Bats of Carl Sandburg Home National Historic Site, Cowpens National Battlefield, Guildford Courthouse National Military Park, Kings Mountain National Military Park, Ninety Six National Historic Site

Final Report

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INTRODUCTION

The Cumberland Piedmont Network is one of 32 Inventory and Monitoring Networks established by the National Park Service as part of the Natural Resource Challenge. The network consists of 14 parks ranging in size from 89 ha to >21,000 ha. The goals of the Inventory and Monitoring Networks are to obtain information on the status of each park's natural resources, monitor these resources over time, and make this information available for park planning, management, and decision making. Although individual Inventory and Monitoring Networks contain parks with similar geographic and biological characteristics, there is considerable variation among parks within a network. The 14 parks within the Cumberland Piedmont Network are in six physiographic regions and cover a range of ecosystems. The five Cumberland Piedmont parks covered in this report occupy a diverse array of habitats ranging from bottomland hardwoods to pine and pine-hardwood forests, upland hardwood forests, granitic domes, and wetlands. The parks also vary considerably in the amount of urbanization and development that has occurred in the surrounding areas.

The goal of this study was documentation of 90% of the bat species occurring within Carl Sandburg Home National Historic Site (CARL), Cowpens National Battlefield (COWP), Guilford Courthouse National Military Park (GUCO), Kings Mountain National Military Park (KIMO), and Ninety Six National Historic Site (NISI). Bats are one of the least studied groups of wildlife and basic inventories of many areas have not been conducted (Weller and Zielinski 2006). No bat surveys had been conducted in any of the five parks prior to this study to our knowledge.

The primary objectives of the current survey were to: 1) develop a list of bat species expected to occur in each park, 2) verify and document the presence of 90% of the bat species within each park, and 3) prepare digital photographic vouchers of each species captured in each park. Secondary objectives were to: 1) identify and describe foraging areas within the parks, and 2) delineate potential bat habitat within the park.

METHODS

A list of expected species was developed for COWP, KIMO, and NISI based on records of occurrence in Menzel et al. (2003) and range maps in the National Atlas created by Bat Conservation International (http://nationalatlas.gov). Expected species lists for CARL and GUCO were based on Whitaker and Hamilton (1998) and the National Atlas range maps. The types of habitats and the amounts of each habitat within a park were also considered when developing the expected species list. Each species was categorized as: 1) expected (E), 2) possible but unlikely or rare (P), 3) not likely to occur (N), and 4) winter migrant (W).

We used mist-nets, acoustic detectors, and building searches to survey each park. Buildings such as barns, maintenance buildings, and other structures were inspected for bats and guano. Building searches were often based on information provided by park personnel.

Mist-nets were set across fly-ways such as streams, roads, and trails with over-hanging and side vegetation in as many habitat types as possible in each park. Each net site was mapped with a Global Position System (GPS) and nets were checked every 15 minutes. Nets were opened for 3-5 hours depending on bat activity and weather. Bats were removed from the net, identified to species, and weighed. Sex, age (adult or juvenile), reproductive condition, and other pertinent information (e.g., parasites, injuries) were also recorded. A uniquely numbered aluminum lipped band was placed on the forearm of each bat before it was released. Digital pictures were taken of each species encountered at each park. Mist-netting was conducted primarily from late May through mid-August 2005 and 2006 although one spring mist-net session was conducted at NISI in 2007.

Acoustic sampling was conducted with AnabatII bat detectors connected to programmable interface and recording modules with compact flash cards (CF-ZCAIMS). Detectors and CF-ZCAIMS were placed in waterproof containers with a 45° angled tube and attached to tripods set at approximately 1.3 m and oriented in the direction with the least clutter (Weller and Zabel 2002). Acoustic sampling was conducted during the summers of 2005 and 2006 and late fall, winter, and early spring 2006-2007. Detectors were used to survey bats at the sample points established by the Cumberland Piedmont Inventory and Monitoring Network at each park. We attempted to survey all points at each park. However, it was not possible to locate or access all of the points at some parks. During our winter surveys, detectors were also set in locations that were expected to maximize detections such as open fields, streams, and ponds. Detectors were set for 1-3 nights per sampling session and many points were sampled during two or more sampling sessions.

Bat calls were analyzed using Analook (Version 4.9j, 2004). Two filters were used: an identification filter and a use/activity filter. Both filters were designed for bats in the eastern United States. The identification filter selected bat passes that contained $\geq$5 calls and generally represented search phase calls (Britzke and Murray, 2000). Search phase calls are those used while searching for prey and contain the most useful characteristics for species identification (Fenton and Bell 1981). Each pass that made it through the identification filter was visually examined to ensure that it contained search phase calls. The filtered passes were identified to species using a combination of quantitative and qualitative methods. A discriminant function model based on >23,000 known search phase calls was used to identify calls (Brizke, 2003). Each identified pass was also visually inspected to confirm or correct the species designation obtained from the discriminant function model. The activity filter required that each bat pass have $\geq$1 bat call and selected lower quality and non-search phase calls (Britzke, 2003). These passes were used as an index of overall bat activity including foraging and commuting activity.

Plant community definitions for each of the sample points were obtained from White (2003, 2004), White and Govus (2003, 2005), and White and Pyne (2003). Additional acoustic sampling points and net sites were assigned broad habitat descriptions (e.g., pine, hardwood, riparian, open field) at the time of sampling. We assessed the habitat within 5 km of each park's boundary using the National Land Cover Dataset (http://www. mrlc.gov/zones/show_data.asp?szones=14) with a 30 m grid resolution. Developed land included low, medium, and high intensity development with impervious surfaces ranging from 20-100%.

RESULTS AND DISCUSSION

The number of species expected to occur in each park during summer ranged from four to five (Table 1). The number of species actually documented in parks ranged from four in COWP and KIMO to eight in CARL (Table 2). Details of bat captures (e.g., age, sex, reproductive condition, body weight) and acoustic recordings are included in the enclosed Access database.

Carl Sandburg Home National Historic Site

Carl Sandburg Home National Historic Site is situated in the Southern Blue Ridge Physiographic Region. The 107 ha site contains open fields and second growth forests in the lower portions of the park and heavily wooded forests and granitic outcrops in the upper portions of the park. Ten plant communities are contained within the park: pine woodland, dry chestnut oak (*Quercus prinus*) forest, mesic chestnut oak forest, Appalachian cove forest, montane oak-hickory (*Carya* spp.) forest, semi-natural wooded upland, herbaceous meadow, aquatic wetland, rush marsh, and a granitic dome community (Nichols et al.). The park also contains two small lakes (Front Lake and Side Lake), three ponds (Duck Pond, Trout Pond, and Mt. Resevoir), barns, and maintenance buildings as well as the Carl Sandburg Home and park buildings.

Mist-netting was conducted at six sites over seven nights (Table 3 and Fig. 1). Five species were captured, including the rare small-footed bat. Three of the species captured were expected to occur in the park whereas the small-footed bat and the evening bat were classified as a possible inhabitants. Two expected species were not captured but were recorded with bat detectors (see below). The northern long-eared bat was the most frequently captured species and was captured at four of the six sites surveyed. Other relatively common species were the little brown bat and the big brown bat (Table 3). Fifteen of the seventeen northern long-eared bats captured were female and eight of these females were either pregnant or lactating. In addition, all six of the little brown bats captured were lactating females and both female big brown bats captured were lactating.

These data suggest that CARL supports maternity colonies of at least three species of bats. Although northern long-eared bats made up the majority of the captures, species diversity in CARL was relatively high compared to other parks (Table 2).

Detectors were set at 11 sites in summer and 15 sites during winter (Tables 4 and 5, Fig. 1). Eight species were identified with the bat detectors. In addition to the five species captured in mist-nets, we also recorded red bats, silver-haired bats, and eastern pipistrelles (Tables 4 and 5). All expected species and three possible species were recorded. Some bat activity was recorded at all sample points during summer or winter (Tables 4 and 5). However, bat activity in summer and winter was greatest in open habitats such as old fields and agricultural areas (CARL07, CARL08, and CARL09) and near water bodies (CARL15, Front Lake, and Side Lake). Species richness was also high at these sites (Tables 4 and 5).

