

**TERRESTRIAL MAMMALS
OF CARL SANDBURG HOME NATIONAL
HISTORIC SITE
FLAT ROCK, NORTH CAROLINA**

PREPARED FOR:

**NATIONAL PARK SERVICE
CARL SANDBURG HOME NATIONAL HISTORIC SITE
81 Carl Sandburg Lane,
Flat Rock, NC 28731**

PREPARED BY:

**DR EDWARD PIVORUN
DR LINDA FULTON**

INTRODUCTION

Although a great deal of biological/ecological information has been gathered on the large charismatic mammals in many of the larger National Parks, virtually no information is available on the presence, distribution and population dynamics of the smaller mammalian species. This is especially true with regards to the rodents and insectivores inhabiting the various parks managed by the United States National Park Service. These smaller members of the mammalian fauna represent a major biomass component that avian, reptilian, and mammalian predators utilize. Rodents and insectivores also have a major impact on the various ecosystems they inhabit, since they utilize the flora and the invertebrate fauna as major food resources. Mammals can have a major effect on the control of insect pests and on the survival of both herbaceous and woody vegetation by impacting seed survival and distribution. Proper management, protection, and documentation of the effects of climatic change on these treasured natural areas requires inventory and monitoring procedures that utilize the expertise of trained biologist from both the public and private sector. The lack of this essential information was the basis for the creation of an inventory and monitoring network to gather this necessary information by the National Park Service. This report covers the results of the mammal inventory (excluding bats) of the Carl Sandburg Home National Historic Site in Flat Rock, NC. This is the first known effort to document the mammalian fauna at the Sandburg site.

The state of North Carolina has a relatively diverse mammalian fauna consisting of 69 species, some rare and some very common. Prior to our fieldwork at the site, we compiled a list of the mammals (excluding bats) that would be expected in the historic site. Our own research trapping efforts near the site (Cashiers and Highlands, NC and northern Pickens and Greenville counties, SC provided us with an informed list of what should be expected at the site. We expected to find or document the presence of 33 species: including 1 marsupial, 4 insectivores, 1 lagomorph, 17 rodents, 9 carnivores, and 1 ungulate (Appendix 1). The diverse habitats present at the Carl Sandburg site represent both manmade grassy fields and a mixed conifer/hardwood forest. The site is surrounded by homesites and the park officials maintain a population of cats that is used to minimize rodent populations in the site's various building. These cats, along with the feral cats observed on the site, may have a profound effect on small mammal populations at the site.

The objective of this study was to conduct a comprehensive inventory to document the mammals living within or otherwise using the Carl Sandburg Home National Historic Site. The focus of the work was to document 90% of the expected mammalian fauna.

Study Area

Carl Sandburg Home National Historic Site (Figure 1):

Location: In Flat Rock, NC, 3 miles south of Hendersonville, off US 25 on Little River Road.

Carl Sandburg, nationally renowned poet, biographer, and winner of two Pulitzer Prizes and his family moved to North Carolina in 1945. Their farm offered the peace and solitude required for his writing and offered Mrs. Sandburg over 30 acres of pastureland that she desired to raise her champion dairy goats.

The 264 acre historic landscape consists of the Sandburg residence, a dairy goat barn complex that is home to the park's Connemara Farms goat herd, sheds, rolling pastures, mountainside woods, five miles of hiking trails on moderate to steep terrain, two small lakes, several ponds, flower and vegetable gardens, and an apple orchard.

The habitat at the Sandburg site is surrounded by relatively expensive homes. A visitor center is located near the public parking area and trails that can be accessed by the public extend from the Sandburg residence to various sections of the park. The park holdings are located at elevations of 2200 ft to approximately 2800 ft. on top of Glassy Mountain. One small stream comes off of Glassy Mountain and a dam creates a lake near the visitors center. Another small stream is also dammed and feeds another small lake in the pasture area. The park is located in the Piedmont region of the Appalachian mountain chain. The majority of the park consists of an upland forest dominated by 30-70 year-old trees with some older individuals occurring throughout. Recently, winter storms damaged and uprooted many white pine. The rest of the park consists of pasture that is mowed each year and buildings.

