *Peromyscus leucopus* = PELE, *P. maniculatus* = PEMA, Unknown *Peromyscus* = PESP, *Ochrotomys nuttalli* = OCNU, *Reithrodontomys humulis* = REHU, *Tamias striatus* = TAST.

## Blue Ridge Province Sites

### Dawson County

1. Nimblewill Creek 1: Blue Ridge WMA, 4.4 miles NW Nimblewill Baptist Church on FS 28. 701 m, mixed oak. SOFU (1), SOHO (1).
2. Nimblewill Creek 2: Blue Ridge WMA, 4.9 miles NW Nimblewill Baptist Church on FS 28. 731 m, mixed oak. SOFU (1), BLBR (2).
3. Nimblewill Creek 3: Blue Ridge WMA, 5.6 miles NW Nimblewill Baptist Church on FS 28. 793 m, mixed oak. SOFU (3), BLBR (1), PELE (1).

### Gilmer County

1. Cohutta 1: Cohutta WMA, Barnes Creek, 4.1 miles N jct. FS 18 on FS 68. 863 m, streamside. SOFU (11), BLBR (3), PEMA (1).
2. Cohutta 2: Cohutta WMA, 4.6 miles N jct. FS 18 on FS 68. 863 m, mixed oak. SOFU (3), BLBR (3), SCAQ (1), PELE (1).
3. Rich Mountain 1: Rich Mountain WMA, 0.5 miles SSW check station on FS 295. 719 m, mixed oak. SOFU (7), BLBR (4), PELE (1), OCNU (1).
4. Rich Mountain 2: Rich Mountain WMA, 1 mile SSW check station on FS 295. 732 m, mesic. SOFU (12), SOHO (2), BLBR (6).
5. Rich Mountain 3: Rich Mountain WMA, 1.8 miles SSW check station on FS 295. 831 m, mesic. SOFU (7), BLBR (1), PEMA (1).
6. Rich Mountain 4: Rich Mountain WMA, 2.35 miles SSW check station on FS 295. 860 m, mesic. SOFU (12), SOHO (1), BLBR (2).

### Lumpkin County

1. Dockery Lake 1: Dockery Lake Rec. Area. 747 m, streamside. SOFU (8), NAIN (1).
2. Dockery Lake 2: Glassmine Top, 3.75 miles N Stonepile Gap on GA 19. 837 m, mixed oak. SOFU (8), SOHO (6), SOLO (1), BLBR (7), SCAQ (1), PEMA (1), MIPI (2).

### Murray County

1. Cohutta 3: Cohutta WMA, 10 miles N jct. FS 18 on FS 68. 1,091 m, mesic. SOFU (18), SOHO (3), BLBR (14), PEMA (3).
2. Cohutta 4: Cohutta WMA, SW shore Lake Conasauga. 976 m, mixed oak. SOFU (4), SOHO (1), BLBR (3), PEMA (1).
3. Cohutta 5: Cohutta WMA, 0.4 miles N jct. FS 68 and FS 17. 1,006 m, mixed oak. SOFU (9), SOHO (2), BLBR (6), PELE (2).
4. Cohutta 6: Cohutta WMA, 3.1 miles N. jct. FS 68 and FS 17. 777 m, mixed oak. SOHO (1), BLBR (1), PELE (2).

## Rabun County

1. Glassy Mountain 1: 1 mile W summit Glassy Mountain on FS 11. 884 m, mesic. SOFU (19), SOHO (6), BLBR (2), PELE (5), NAIN (1).
2. Glassy Mountain 2: 0.5 mile S summit Glassy Mountain on FS 11. 823 m, mixed oak. SOFU (6), BLBR (2).
3. Hale Ridge: 1.9 miles S jct. FS 7 and Overflow Creek Rd. 914 m, mixed oak. SOCI (1), SOFU (5), BLBR (4).
4. Long Ridge 1: 1.5 miles W Low Gap on FS 410. 793 m, mixed oak. SOFU (1).
5. Long Ridge 2: 2.0 miles W Low Gap on FS 410. 793 m, mesic. SOFU (4), SOHO (5), SOLO (2), BLBR (4).
6. Rabun Bald 1: Near summit of Rabun Bald. 1,372 m, mesic. SOCI (47), SOFU (1), BLBR (5), CLGA (2), PESP (1), OCNV (2), NAIN (1).
7. Rabun Bald 2: Beegum Gap on Old Rabun Bald Rd. 1,128 m, mesic. SOCI (17), SOFU (13), BLBR (4), PEMA (2), CLGA (1).
8. Thomas Creek 1: 4 miles E Dillard on FS 150. 1,012 m, mesic. SOCI (6), SOFU (23), SOHO (1), BLBR (5).
9. Thomas Creek 2: 3.1 miles E Dillard on FS 150. 945 m, streamside. SOCI (5), SOFU (16), BLBR (3), PEMA (4).
10. Thomas Creek 3: 2.5 miles E Dillard on FS 150. 914 m, pole-stage cove hardwoods. SOCI (5), SOFU (31), BLBR (4), OCNV (2).