The bat fauna of CARL was the richest of any of the parks sampled (Table 3). The high species richness of this park was likely due to several factors. Because CARL is located in the lower portion of the Blue Ridge Mountains, it contains species that occur in the mountains as well as in the Piedmont. Further, although CARL is relatively small, it has a diversity of habitats ranging from old fields to montane hardwood forests and rock outcrops. Further, there are several small lakes and ponds on CARL. Water is an important habitat feature for most bats (Cross 1988, Racey 1998) and thus, the several small lakes and ponds on CARL probably contributed to the high number of species and high detection rates of bats. Finally, urbanization and development surrounding CARL is not extreme, although it is higher than some other parks included in this survey. For example, only 8% of the area within 5 km of the park boundary is developed and canopy cover within this area is 74%. Thus, the surrounding area as well as the park probably provide roosting and foraging habitat for a wide variety of species.

The capture of a small-footed bat on CARL is noteworthy. Small-footed bats are one of the rarest species in the eastern U.S. and little is known about their ecology (Whitaker and Hamilton 1998). Small-footed bats often roost in rock crevices and talus slopes, particularly those that receive full sunlight (Best and Jennings 1997, Stihler 2006). Thus, rock outcrops in CARL are probably an important habitat feature for this species. Little is known about the foraging habitat preferences of this species. However, we only recorded them over the Trout Pond and Side Lake, suggesting that water bodies are important components of their foraging habitat.

Cowpens National Battlefield

Cowpens National Battlefield is situated in the Piedmont of South Carolina. The 341 ha site is a mixture of old fields and woodlands. Important tree species include loblolly (*Pinus taeda*) and shortleaf pine (*P. echinata*), sweetgum (*Liquidambar styraciflua*), yellow poplar (*Liriodendron tulipifera*), white oak (*Quercus alba*), southern red oak (*Q. falcata*), scarlet oak (*Q. coccinea*), and mockernut hickory (*Carya alba*; Nichols et al.). Several small streams run through the park. Approximately 9% of the land within 5 km of the park is developed whereas 37% is forested and 41% is agricultural.

Although six sites were mist-netted over nine nights, we were not able to catch any bats at COWP (Table 6; Fig. 2). However, we were able to record bats throughout the park. During summer, bats were recorded at 13 of the 16 points sampled and during winter bats were recorded at seven of the 14 points surveyed. During summer we recorded three species: big brown bats, red bats, and eastern pipistrelles. During winter we recorded big brown bats, red bats, and hoary bats. All of the species recorded were expected to occur in summer or winter. The only species expected to occur in summer that was not recorded was the evening bat. The only expected winter migrant that was not recorded was the silver-haired bat.

Our inability to capture bats at COWP, despite their presence, was probably due to the layout of the COWP landscape. The park has extensive open field areas that are broken up by small wooded areas. Because there were so many open areas, bats may not use well defined flyways, and thus, our nets were ineffective.

Although bats were recorded at most of the sample points in summer, there was considerable variation in the amount of bat activity recorded at each sample point. The highest bat activity was recorded at COWP09, a successional bottomland site. Riparian areas are important to bats (Cross 1988, Racey 1998) because they provide drinking water, a source of insect prey, and oftentimes, roost trees. Other areas that received high use were some of the old field habitats and the loblolly pine plantation. Open areas such as meadows, old fields, and forest gaps are often important foraging habitats for bats because the have few physical obstructions to interfere with flight or echolocation (Fenton 1990). Several studies in the south have found that big brown bats, red bats, and eastern pipistrelles use early successional habitats such as recent clearcuts and wildlife openings (Ellis et al. 2002, Menzel et al. 2005, Loeb and O'Keefe 2006). Thus, it appears that COWP provides good foraging habitat for the three species inhabiting the park.

The species found in COWP during summer are three of the most common species of bats in the eastern U.S. (Agosta 2002, Whitaker and Hamilton 1998). During summer, red bats and eastern pipistrelles roost primarily in the foliage of hardwood trees (Carter and Menzel 2007). However, they have slightly different preferences for roost trees. Red bats prefer relatively large trees that receive considerable solar exposure (Hutchinson and Lacki 2000, Leput 2004, Mager and Nelson 2001). Thus, roost trees are often in the open or on the forest edge. Eastern pipistrelles use a variety of hardwood species for roosting, but reproductive females prefer to use oaks in interior forest (Veilleux et al. 2004). Thus, providing mixed hardwood forests with large oaks on both the forest edge and the interior should provide roosting habitat for red bats and eastern pipistrelles.

Big brown bats form maternity colonies of 5-700 bats, although in the eastern US, colonies usually contain 25-75 bats (Kurta and Baker 1990). Historically, they used large trees with cavities or large hollows for roosting (Agosta 2002). However, due to the loss of large cavity bearing trees, big brown bats in the east usually roost in man-made structures such as houses, barns, and churches (Kurta and Baker 1990). Big brown bats are highly adaptable and do well in rural and urban environments (Duchamp et al. 2004, Furlonger et al. 1987). They are strong flyers and often forage long distances from their roosts. For example, big brown bats captured on a wildlife refuge near Denver, Colorado roosted in buildings 9.2-18.8 km from the refuge in highly urbanized areas (Everette et al. 2001). Thus, big brown bats recorded on COWP may have been roosting on site or may have been roosting in the many buildings and barns in the surrounding area.

During winter we recorded hoary bats as well as red bats and big brown bats in COWP. Hoary bats are rarely found in the southern Piedmont and Coastal Plain during summer but migrate to these areas during winter (Cryan 2003, Cryan et al. 2004). Little is known about the winter roosting habits of hoary bats. The closely related red bat and Seminole bat roost in leaf litter, in trees with persistent dead leaves, vines, and pine needle clusters suspended from low trees during winter (Hein et al. 2005, Mormann and Robbins 2007). Thus, it is likely that COWP provides ample roosting habitat for hoary bats as well as red bats during winter. Further, because hoary bats are large bats, they prefer to forage in open areas (e.g., Ford et al. 2005). Thus, the many open areas surrounded by woodlands on COWP probably provide excellent habitat for this species during fall, winter, and early spring.

In summary, although no bats were captured on COWP, at least three species utilize the park during summer and winter. Because much of the area surrounding COWP is agricultural, the wooded areas on COWP probably provide good roosting habitat for the tree roosting red bats, pipistrelles, and hoary bats.

<u>GUCO</u>

Guilford Courthouse National Military Park is an 89 ha park surrounded primarily by urban development. The park contains many open field areas as well as upland hardwood and mixed pine-hardwood forests. Oaks are the predominant hardwood in the park (Nichols et al.). A small stream runs through the park.

Six sites were mist-netted at GUCO (Table 9 and Fig. 3). Four species were captured, all of which were expected species (Table 1). The only species expected to occur on GUCO that was not documented was the Brazilian free-tailed bat. Big brown bats were the dominant species captured throughout the park (Table 9). Other species captured were red bats, evening bats, and eastern pipistrelles. Twenty-two of the big brown bats were juveniles suggesting that $\geq$1 maternity colony was on or near GUCO. We also captured a lactating red bat, two juvenile red bats, a lactating pipistrelle, and a juvenile pipistrelle, again suggesting the area supports reproductive populations of these bats.

Bats were recorded at 10 of the 14 points sampled during summer (Table 10). We recorded all of the species that we captured as well as silver-haired bats (Table 10). Silver-haired bats were expected to occur during winter (Table 1). Bat activity was greatest at the two yellow poplar bottomland sites, the grassy field, and the wisteria hole (Table 10). Species richness was greatest at the grassy field and one of the bottomland yellow poplar sites. Bats were recorded at 13 of the 15 sites sampled during spring 2007. Again, activity was greatest in the bottomland yellow poplar sites, the wisteria hole, and the open field conditions around the GUCO House (Table 11). However, activity was also high in some of the forested points such as GUCO10 (a white oak-hickory forest), GUCO08 (an old successional yellow poplar-red maple (*Acer rubrum*)-oak forest), and others (GUCO03, GUCO04, and GUCO9&12).