METHODS

An initial visit to the Sandburg site was conducted in 2003. During this visit, we met with park officials, obtained maps of the park, located areas of interest, and surveyed important roads and access points by vehicle and foot. In order to document the occurrence of as many terrestrial mammalian species as possible within the park, we used: small mammal trapping arrays consisting of live traps, pitfall traps, remotely triggered film and digital cameras and visual encounters. The location of each survey site was accurately recorded using a Global Positioning System or GPS unit.



Figure 1. Location of the Carl Sandburg Home National Historic Site, Flat Rock, NC.

Small Mammal Trapping

Fieldwork took place from February 2004 to June 2006. Mammals were surveyed at 19 sites (Table 1 and Figure 2). Each site was selected based on the available habitat within the Sandburg site and on the likelihood that particular target species would be located at these sites.

Table 1. Trapping locations and coordinates for each site surveyed at Carl Sandburg Home National Historic Site, Flat Rock, North Carolina.

Location		UTM	
Site #	Habitat/Sampling Method	Easting	Northing
1	Pasture and edge of woodland Traps/pitfall*	368356	3904101
2	Pasture/edge of stream past dam on Side Lake Traps/pitfall	368311	3904151
3	Pasture/wetland/stream edge entering Side Lake Camera*	368137	3904104
4	Stream edge Traps	368468	3904187
5	Woodland and seepage area Traps	367893	3903977
6	Pasture outside fence to goat area Traps/pitfall	368020	3903826
7	Pasture inside a fenced goat area Traps/pitfall	368138	3903790
8	Woodland/stream edge and rock outcrop Camera; Traps/pitfall	368080	3903722
9	Open woods behind Main House Traps	368348	3903829
10	Woodland-west facing Trapping	368347	3903764
11	Woodland-east facing Trapping	368392	3903691
12	Woodland-east facing-Little Glassy Mt Camera; Traps	368378	3903511
13	Woodland-west facing-Little Glassy Mt Camera; Traps	368305	3903505

Location		UTM	
Site #	Habitat/Sampling Method	Easting	Northing
14	Woodland–west facing Traps	368306	3903317
15	Rock outcrop Traps	367892	3903396
16	Woodland-southwest facing Camera	368382	3903255
17	Rock outcrop Traps	368504	3903016
18	Stream edge/woodland Camera; Traps	368420	3902987
19	Woodland/edge of reservoir Camera; Traps/pitfall	368433	3903078

* Cameras were out every month from February 2004 to October 2006.

* Trapping occurred over a 2 –3 day period during 4/04; 4/04; 3/05; 5/05; 10/05; 2/06; 2/06; 4/06; 5/06; 6/06 and 10/06.