## Towns County

1. Brasstown Bald 1: Head of Chestnut Cove NE Old Wagon Rd. 1,293 m, mesic. SOFU (39), BLBR (5), PEMA (3), CLGA (11).
2. Brasstown Bald 2: 0.3 miles S FS visitor center on GA 180 Spur. 1,280 m, mixed oak. SOCI (1), SOFU (63), SOHO (4), BLBR (7), PEMA (15), CLGA (1), NAIN (2).
3. Brasstown Bald 3: Mile Marker 1 on GA 180 Spur. 1,098 m, mixed oak. SOFU (25), BLBR (4).
4. Burnt Cabin Branch: 2 miles N Tate City on FS 70-2. 808 m, streamside. SOCI (20), SOFU (11), BLBR (5), PEMA (3), CLGA (1).
5. Swallow Creek 1: Swallow Creek WMA, Fork Ridge, 1.9 miles SW Swallow Creek Rd. 1,043 m, mixed oak. SOCI (2), SOFU (2), SOHO (1).
6. Swallow Creek 2: Swallow Creek WMA, Fork Ridge, 1.1 miles SW Swallow Creek Rd. 900 m, pole-stage cove hardwoods. SOFU (5), SOHO (1), BLBR (2).
7. Swallow Creek 3: Swallow Creek WMA, Fork Ridge, 0.8 mile SW Swallow Creek Rd. 902 m, mesic. SOCI (1), SOFU (10), SOHO (1), BLBR (1).
8. Tray Mountain 3: Swallow Creek WMA, Mossy Cove Branch on FS 698. 1,037 m, mixed oak. SOCI (23), SOFU (31), SOHO (2), BLBR (17), PEMA (6), CLGA (2).
9. Tray Mountain 4: Swallow Creek WMA, Jct. FS 698 and FS 698-A. 841 m, mesic. SOCI (5), SOFU (5), BLBR (5), PEMA (1).

## Union County

1. Canada Creek 1: 1.9 miles WSW Suches along Mt. Airy Creek. 793 m, streamside. SOFU (36), SOHO (2), SOLO (1), BLBR (6), PEMA (2), PELE (1), OCNV (2), NAIN (4).
2. Canada Creek 2: 2.3 miles WSW Suches at headwaters of Knight Branch. 738 m, mixed oak. SOFU (43), SOHO (2), BLBR (8), CYPA (1), PELE (3), NAIN (3), TAST (1).

3. Canada Creek 3: 2.1 miles SW Suches at headwaters of Knight Branch. 823 m, mesic. SOFU (24), SOHO (2), BLBR (5), PEMA (2), NAIN (2).
4. Canada Creek 4: 2 miles W Suches, Rich Mountain Ridge. 814 m, clearcut. SOFU (13), SOHO (8), SOLO (4), BLBR (5), PELE (1), OGNU (2), MIPI (1), NAIN (1).
5. Canada Creek 5: 2 miles W Suches, Rich Mountain Ridge. 876 m, mixed oak. SOFU (9), SOHO (4), BLBR (15), PELE (3), OGNU (5), MIPI (1), NAIN (1).
6. Lake Winfield Scott 1: 0.3 mile N Lake Winfield Scott Rec. Area on GA 180. 817 m, mixed oak. SOFU (55), SOHO (1). SOLO (2), BLBR (6), PEMA (2), PELE (2), NAIN (5).
7. Lake Winfield Scott 2: 1.25 miles N Lake Winfield Scott Rec. Area on GA 180. 872 m, streamside. SOFU (99), SOHO (2), BLBR (10), PEMA (3), PELE (1), NAIN (4).
8. Sosebee Cove: Sosebee Cove Scenic Area on GA 180. 1,000 m, mesic. SOFU (56), BLBR (23), PESP (3).

#### White County

1. Tray Mountain 1: 4.7 miles S Tray Mountain Gap on FS 79. 768 m, mixed oak. SOCI (1), SOFU (23), SOHO (4), BLBR (11), PELE (4).
2. Tray Mountain 2: 0.4 mile S Tray Mountain Gap on FS 79. 1,122 m, mixed oak. SOCI (23), SOFU (30), SOHO (5), BLBR (14), PEMA (2), PELE (2).

#### Upper Piedmont Province

##### Stephens County

1. Lake Russell 1: Lake Russell WMA, near summit Currahee Mountain. 488 m, mixed oak/pine. SOLO (2), BLBR (2).
2. Lake Russell 2: Lake Russell WMA, jct. FS 62 and FS 62-A. 366 m, clearcut. SOLO (1), CYP A (7), REHU (8), PELE (2).
3. Lake Russell 3: Lake Russell WMA, jct. FS 62 and 62-A. 360 m, mixed oak/pine. No animals recovered.
4. Lake Russell 4: Lake Russell WMA, Dick's Creek Bridge on FS 87. 335 m, mixed oak/pine. SOLO (3), BLBR (1).
5. Panther Creek 1: Confl. Davidson Creek and Panther Creek. 245 m, Piedmont montane. SOFU (1), SOLO (3), BLBR (4).
6. Panther Creek 2: 1 mile W Union Baptist Church, confl. Panther Creek and unnamed tributary. 243 m, Piedmont montane. SOFU (2), BLBR (1), PELE (2).