The species composition of the GUCO bat fauna was similar to that found with bat detectors for sites on Buffalo Creek, which is approximately 10 km from GUCO in Guilford County (Kalcounis-Ruppell et al. 2007). Similar to GUCO, the most common species detected in the Buffalo Creek area were big brown bats, eastern pipistrelles, evening bats, and red bats. Hoary bats, Brazilian free-tailed bats, and *Myotis* spp. were also detected but very infrequently. During summer, the bat community of GUCO based on capture data was highly dominated by big brown bats. Thus, although species richness was relatively high, species diversity was the lowest of all the parks (Table 2). Big brown bats are a highly adaptable species and do well in urban environments (Duchamp et al. 2004, Furlonger et al. 1987, Kurta and Teramino 1992, Ulrey et al. 2005). GUCO was the most urbanized park of any in this study. Fifty percent of the land within 5 km of GUCO is developed (>20% impervious surface). Other urban national park units in the South such as Chattahoochee River National Recreation Area and Ocmulgee National Monument also have bat communities that are highly dominated by big brown bats (Loeb 2006). Even though GUCO was highly dominated by big brown bats, it also provided roosting or foraging habitat for breeding populations of red bats, eastern pipistrelles, and evening bats. Because parks may be important refuges for wildlife in urban environments (e.g., Mahan and O'Connell 2005, Morrison and Chapman 2005), GUCO may be a critical area for bats in the Greensboro area.

The bottomland habitats (including the wisteria hole) as well as open grassy areas in the park appear to be particularly important for bats during the summer. The highest activity was recorded at GUCO07, a bottomland yellow poplar stand close to a small stream (Fig. 3). Riparian areas are important to bats and provide both foraging and roosting habitat (Cross 1986, Racey 1998, Seidman and Zabel 2001). Riparian areas were also important during spring, but bats made greater use of forested stands in the spring than in the summer. During summer when the trees are completely leafed out, densely forested areas may have too much clutter to make them suitable foraging sites (Aldridge and Rautenbach 1987, Crome and Richards 1988, Fenton 1990). However, during winter and spring, these areas should have less clutter and bats may use them more.

We did not document Brazilian free-tailed bats in GUCO. Brazilian free-tailed bats in the eastern U.S. roost primarily in buildings and other artificial structures (Wilkins 1989) and are often found in urban areas in the south. However, these bats are also very high flying bats and often forage over large rivers and agricultural areas (Best and Geluso 2003, Lee and McCracken 2005). Thus, although they may be in the Greensboro area, GUCO may not provide good foraging habitat. Kalcounis-Rupell et al. (2007) recorded Brazilian free-tailed bats on Buffalo Creek but, in very low numbers.

In summary, GUCO has a relatively rich bat fauna but due to the dominance of big brown bats, the diversity is relatively low. This pattern is common for urban parks (Loeb 2006). However, because the park supports a number of species, it may be an important refuge in the rapidly urbanizing landscape surrounding the park.

Kings Mountain National Military Park.

KIMO is a 1,597 ha park which contains a series of ridges running from southwest to northeast. Floodplain forests are dominated by yellow poplar, sweetgum (*Liquidambar styraciflua*), black walnut (*Juglans nigra*), and sycamore (*Plantanus occidentalis*; Nichols et al.). White oak (*Q. alba*), red maple, yellow poplar and flowering dogwood (*Cornus florida*) dominate mesic and dry-mesic slopes and chestnut oak (*Q. prinus*), scarlet oak (*Q. coccinea*), shortleaf pine (*Pinus echinata*), post oak (*Q. stellata*), and blackjack oak (*Q. marilandica*) dominate dry sites. KIMO has an active prescribe burning program to reduce fuel levels and increase the diversity of the plant communities. Kings Mountain State Park, a 2,786 ha park, surrounds the southern and eastern boundaries of KIMO. Thus, only 2% of the area within 5 km of the park is developed and 68% of the area is forested.

Four sites were mist-netted over six nights (Table 12; Fig. 4). Three species were captured: the big brown bat, the red bat, and the eastern pipistrelle. All three species were expected to occur. All of the big brown bats were adult males, two of the three red bats were adult males, and the eastern pipistrelle was an adult male. However, the adult female red bat that was captured was lactating. Evening bats were also expected to occur but were not captured or detected acoustically.

Bats were detected at nine of the 21 acoustic sampling points surveyed during the summers of 2005 and 2006. Further, activity was low at most points where bats were detected (Table 13). The highest activity was in a blackjack oak woodland and a red oak-yellow poplar-umbrella magnolia (*Magnolia tripelata*) stand. We recorded the same three species that we captured: big brown bats, red bats, and eastern pipistrelles.   During winter, bats were detected at five of the seven points surveyed. Activity was highest in the blackberry-smilax shrubland, the blackjack oak woodland, and an oak-pine stand (Table 14). In addition to big brown bats and red bats, we also recorded hoary bats, an expected winter migrant.

Bat captures and bat activity were relatively low in KIMO although most of the expected species were documented. Evening bats were an expected species but were not captured or recorded acoustically. Little is known about the foraging and roosting habits of evening bats in the southern Piedmont. However, based on studies in other regions of the eastern U.S., evening bats are relatively adaptable in their choice of roost tree species and conditions. For example, in the Coastal Plain of Georgia, evening bats roost primarily in cavities and crevices in live pines, although hardwoods and snags are also used (Miles et al. 2006). In the Ouachita Mountains of Arkansas, evening bats roost primarily in cavities in snags (Perry et al. 2007), and in Missouri, they roost primarily in live and dead oaks (Boyles and Robbins 2006). However, evening bats in Missouri prefer to roost in areas that have been prescribed burned on a biennial basis for 4-5 years (Boyles and Aubrey 2006). Thus, KIMO may become more suitable for evening bats after stands have been burned several times.

The low bat activity recorded by our bat detectors may have been due to the relatively dense nature of the forests on KIMO. Bats usually avoid areas of dense clutter due to decreased efficiencies of flight and acoustical interference (Aldridge and Rautenbach 1987, Fenton 1990). Most of our detectors were set in forest habitats and thus, we did not detect high bat activity. Bat activity appeared to be higher in winter, perhaps due to the decreased clutter due to leaf drop off. During winter, we also detected hoary bats. Hoary bats usually migrate north in summer and return to the south during fall and winter (Cryan 2003, Cryan et al. 2004). Although we did not detect eastern pipistrelles during winter, it is likely that they are in the area. Hibernation sites are usually close to their summer roost sites (Whitaker and Hamilton 1998). However, due to their small size, they may not be as active during the winter as the larger big brown bats, red bats and hoary bats.

In summary, at least four species of bats inhabit KIMO. Big brown bats, red bats, and eastern pipistrelles were year round residents whereas hoary bats were found during winter. The bat population of KIMO was relatively low and male-biased. This was surprising since the park is in a densely forested area and there has been little urbanization or development surrounding the park. However, the dense nature of the forest may preclude a lot of bat activity and the prescribed burning program may result in higher bat populations in future years.

Ninety Six National Historic Site

NISI is a 400 ha park in the Piedmont of South Carolina. Mixed hardwood and pine-hardwood forests dominate much of the site (Nichols et al.). However, there are several grassy fields and riparian and bottomland forests along Spring Branch and Henley Creek. The park also contains Star Fort Lake (11 ha) and Little Pond (0.4 ha). The area surrounding the park is primarily rural with 20% of the area within 5 km in agriculture and only 1% considered developed.

Six sites were mist-netted over seven nights (Table 15 and Fig. 5). Four species were captured: big brown bats, red bats, Seminole bats, and evening bats (Table 15). All of these were expected to occur in NISI. The only species that was expected to occur that we did not capture was the eastern pipistrelle. However, we obtained acoustic records for pipistrelles at several sites (Tables 16 and 17). There were numerous indications that the bats on NISI were productive. All three of the adult big brown bats that we captured were lactating, all three of the adult red bats that we captured were pregnant, and five of the six adult female evening bats that we captured were either pregnant or lactating.

Some bat activity was recorded at 13 of the 15 sample points surveyed during May and June 2005. The greatest activity was recorded in two of the bottomland sites (NISI01 and NISI13; Table 16). Other sites that received relatively high use were an old field and a water oak (*Q. nigra*) forest. It is not possible to distinguish the calls of red bats and Seminoles bats. Therefore, we recorded at least four species of bats, possibly five. In addition to the species which we captured (big brown bats, red bats/Seminole bats, and evening bats), we also recorded eastern pipistrelles. Thus, all of the expected species were documented. During late winter and early spring we recorded bat activity at 13 of the 15 sites we surveyed. In addition to sampling 11 of the NPS sites, we also surveyed sites that were expected to have high bat activity such as Little Pond and Star Fort Lake (Table 17 and Fig. 5). As in summer, activity was high in bottomland and riparian areas such as NISI14, Little Pond, and Star Fort Lake (Table 17). Activity was also relatively high in the two old field sites sampled (NISI03 and NISI09). During winter we also recorded hoary bats at two sites. This species was an expected winter migrant.