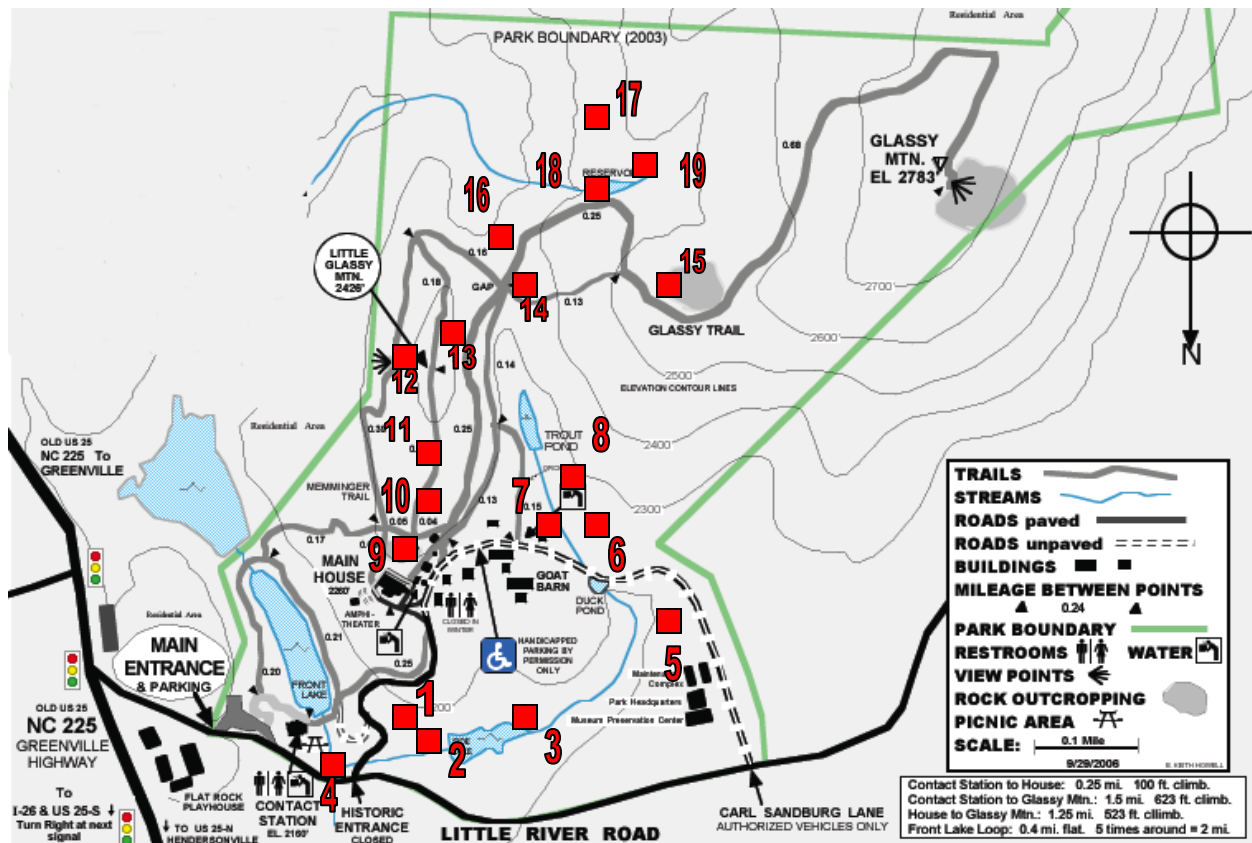


Figure 2. Trapping locations for each site surveyed at Carl Sandburg Home National Historic Site, Flat Rock, NC.

Specimens were collected using four different trapping methods: Sherman live-traps, Tomahawk box-traps, and dry pitfall buckets. Snap traps were not utilized since the park personnel did not want any animals harmed during the sampling procedures. Each night that a trap was open was considered a trap-night. Trap nights at each site varied, depending upon the number of traps deployed, how long traps were actively open, and the effect of raccoons (*Procyon lotor*) on trap site integrity. Some sites were markedly affected by raccoon depredation on the traps. Data could not be collected, since every trap was disturbed, opened or destroyed. Woodlands, rock outcrops, stream side and pond edges, pastures, and areas in close proximity to buildings were sampled for small mammals.

Four film (initially) or four digital cameras were deployed in various habitats to monitor the presence of larger mammalian species. These cameras are triggered by warm moving bodies and allow for photographic confirmation of mammalian species. Mammals as small as shrews and as large as coyotes were documented as present at the Sandburg site.

Specific trap locations and distances between traps varied with habitat type, available cover, and specialized microhabitats. Traps were placed near maintained runways, fresh droppings, and other habitat components that often indicate high levels of small mammal activity. Small and large (Sherman) live-traps were baited with peanut butter. Tomahawk box-traps were set along small trails, along stream edges, along rock outcroppings, under rock overhangs, or within thick underbrush attempting to capture medium-sized mammals. These traps were baited with a mixture of sliced apples and peanut butter. One gallon pitfall buckets were placed along logs and rocks and sunk to ground level in areas of suspected high levels of small mammal activity. Since these pitfall traps were used to live capture mammals, holes were punched in the bottom of the buckets to prevent rainwater from filling the traps and drowning captured mammals.

All individuals were identified with the use of standard museum body measurements (total length, tail length, and hind foot length), and weight. All specimens captured alive were identified, measured (if possible and needed), photographed (if possible) and released. No specimens were euthanized. However, a few animals were found dead in the traps.

Visual Encounters

Field observations were also used to informally document mammals throughout the Sandburg site. Visual encounters include direct observation of individuals, sign (scat and tracks) and roadkill.

RESULTS

Weather conditions were typical of the region during the three year survey period with exception to the amount of rainfall. Rain occurred sparsely throughout a large portion of the first two years of the survey period resulting in a drought for most of those years.