Species richness and diversity were relatively high at NISI (Table 2). Five species were documented at NISI including hoary bats which are a winter migrant. Although the only capture of a Seminole bat was during spring, this species is most likely a year-round resident. There is no evidence of migration in Seminole bats (Wilkins 1987) and NISI is well within the range of this species. Further, Seminole bats roost primarily in pines (Menzel et al. 1998) and forage in pine stands as well as bottomland and upland hardwood sites (Carter et al. 2004). Thus, NISI provides both roosting and foraging habitat for this species. Further, we may have recorded them acoustically during the summer, but it is not possible to distinguish the calls of red bats and Seminole bats.

Not only did NISI have a relatively high species richness and diversity, it also appears to provide good habitat for bats as indicated by the high level of reproductive activity. Most of the bats we captured were pregnant or lactating females. Further, we suspect that there was a maternity roost very near one of our nets (N2) near Star Fort

Lake. Three pregnant females were captured very early in the evening which suggests that they had just left their roost tree.

Bat activity was recorded at most the sites surveyed although there was considerable variation in the amount of activity among sites. Bottomland sites and water bodies received the greatest activity although the old field sites also received considerable activity, particularly in winter. However, there was some activity in most of the forested stands as well.

In summary, NISI contains a relatively rich and diverse bat fauna. The diversity of habitats, several water bodies and bottomlands, as well as the lack of development around the park probably contribute to the healthy bat populations.

CONCLUSIONS

In summary, 75%-100% of the expected species were documented in each of the parks (Table 18). We also documented presence of some possible species as well as the presence of some winter migrants. In cases where <90% of the expected species were documented, we documented three of the four expected species (COWP and KIMO) or four of the five expected species (GUCO).

Maintaining bat populations in the parks can best be achieved by providing critical habitat elements, particularly roosting habitat. Roosts provide protection from the elements and predators, and serve as the site for rearing young (Kunz 2003). In general, North American tree roosting bats prefer large trees, usually in areas with relatively open canopies (Kalcounis-Ruppell et al. 2005). Thus, management that favors large trees and snags will benefit bats. Providing foraging habitat is also an important consideration. Because bats usually prefer to forage in less cluttered habitats, forest management practices such as prescribed fire, thinning, and the creation of small gaps may improve bat foraging habitat in some areas (Hayes and Loeb 2007). Further, riparian areas including lakes and ponds are important foraging habitats for bats. The landscape surrounding the parks also appears to have a significant impact on bat communities (Loeb 2006). Although increased development has not affected species richness in the parks studied, it has affected species diversity. As development increases around the parks, species richness may begin to decline. Further research is needed to determine the role of these national parks in conservation of regional biodiversity, particularly in rapidly urbanizing areas.

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Table 1. List of expected and possible species in each park unit. Species are designated as expected to occur (E), possible but unlikely or rare (P), not expected to occur (N), and expected to occur during winter (W). Letters in bold-face indicate that the species was documented in the park.

Species	CARL	COWP	GUCO	KIMO	NISI
Rafinesque's big-eared bat *Corynorhinus rafinesquii* (CORA)	P	N	N	N	N
Big brown bat *Eptesicus fuscus* (EPFU)	**E**	**E**	**E**	**E**	**E**
Silver-haired bat *Lasionycteris noctivagans* (LANO)	**P**	W	**W**[1]	W	W
Red bat *Lasiurus borealis* (LABO)	**E**	**E**	**E**	**E**	**E**
Hoary bat *Lasiurus cinereus* (LACI)	W	**W**	W	**W**	**W**
Seminole bat *Lasiurus Seminolus* (LASE)	N	P	P	N	**E**
Small-footed bat *Myotis leibii* (MYLE)	**P**	N	N	N	N
Little brown bat *Myotis lucifugus* (MYLU)	**E**	N	N	N	N
Northern long-eared bat *Myotis septentrionalis* (MYSE)	**E**	P	N	P	N
Evening bat *Nycticeius humeralis* (NYHU)	**P**	E	**E**	E	**E**
Eastern pipistrelle *Pipistrellus subflavus* (PISU)	**E**	**E**	**E**	**E**	**E**
Brazilian free-tailed bat *Tadarida brasiliensis* (TABR)	N	N	E	N	P

[1] Documented in summer and winter.

Table 2. Species richness based on captures and acoustic data and captures, and Shannon's diversity index based on capture data only at five National Park units in the Cumberland Piedmont Inventory and Monitoring Network.

Park	Species Richness Captures only	Species Richness Capture & Acoustic	Shannon's Diversity Index
CARL	5	8	1.14
COPW	0	4	
GUCO	4	5	0.63
KIMO	3	4	0.97
NISI	4	6	1.22

Table3. Mist net sites, site descriptions, and number of bats captured at each site at Carl Sandburg Home National Historic Site, June 2005 and 2006. Site numbers correspond to numbers on map (Fig. 1).

Site	Site #	Dates Surveyed	Habitat Type and Description of Survey Location	EPFU	MYLE	MYLU	MYSE	NYHU
Front Lake	N1	6/20/2005 6/20/2006	Hemlock-hardwood bottomland; riparian habitat	3		6	4	
Glassy Trail Reservoir	N2	6/21/2005	Rhododendron, Pine-Oak; Riparian				4	
Goat Barn	N3	6/22/2005	Oak-pine forest; pasture					
Main House	N4	6/23/2005	Hemlock, rhodondendron	1				
Five Points	N5	6/21/2006	Mixed hardwood		1		8	
Historic Entrance	N6	6/22/2006	Bottomland hardwood				1	1
Total				4	1	6	17	1

Table 4. Acoustic sampling sites, site descriptions, mean number of bat passes recorded at each point, and species detected at each point with AnabatII bat detectors during June 2005 and 2006 at Carl Sandburg Home National Historic Site.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/ Night	EPFU	LABO	LANO	MYLE	MYLU	MYSE	NYHU	PISU
CARL01	4	Montane oak-hickory	17	+				+	+		+
CARL02	1	Flat rock community	0								
CARL03	1	Granite flat rock community	29		+			+	+		+
CARL05	1	Chestnut oak-mountain laurel	22	+							
CARL06	3	Chestnut oak forest	10.3		+						+
CARL07	4	Agricultural field/Tulip poplar successional patch	47.8	+	+	+		+			+
CARL08	4	Old field	54.5	+	+	+		+			+
CARL09	4	Old field	27.0	+							

Table 4. Con't.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/ Night	EPFU	LABO	LANO	MYLE	MYLU	MYSE	NYHU	PISU
CARL10	4	White pine-hemlock successional forest	3.8	+							
CARL11	3	Chestnut oak slope	5.3								
CARL15	2	Red oak-red maple near trout pond	769	+	+		+	+	+	+	+

Table 5. Acoustic sampling sites, site descriptions, total number of bat passes recorded, and species detected with AnabatII bat detectors during March and April 2007 at CARL.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/ Night	EPFU	LABO	LANO	MYLE	MYLU	MYSE	NYHU	PISU
CARL01	2	Montane oak-hickory	2								
CARL02	2	Flat rock community	60.5	+		+					
CARL03	2	Granite flat rock community	1.5								
CARL05	2	Chestnut oak-mountain laurel	6.5	+							
CARL06	2	Chestnut oak forest	32		+						
CARL07	2	Agricultural field/Tulip poplar successional patch	37	+	+	+					
CARL08	2	Old field	92.5	+	+	+					
CARL09	2	Old field	0.5								

Table 5. Con't.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/ Night	EPFU	LABO	LANO	MYLE	MYLU	MYSE	NYHU	PISU
CARL10	2	White pine-hemlock successional forest	14	+							
CARL11	2	Chestnut oak slope	0								
CARL13	2	Pitch pine-mountain laurel	2								
CARL15	2	Red oak-red maple near trout pond	27	+							
Front Lake	2	Hemlock-hardwood bottomland; riparian habitat	214	+	+			+	+		+
Mt. Reservoir	2	Rhododendron, Pine-Oak; Riparian	25	+	+	+			+		
Side Lake	2	Riparian; open field	282.5	+	+	+	+	+	+	+	

Table 6. Mist net sites and site descriptions at Cowpens National Battlefield June and July 2005 and June 2006. Site numbers correspond to numbers on map (Fig. 2).

Site	Site #	Dates Surveyed	Habitat Type and Description of Survey Location
Picnic Area	N1	6/28/2005	Sweetgum/open field
Loop Road/ Morgans Camp	N2	6/28/2005 6/29/2005	Oak/Sweetgum
Loop Road West VIP	N3	7/5/2005	Oak-Yellow poplar
Loop Road Visitor's Center	N4	7/6/2005 7/7/2005 6/15/2006	Oak-hickory
Richard Scruggs Chimney	N5	6/12/2006	Hardwood bottomland
East of Scruggs House	N6	6/14/2006	Hardwood and open fields

Table 7. Acoustic sampling sites, site descriptions, mean number of bat passes recorded at each point, and species detected at each sample point in COWP with AnabatII bat detectors during June and August 2005 and June 2006.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO	PISU
COWP01	4	Successional loblolly pine stand	1.5			
COWP02	3	Old field	3.7	+		
COWP03	3	Old field, not mowed	6.3	+	+	+
COWP04&13	4	Red bud, eastern juniper woodland	6.25		+	
COWP05	4	Scarlet oak dry forest	0			
COWP06	3	Loblolly pine plantation	12.7		+	+
COWP07	3	Dry oak-hickory forest	0.7			
COWP08	3	Successional pine-red maple-yellow poplar forest	1.7			
COWP09	2	Successional bottomland	96.5		+	+
COWP10	2	Successional forest with dense Smilax understory	3.5		+	
COWP11	3	Old field	26.7		+	+
COWP12	3	Successional old field	8.0		+	+

Table 7. Con't.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO	PISU
COWP14	3	Yellow poplar/successional bottomland	0			
COWP15	3	Oak-pine forest	0			
COWP16	3	Oak savanna	5.3			+
COWP17	2	Mesic hardwood (white oak, yellow poplar, sweetgum)	6.25		+	

Table 8. Acoustic sampling sites, site descriptions, mean number of bat passes recorded at each point, and species detected at each sampling point in COWP with AnabatII bat detectors during November 2006 and January-February 2007.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO	LACI	PISU
COWP01	2	Successional loblolly pine stand	18		+	+	
COWP02	2	Old field	4			+	
COWP03	2	Old field, not mowed	0				
COWP04&13	2	Red bud, eastern juniper woodland	4.5				
COWP05	2	Scarlet oak dry forest	2				
COWP06	4	Loblolly pine plantation	0				
COWP07	2	Dry oak-hickory forest	0				
COWP09	2	Successional bottomland	0.5				
COWP10	2	Successional forest with dense Smilax understory	2.5	+			
COWP11	4	Old field	0.75				
COWP12	4	Successional old field	0				

Table 8. Con't.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO	LACI	PISU
COWP15	4	Oak-pine forest	0				
COWP16	4	Oak savanna	0				
COWP17	2	Mesic hardwood (white oak, yellow poplar, sweetgum)	0				

Table 9. Mist net sites, site descriptions, and number of bats captured at each site at Guilford Courthouse National Military Park, July 2006. Site numbers correspond to numbers on map (Fig. 3).

Site	Site #	Dates Surveyed	Habitat Type and Description of Survey Location	EPFU	LABO	NYHU	PISU
Tour Stop 6	N1	7/10/2006	Pine-hardwood forest	3			
Forest Lawn Cemetery	N2	7/10/2006	Pine-hardwood forest	7			
Old Garden Road	N3	7/11/2006	Pine-hardwood forest	11	1	1	
Forbis Monument	N4	7/11/2006	Pine-hardwood forest	9			1
Greene Monument	N5	7/12/2006	Pine-hardwood forest	2	1		1
Cavalry Monument	N6	7/12/2006	Pine-hardwood and open field	7	2	1	
Total				39	4	2	2

Table 10. Acoustic sampling sites, site descriptions, mean number of bat passes recorded at each point, and species detected at each sample point in GUCO with AnabatII bat detectors during July 2006.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO	LANO	NYHU	PISU
GUCO01	1	White oak forest	1					
GUCO02	1	White oak – post oak – red oak forest	2					
GUCO03	1	Successional yellow poplar forest	15					
GUCO04	1	Oak – hickory – pine forest	3					
GUCO05	1	Yellow poplar – shortleaf pine forest	0					
GUCO06	1	Grassy field	209	+	+	+	+	+
GUCO07	2	Bottomland yellow poplar/shrubland	441.5	+	+	+	+	+
GUCO08	2	Old successional yellow poplar, red maple, oak forest	0					
GUCO09&12	1	Yellow poplar bottomland/beech slope	5.0					
GUCO11	2	Loblolly pine/sweetgum forest	0					
GUCO13	1	Wisteria hole	134	+				
GUCO14	1	White oak stand	76		+			+

Table 10. Con’t

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO	LANO	NYHU	PISU
GUCO15	1	Yellow poplar bottomland	187		+			+
GUCO16	2	Successional Virginia pine stand	0					

Table 11. Acoustic sampling sites, site descriptions, mean number of bat passes recorded at each point, and species detected at each sample point in GUCO with AnabatII bat detectors during April 2007.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO	LANO	NYHU	PISU
GUCO01	1	White oak forest	21					
GUCO02	1	White oak – post oak – red oak forest	0					
GUCO03	1	Successional yellow poplar forest	65	+				
GUCO04	1	Oak – hickory – pine forest	56		+			
GUCO05	1	Yellow poplar – shortleaf pine forest	14					
GUCO06	1	Grassy field	0					
GUCO07	1	Bottomland yellow poplar/shrubland	337	+	+		+	+
GUCO08	2	Old successional yellow poplar, red maple, oak forest	201	+	+		+	+
GUCO09&12	1	Yellow poplar bottomland/beech slope	49		+			
GUCO10	1	White oak- hickory forest	144		+			
GUCO11	2	Loblolly pine/sweetgum forest	31		+			
GUCO13	1	Wisteria hole	306	+	+	+	+	+

Table 11. Con't

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO	LANO	NYHU	PISU
GUCO14	1	White oak stand	19					
GUCO15	1	Yellow poplar bottomland	122		+			+
GUCO16	2	Successional Virginia pine stand	26					
GUCO House	254	Open field	251	+	+	+	+	+

Table 12. Mist net sites, site descriptions, and number of bats captured at each site at Kings Mountain National Military Park, July 2005 and June 2006. Site numbers correspond to numbers on map (Fig. 4).

Site	Site #	Dates Surveyed	Habitat Type and Description of Survey Location	EPFU	LABO	PISU
Crossroads at water treatment plant	N1	7/14/2005	Oak-hickory forest		1	
Shebyville fire road	N2	7/26/2005	Oak-hickory forest	1	1	
Stone House Site	N3	7/25/2005 6/29/2006	Oak-hickory forest	1		
South Fire Road	N4	7/27/2005 6/28/2006	Oak-hickory forest	2	1	1
Total				4	3	1

Table 13. Acoustic sampling sites, site descriptions, mean number of bat passes recorded at each point, and species detected at each sample point in KIMO with AnabatII bat detectors during July 2006.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO	PISU
KIMO01	3	Xeric chestnut oak forest	10.3		+	+
KIMO02	1	Submesic mixed hardwood forest	0			
KIMO03	1	Sweetgum, yellow poplar riparian forest	7			
KIMO04	2	Mixed dry-mesic hardwoods	3			
KIMO05	1	Submesic oak-hickory forest	0			
KIMO06	1	Shortleaf pine-white oak forest	0			
KIMO07	1	Blackjack oak woodland	3			
KIMO08	1	Dry chestnut oak forest	0			
KIMO09	1	Southern red-shortleaf pine forest	0			
KIMO10	1	Chestnut oak-scarlet oak-shortleaf pine	0			
KIMO11	1	White oak-chestnut oak-hickory forest	1			
KIMO12	1	Shortleaf pine forest	0			

Table 13. Con't.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO	PISU
KIMO13	1	Dry scarlet oak-black oak forest	0			
KIMO14	1	Dry mixed oak forest	0			
KIMO15	1	Shortleaf pine-white oak-southern red oak	3			
KIMO16	2	Blackjack oak woodland	64.5	+	+	+
KIMO17	3	Yellow poplar-red mulberry walnut bottomland	0			
KIMO18	4	Red oak-yellow poplar-umbrella magnolia forest	22.5		+	+
KIMO19	3	Submesic oak-shortleaf pine forest	0.67			
KIMO20	1	Blackberry-smilax shrubland	0			
KIMO21	1	Chestnut oak-scarlet oak-mountain laurel	0			

Table 14. Acoustic sampling sites, site descriptions, mean number of bat passes recorded at each point, and species detected at each sample point in KIMO with AnabatII bat detectors during February 2007.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO	LACI
KIMO06	2	Shortleaf pine-white oak forest	3			
KIMO07	2	Blackjack oak woodland	14	+	+	+
KIMO10	2	Chestnut oak-scarlet oak-shortleaf pine	11		+	
KIMO11	2	White oak-chestnut oak-hickory forest	2			
KIMO12	2	Shortleaf pine forest	0			
KIMO13	2	Dry scarlet oak-black oak forest	0			
KIMO20	2	Blackberry-smilax shrubland	39.5	+	+	+

Table 15. Mist net sites, site descriptions, and number of bats captured at each site at Ninety Six National Historic Site, May and June 2005 and April 2007. Site numbers correspond to numbers on map (Fig. 5).