During the survey, 17 species of terrestrial mammals were recorded, and 135 individual observations of mammals were made (including those captured, observed, or documented by sign; Appendix 1). No endangered, threatened, or

candidate species for listing as endangered or threatened were captured. The 17 species of mammals that were documented, however, represent 52 percent of the 33 species that were expected to occur at the Sandburg site: The marsupial (1 documented of 1 expected; 100%); insectivores (2 documented of 4 expected; 50%) included 1 of the 3 expected shrews (33%), the single expected mole (100%); rodents (8 documented of 17 expected; 47%) including 3 of the 4 expected squirrels (75%), and 4 of the 12 expected rats/mice/voles (33%); lagomorphs (1 documented of 1 expected; 100%); carnivores (5 documented of 9 expected: 56%) included two of the three expected canines (67%), the single expected raccoon (100%), the single expected bear (100%), zero of the three expected mustelids (0%), the single feline (1 documented of 1 expected; 100%); and ungulate (0 documented of 1 expected; 0%). All species found during the survey are relatively widespread and considered common in North Carolina.

Mammalian Trapping

Seventeen sites were surveyed for small mammals during the three year period resulting in 1,600 combined trap nights. A total of 1500 Sherman live-trap nights, 10 Tomahawk box-trap nights, and 90 pitfall trap nights were conducted during the survey. These trapping methods were used throughout different habitats within the Sandburg site. Woodlands received 960 trap nights and pastures received 640 trap nights.

A total of 24 small mammals representing 5 species were captured during the 1,600 combined trap nights (Table 2). Measurements of specimens collected can be found in Appendix 2. During this portion of the study, 33 percent, or 5 of the 15 small mammals (squirrel size or smaller) on the initial list were captured. Sherman live-traps captured all individuals of the five species, Tomahawk box-traps did not capture a single species, and dry pit-fall buckets did not capture a single species. The relatively low success of the live trapping procedures can be attributed to: 1) the fact that drought conditions were present during the first two years of the study, 2) the fact that the site is in the Piedmont region of the state (small mammal diversity is usually very low in the Piedmont), 3) the relatively xeric habitats noted throughout the woodlands (steep topography and very thin soil layers) and 4) the presence of numerous feral and domestic cats and dogs in both the pastures and woodlands as documented by the remote cameras. From the 19 trap and camera sites collectively: 1) the most numerous species in the woodlands were the white-footed mouse (*Peromyscus leucopus*), raccoons, opossums, gray squirrels and chipmunks, and 2) the most numerous species in the pastures were the short-tailed shrew (*Blarina brevicauda*), the meadow vole (*Microtus pennsylvanicus*) and the cotton rat (*Sigmodon hispidus*). Numerous is a relative term, since so few animals were live trapped. However, these species are the species that one would expect in these habitats in this part of the USA.

Table 2. Small mammals captured from different habitat types at the Carl Sandburg Home Historic Site

Species	Woods	Pasture	Total
Short-tailed shrew		3	3
White-footed mouse	9	3	12
Meadow vole		2	2
Hispid cotton mouse		5	5
Golden mouse	2		2
Total individuals	11	13	24

Total species

2

4

Visual Encounter

Both direct visual observations (including sign) and image capture via remote cameras documented the presence of 108 mammals representing 13 species (Table 3). Using visual encounters, 39 percent of the 33 mammal species on the original list were documented. One hundred and eight individual mammals of 10 species were sighted, signs at 2 locations for 2 species (bear and beaver) were documented, and those found dead on the road (mole) represented 1 individual of 1 species in the park.

Gray squirrels, chipmunks, a woodchuck, and cottontail rabbits were observed repeatedly at various woodland sites or pasture edges. Raccoons and opossums were captured by the remote cameras during each of the many monitoring periods (in both the woodlands and pastures). Bobcats, gray fox and coyotes were captured by the remote cameras occasionally (in the woodlands). These predators were intermittent users of the Sandburg site.

Table 3. Mammals visually encountered at the Carl Sandburg Home Historic Site.