Site	Site #	Dates Surveyed	Habitat Type and Description of Survey Location	EPFU	LABO	LASE	NYHU
Charleston Road	1	5/24/2005	Open oak woodland	3	1		2
Crossroads Bumblebee hill/pond road	2	5/25/2005	Mixed oak-pine	4	2		
Star Fort Lake North	3	5/26/2005	Bottomland Hardwood				3
Star Fort Lake South Shore	4	6/06/2005 4/17/2007	Oak-pine forest		1	1	1
Gouedy Complex/Charleston Rd	5	6/07/2005	Oak-hickory forest				1
Little Pond	6	4/18/2007	Bottomland hardwood				
Total				7	4	1	7

Table 16. Acoustic sampling sites, site descriptions, mean number of bat passes recorded at each point, and species detected at each sample point in NISI with AnabatII bat detectors during May and June 2005. It is not possible to distinguish calls of red bats (LABO) and Seminole bats (LASE), thus they are combined.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO/ LASE	NYHU	PISU
NISI01	2	Green ash-box elder bottom	124	+	+		+
NISI02	1	Young oak-hickory-pine stand	1				
NISI03	1	Old field	24	+	+		
NISI04	1	Water oak forest	47		+		
NISI05	1	Successional loblolly pine stand	0				
NISI06	1	Successional loblolly pine stand	5				
NISI07	1	Bottomland oak forest	13				
NISI08	1	Loblolly pine stand	9				
NISI09	1	Old field	10		+		
NISI10	1	Successional loblolly pine stand	2				
NISI11	1	Yellow poplar-white oak bluff	3				
NISI12	1	Red oak-white oak-Florida maple	8		+		

Table 16. Con't

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO/ LASE	NYHU	PISU
NISI13	1	Sweetgum-red maple successional bottom and slope	130	+	+		+
NISI14	1	Green ash-box elder	0				
NISI15	1	Successional black walnut forest	11		+		

Table 17. Acoustic sampling sites, site descriptions, mean number of bat passes recorded at each point, and species detected at each sample point in NISI with AnabatII bat detectors during March and April 2007. It is not possible to distinguish calls of red bats (LABO) and Seminole bats (LASE), thus they are combined.

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO/ LASE	LACI	NYHU	PISU
NISI02	2	Young oak-hickory-pine stand	3					
NISI03	2	Old field	86.5	+	+	+		
NISI04	2	Water oak forest	8					
NISI05	2	Successional loblolly pine stand	2					
NISI06	2	Successional loblolly pine stand	0					
NISI08	2	Loblolly pine stand	22.5					
NISI09	2	Old field	130.5	+	+		+	+
NISI10	2	Successional loblolly pine stand	0.5					
NISI11	2	Yellow poplar-white oak bluff	9	+	+		+	
NISI13	1	Sweetgum-red maple successional bottom and slope	15.5		+		+	
NISI14	2	Green ash-box elder	342.5	+				

Table 17. Con't

Site	Nights Sampled	Habitat Type	Mean Bat Passes/Night	EPFU	LABO/ LASE	LACI	NYHU	PISU
Little Pond	3	Hardwood bottomland	140.3	+	+		+	
Service Rd 1	1	Pine-hardwood forest	0					
Service Rd 2	1	Pine-hardwood/small opening	197	+	+		+	
Star Fort Lake	1	Lakeside/grassy area	741	+	+	+		+

Table 18. Number and percent of species documented on each park during summer and winter surveys 2005 – 2007.

	CARL	COWP	GUCO	KIMO	NISI
Expected Species Documented	5 (100%)	3 (75%)	4 (80%)	3 (75%)	5 (100%)
Possible Species Documented	3 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Winter Migrants Documented	0 (0%)	1 (50%)	1 (50%)	1 (50%)	1 (50%)

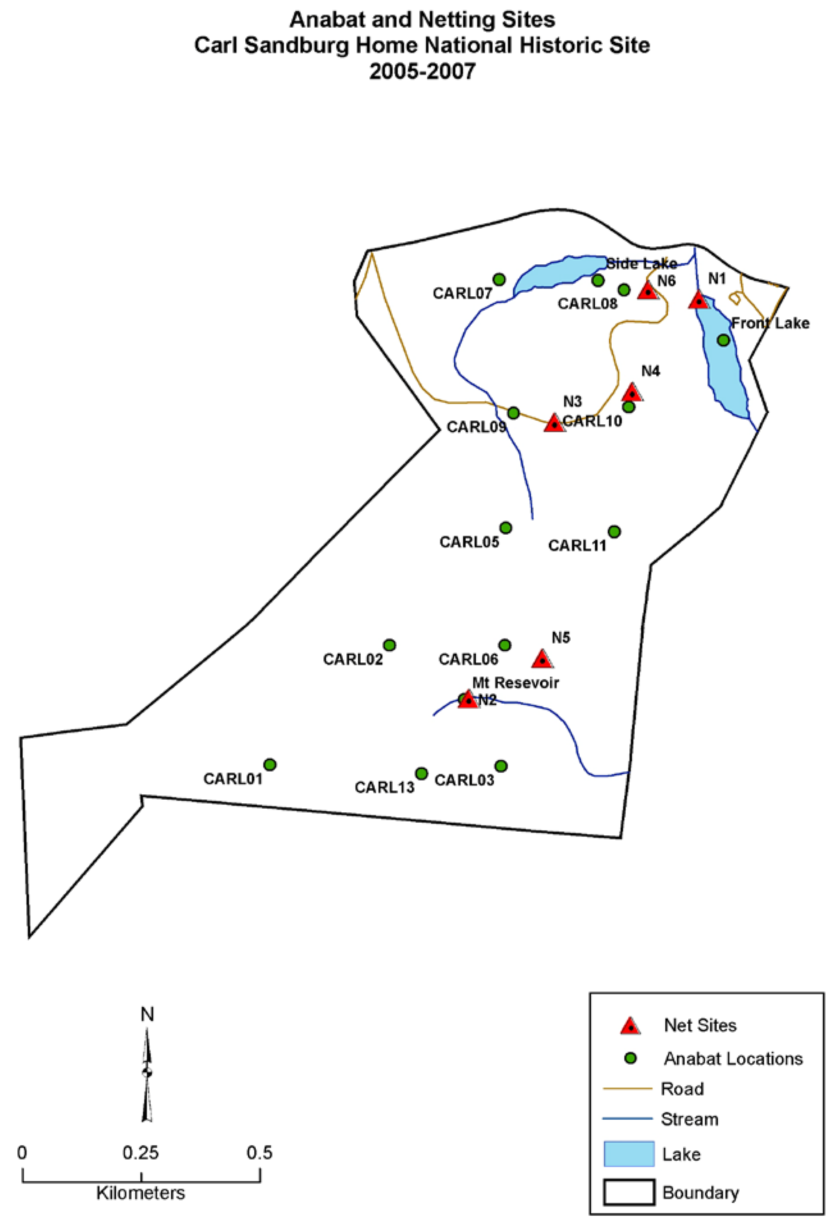

Fig. 1. Bat survey points on Carl Sandburg Home National Historic Site. See Tables 3, 4, and 5 for descriptions of each site.

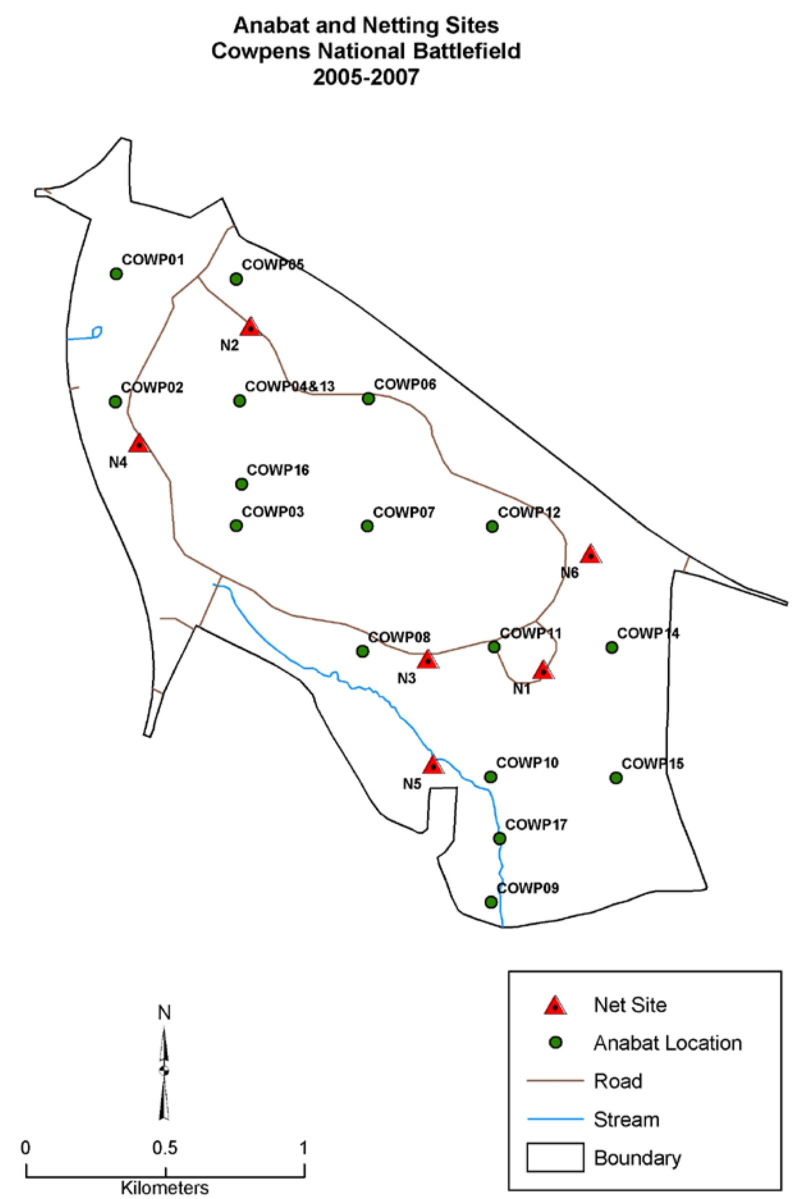

Fig. 2. Bat survey points in Cowpens National Battlefield. See Tables 6 and 7 for site descriptions

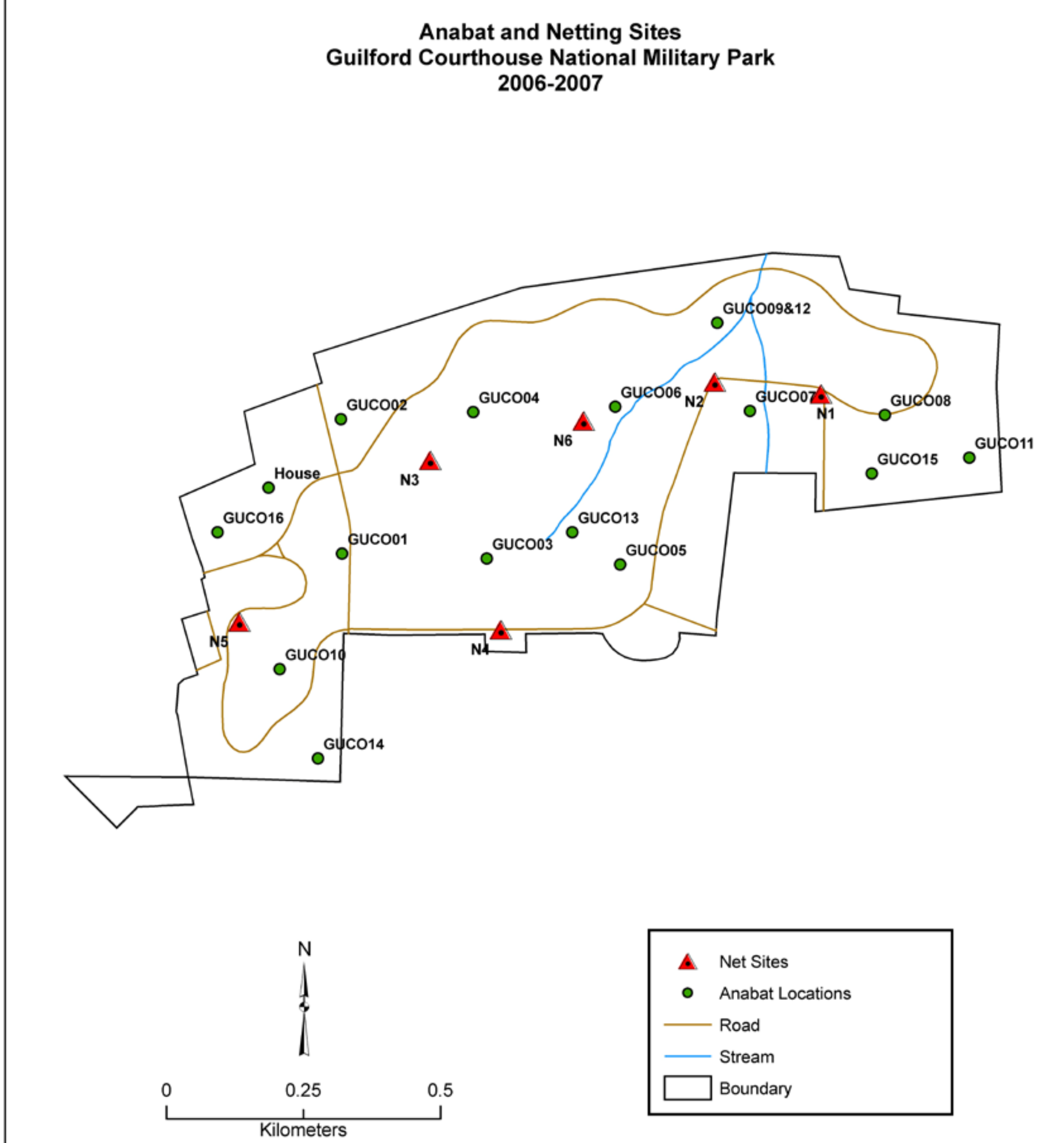

Fig. 3. Bat survey points on Guilford Courthouse National Military Park. See Tables 9, 10, and 11 for site descriptions.