Species	Visual Encounters			
	Visual/Camera	Sign	Dead	Total
Virginia opossum	0/19			19
Short-tailed shrew	0/1			1
Eastern mole			1	1
Eastern cottontail	2/0			2
Eastern chipmunk	6/0			6
Woodchuck	1/0			1
Gray squirrel	5/3			8
Coyote	0/4			4
Gray fox	0/10			10
Raccoon	0/54			54
Beaver		1		1
Bear		1		1
Bobcat	0/3			3
Total individuals	108	2	1	111
Total species	10	2	1	

DISCUSSION

The mammalian fauna found at the Sandburg site is typical of the Piedmont region of North Carolina. The major goal of this study was to document 90 percent of the mammal species expected to be present. During this study, approximately 52 percent or 17 of the 33 terrestrial species on the initial list were found at the Sandburg site. Of the 17 species not documented during this study, three are primarily associated with human constructed buildings (house mouse, Norway rat and black rat); one is considered rare [least weasel (*Mustela nivalis*)], four are considered localized [rice rat (*Oryzomys palustris*), meadow jumping mouse (*Zapus hudsonius*), Eastern woodrat (*Neotoma*

floridana) and muskrat (*Ondatra zibethicus*)], one is considered extremely cryptic [long-tailed weasel (*Mustela frenata*)], and three are considered extremely difficult to live trap [Southeastern shrew (*Sorex longirostris*), least shrew (*Cryptotis parva*), and Eastern harvest mouse (*Reithrodontomys humulis*)]. In addition, five species not documented in this study are generally common in this part of the Southeastern United States [Southern flying squirrel (*Glaucomys volans*), pine vole (*Microtus pinetorum*), striped skunk (*Mephitis mephitis*), white-tailed deer (*Odocoileus virginianus*), and red fox (*Vulpes vulpes*)].

Trapping success varied greatly, likely due to varying weather conditions during the study. However, the primary reason that so few small shrews, mice and voles were captured may be due to the presence of a large number of domestic and feral cats on the site. In addition, the presence of domestic dogs (photographed by the remote cameras) may be part of the explanation as to why deer and skunks were not photographed at the site. Cats were photographed by the remote cameras in both the pastures and woodlands. In addition, cotton rats were observed being carried in the mouths of the domestic cats used to limit rodent populations in the goat barns located at the Sandburg site.

The combination of all methods used contributed to a better understanding of the total species composition located at the Sandburg site. Even though visual encounters contributed more individuals and more species, the primary goal of 90 percent of the expected species was not met. However, this study provides current species data and distribution for mammals within the Carl Sandburg Home Historic Site.

RECOMMENDATIONS

Future management efforts on the Sandburg site should continue to focus on maintaining a diverse array of available habitats such as pasture, small bodies of water, and intact forests. Varied habitats are vital for maintaining a diverse mammalian fauna.

Efforts should also be focused on the maintenance of snags (standing dead trees) retention and coarse woody debris (tree trunks and branches on the ground) within the woodlands. Trees damaged during storm events should be left standing unless they pose an immediate danger to the public. Live cavity trees and snags should be retained because they provide sites for dens, nest sites, and roosts.

One factor that should be examined is the removal of feral cats and dogs from the property. Politically this would be difficult if the cats and dogs wandering on the property belong to neighboring home sites. In addition, the use of cats to control rodents in the barns may be having a deleterious effect on small mammals populations outside the developed areas. Other avenues of rodent control in the barns may be desirable if populations of small mammals in the Sandburg site are to increase in the woodlands and pastures.

REFERENCE

Webster, D., J. F. Parnell, and W. C. Biggs. 1985. Mammals of the Carolinas, Virginia, and Maryland. The University of North Carolina Press, Chapel Hill and London, 255 pp.

Appendix 1. Mammal species known, expected, and observed on Carl Sandburg Historic Home Site: 2004-2006.

Standard Common Name	Standard Scientific Name	Observed	
		Yes	No
Order: Didelphimorphia			
Family: Didelphidae (Opossum)			
Virginia opossum	<i>Didelphis virginiana</i>	X	
Order: Insectivora			
Family: Soricidae (Shrews)			
Southeastern shrew	<i>Sorex longirostris</i>		X
Short-tailed shrew	<i>Blarina brevicauda</i>	X	
Least shrew	<i>Cryptotis parva</i>		X
Family: Talpidae (Moles)			
Eastern mole	<i>Scalopus aquaticus</i>	X	
Order: Lagomorpha			
Family: Leporidae (Rabbits)			
Eastern cottontail	<i>Sylvilagus floridanus</i>	X	
Order: Rodentia			
Family: Sciuridae (Squirrels)			
Eastern chipmunk	<i>Tamias striatus</i>	X	
Woodchuck	<i>Marmota monax</i>	X	
Gray squirrel	<i>Sciurus carolinensis</i>	X	
Southern flying squirrel	<i>Glaucomys volans</i>		X
Family: Muridae (rats & mice)			
Eastern harvest mouse	<i>Reithrodontomys humulis</i>		X
White-footed mouse	<i>Peromyscus leucopus</i>	X	
Golden mouse	<i>Ochrotomys nuttalli</i>	X	
Hispid cotton rat	<i>Sigmadon hispidus</i>	X	
Rice rat	<i>Oryzomys palustris</i>		X
Meadow vole	<i>Microtus pennsylvanicus</i>	X	
Pine vole	<i>Microtus pinetorum</i>		X
Muskrat	<i>Ondatra zibethicus</i>		X
Norway rat	<i>Rattus norvegicus</i>		X
Black Rat	<i>Rattus rattus</i>		X
House mouse	<i>Mus musculus</i>		X
Family: Dipodidae (Jumping mice)			
Meadow jumping mouse	<i>Zapus hudsonius</i>		X
Beaver	<i>Castor canadensis</i>	X	
Family: Canidae (Foxes and allies)			
Coyote	<i>Canis latrans</i>	X	
Red fox	<i>Vulpes vulpes</i>		X
Gray fox	<i>Urocyon cinereoargenteus</i>	X	
Family: Procyonidae (Raccoons and allies)			
Raccoon	<i>Procyon lotor</i>	X	

Family: Ursidae (Bears)

Black Bear	<i>Ursus americana</i>	X
------------	------------------------	---

Family: Mustelidae (Weasels and allies)

Long-tailed weasel	<i>Mustela frenata</i>	X
--------------------	------------------------	---

Least weasel	<i>Mustela nivalis</i>	X
--------------	------------------------	---

Striped skunk	<i>Mephitis mephitis</i>	X
---------------	--------------------------	---

Family: Felidae (Cats)

Bobcat	<i>Lynx rufus</i>	X
--------	-------------------	---

Order: Artiodactyla (Even-toed ungulates)**Family: Cervidae (Deer)**

White-tailed deer	<i>Odocoileus virginianus</i>	X
-------------------	-------------------------------	---

Appendix 2. All terrestrial mammals live trapped at the Carl Sandburg Home National Historic Site, 2004-2006.

Order

Species

Date	Site	Sex	Repro. Cond.	Age	Lengths (mm)			Weight (g)	
					Total	Tail	HF**		
Insectivora									
Short-tailed shrew (<i>Blarina brevicauda</i>)									
Feb 06	1	-	-	A	101	20	14	15.6	
Apr 06	3	-	-	A	110	19	14	17	
May 06	3	-	-	A	105	21	14	16.5	
Rodentia									
White-footed mouse (<i>Peromyscus leucopus</i>)									
Apr 04	2	M	-	A	148	64	20	17.9	
Apr 04	2	F	-	A	152	70	19	16.5	
Apr 04	2	F	-	A	155	65	19	17.2	
Feb 06	16	M	-	A	139	60	19	16.0	
Feb 06	16	F	-	J	130	55	18	10.6	
Apr 06	16	F	-	A	147	68	20	18.3	
Apr 06	14	M	-	A	153	70	19.5	16.9	
Apr 06	14	M	-	A	150	61	20	15.7	
Jun 06	14	M	-	A	144	68	21	16.8	
Jun 06	14	F	-	A	154	64	19	15.6	
Jun 06	6	M	-	A	148	58	20	18.0	
Jun 06	2	M	-	A	151	62	19	16.8	
Meadow vole (<i>Microtus pennsylvanicus</i>)									
May 06	1	M		A	145	45		60.3	
May 06	2	F		A	170	56		55.0	
Golden Mouse <i>Ochrotomys nuttalli</i>									
Feb 06	4	M		A	185	80		14.5	
Apr 05	13			J	-	-		-	
Hispid Cotton Rat <i>Sigmadon hispidus</i>									
Feb 06	15	M		A	250	92		165.0	
Feb 06	15	F		A	267	98		161.5	
Apr 06	15	F		A	254	94		183.7	
May 06	16	M		A	288	105		174.9	
Oct 06	16	M		A	-	-		-	