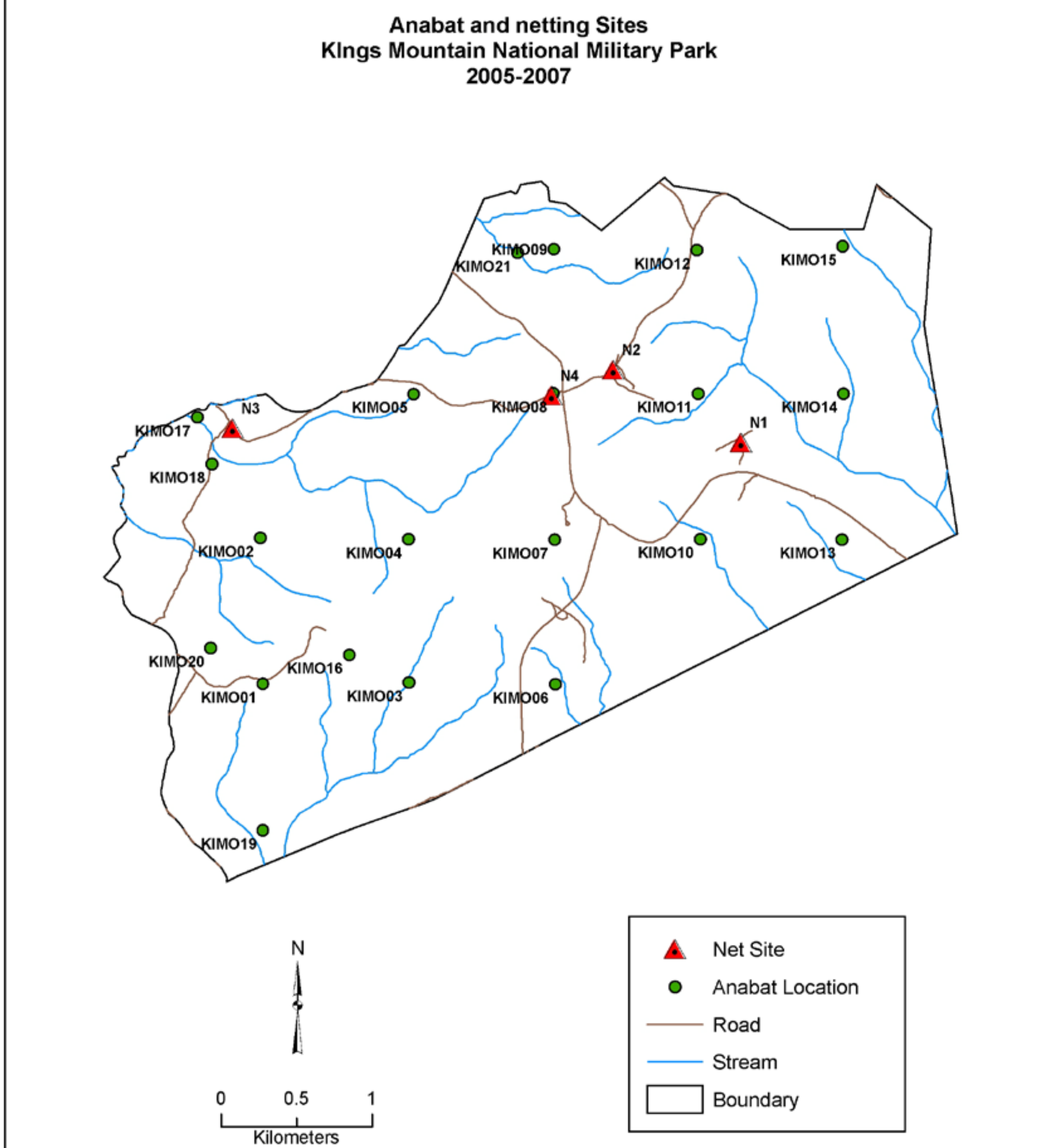

Fig. 4. Bat survey points on Kings Mountain National Military Park. See Tables 12 and 13 for a description of each site.

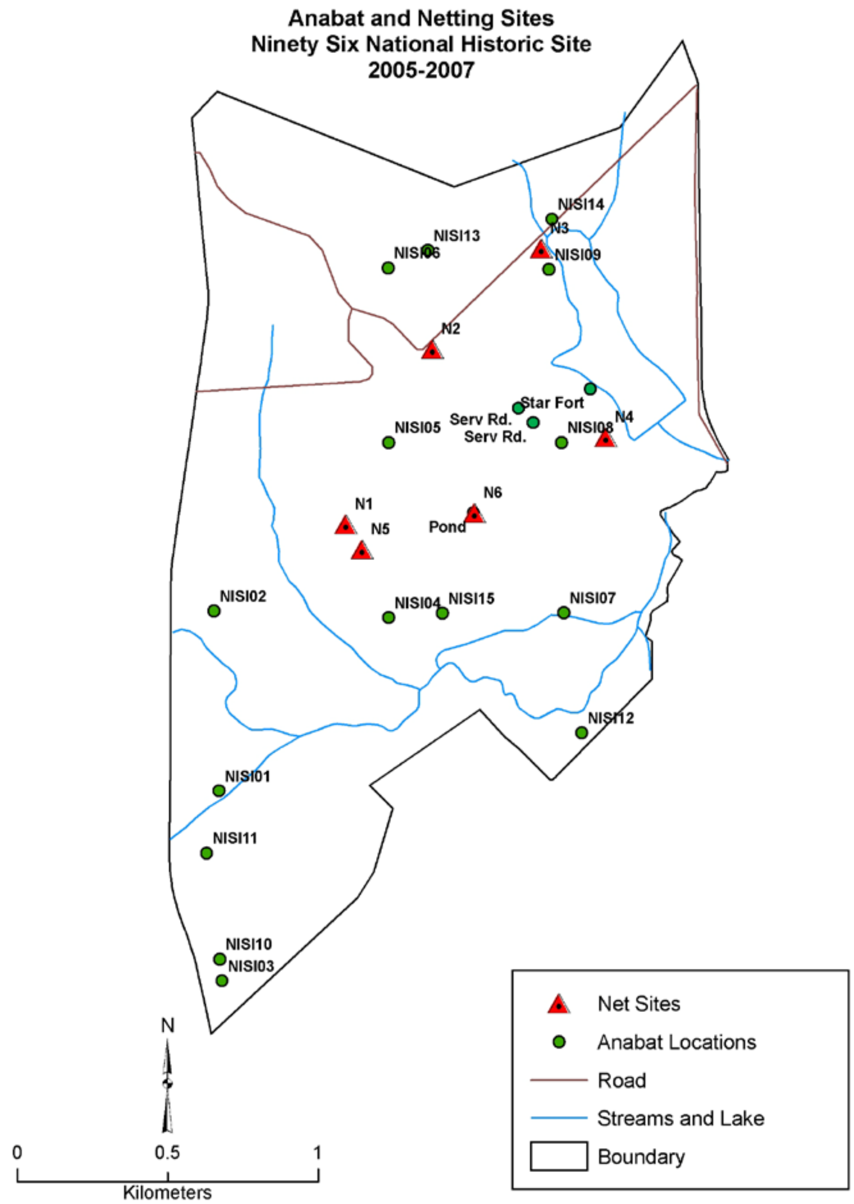

Fig. 5. Bat survey points in Ninety Six National Historic Site. See Tables 15, 16, and 17 for site descriptions.

Appendix 1. Date of capture, location, common name, and band number of bats in photos on CD.

Park	PhotoId	Date	Location	Species/Band No.
CARL				
	EPFU_1	6/20/2006	Front Lake	Big brown bat (0649)
	MYLE_1	6/21/2006	Five Points	Small-footed bat (0636)
	MYLE_2	6/21/2006	Five Points	Small-footed bat (0636)
	MYLU_1	6/20/2006	Front Lake	Little brown bat (0645)
	MYLU_2	6/20/2006	Front Lake	Little brown bat (0645)
	MYLU_3	6/20/2006	Front Lake	Little brown bat (0644)
	MYSE_1	6/21/2006	Five Points	Northern long-eared bat (0637)
	MYSE_2	6/22/2006	Historic Entrance	Northern long-eared bat (0858)
	NYHU_1	6/22/2006	Historic Entrance	Evening bat (0633)
GUCO				
	EPFU_1	7/10/2006	Forest Lawn Cemetary	Big brown bat (1449)
	EPFU_2	7/11/2006	Forbis Monument	Big brown bat (1441)
	EPFU_3	7/11/2006	Forbis Monument	Big brown bat (1441)
	EPFU_4	7/11/2006	Forbis Monument	Big brown bat (1441)
	LABO_1	7/11/2006	Old Garden Road	Red bat (1455)
	LABO_2	7/11/2006	Old Garden Road	Red bat (1455)
	LABO_3	7/11/2006	Old Garden Road	Red bat (1455)
	LABO_4	7/12/2006	Cavalry Monument	Red bat (1432)
	NYHU_1	7/112006	Old Garden Road	Evening bat (1454)
	NYHU_2	7/112006	Old Garden Road	Evening bat (1454)
	NYHU_3	7/12/2006	Cavalry Monument	Evening bat (1431)
	PISU_1	7/11/2006	Forbis Monument	Eastern pipistrelle (1440)
KIMO				
	EPFU_1	6/28/2006	South Fire Road	Big brown bat (0631)
	EFPU_2	6/29/2006	Stone House Site	Big brown bat (0629)
	EPFU_3	7/27/2005	South Fire Road	Big brown bat (0877)
	LABO_1	6/28/2006	South Fire Road	Red bat (0632)
	LABO_2	6/28/2006	South Fire Road	Red bat (0632)
	PISU_1	6/28/2006	South Fire Road	Eastern pipistrelle (0630)
NISI				
	EPFU_1	5/24/2005	Charleston Road	Big brown bat (0852)
	LABO_1	4/17/2007	Star Fort Lake So. Shore	Red bat (1501)
	LASE_1	4/17/2007	Star Fort Lake So. Shore	Seminole bat (1502)
	LASE_2	4/17/2007	Star Fort Lake So. Shore	Seminole bat (1502)
	NYHU_1	4/17/2007	Star Fort Lake So. Shore	Evening bat (1503)