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Inventory of Bat Community Composition at Valley Forge National Historical Park

Technical Report NPS/NER/NRTR--2006/055



ON THE COVER

Photographs of a northern long-eared bat (*Myotis septentrionalis*) and a eastern red bat (*Lasiurus borealis*) caught at Valley Forge National Historic Site during the 2004-2005 bat inventory.

Photographs by: James A. Hart.

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U.S. Department of the Interior
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Abstract and Keywords

During 2005, mist-netting surveys were conducted in the Valley Forge National Historical Park (NHP) to predict and detect bat communities. Five sites were mist-netted for bats during 10 nights for a total of 45 netnights (the total number of nets set up multiplied by the total number of nights) resulting in an average capture of 0.7 bats per netnight. A total of 32 bats comprised of four species were captured, including 23 little brown bats (*Myotis lucifugus* [21 females and two males]); five big brown bats (*Eptesicus fuscus* [four males and one female]); one male red bat (*Lasiurus borealis*), and three northern long-eared bats (*Myotis septentrionalis* [two females and one male]). No federally listed species were captured, although the northern long-eared bat is presently considered to be vulnerable in Pennsylvania and the northeast region of the United States. Although all sites were set up along likely travel and foraging corridors, those sites where canopy closure and bank vegetation was greatest, including sites along Valley Creek, produced the most bats and the greatest diversity of species. Possible maternity colony sites in barns and outbuildings were also investigated through visual inspection. Although there were reports of solitary bats being excluded from several structures, only the Knox-Tindle Farmhouse had what appeared to be historic evidence of a permanent colony. Presently, this colony seems to have disappeared, possibly due to disturbance during renovation of the top floor and attic area of the house.

Recommendations for future research include conducting spring and fall surveys for silver-haired bats (*Lasionycteris noctivagans*) to ascertain whether this species uses parts of the park as “temporary stopover” sites, and conducting more intensive surveys for use of forests by tree bats including red and hoary (*L. cinereus*) bats. The proposed focus on silver-haired bats stems from the number of historic records accumulated within the southeastern portion of Pennsylvania and the lack of evidence that this species presently occurs at Valley Forge.

Determining habitat appropriateness for the northern long-eared bat, as well as searching and managing for any newly discovered maternity colonies of any and all species, should also be a focus for future surveys. Subsequent research could also look at impacts of severe deer browse on habitat quality for Chiropteran communities. This research could be used to create a management plan that ensures that adequate habitat remains for the occurring bat community and that both species diversity and population viability remain stable. Artificial habitat in the form of bat boxes and possibly a bat “condo” could also be set up to sustain the present populations.

Keywords: NPS, inventory, monitoring, bats, *Myotis lucifugus*, *M. septentrionalis*, *Eptesicus fuscus*, *Lasiurus borealis*, Valley Forge National Historical Park, endangered, conservation

Summary

Although the fauna of Pennsylvania has been studied extensively across much of the state it has only recently been investigated in NPS properties such as the Valley Forge National Historical Park (NHP). This study was initiated to predict and determine the bat communities within the park unit and to generate recommendations that would ensure that adequate habitat exists for these species. To that end, five sites were surveyed over the course of 10 nights for a total of 45 netnights, and resulted in the capture of 32 bats of four species. The most common species captured included the little brown (*Myotis lucifugus*) and big brown (*Eptesicus fuscus*) bats, comprising 87.5% of all bats captured and released. Three northern long-eared bats (*M. septentrionalis*) were captured. The occurrence of the northern long-eared bat at Valley Forge NHP may indicate that the habitat within the park supports a stable population of this species, although no known maternity colonies were found.

Recommendations for continued research include more surveys to assess use of forests by tree species such as the red (*Lasiurus borealis*) and hoary (*L. cinereus*) bats, spring and fall mist-netting for the silver-haired bat (*Lasionycteris noctivagans*), and continued monitoring of possible maternity sites. Recommendations also include the creation of artificial roost sites for bats.

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Introduction

Background and Rationale

During the early 1970s, Charles Mohr reported that bat species across the United States appeared to be in a serious decline (Mohr 1972). Although that study focused primarily on those species found hibernating in caves, mines, tunnels, and other underground sites, the article signaled an awareness that all bat species were most likely at risk due to a variety of factors, including habitat loss, disturbance to hibernacula and other winter sites, and loss of summer roosting sites. A concerted effort was begun throughout the United States to assess bat populations through visual inspection of winter hibernacula, as well as examinations of buildings for indications of use by maternity colonies (O'Shea and Bogan 2003). In Pennsylvania, surveys took the form of mid-winter bat hibernacula surveys conducted by Pennsylvania Game Commission personnel, and summer concentration counts primarily conducted by volunteers (Pennsylvania Game Commission 1984-present).

During the summer of 1999, the federally endangered Indiana bat (*Myotis sodalis*) was found roosting in an old church in Blair County, Pennsylvania, along with over 20,000 little brown bats (*Myotis lucifugus*) (Butchkoski and Hassinger 2001). Although Cheng (2003) reported the discovery of Indiana bats using an historical barn in Iowa, the detection of the colony in Blair County indicated a need to survey for alternative summer roosting sites in the northeastern portion of the United States where known Indiana bat maternity sites normally occur in more traditional natural settings. Mist-netting surveys, across the state, and radio-tracking of banded Indiana and little brown bats were begun in order to determine the habitats used by this species and other summer resident bat species. Although the majority of these surveys and studies were conducted on private and state-owned property, comparative effort did not occur until relatively recently on property owned by federal agencies such as the National Park Service, although several intensive studies were conducted in the Allegheny National Forest (Sanders Environmental, Inc. 2005; USDA-FS 2005).

Inventorying and monitoring programs and surveys are currently underway or have been completed at many Department of the Interior properties (including the Valley Forge National Historical Park) directed at either assessing small mammal communities (Yahner et al. 1997) or establishing terrestrial vertebrate survey protocols (Yahner et al. 1994). Other recent research includes a reptile and amphibian inventory (Tiebout 2003) and a bird communities inventory (Yahner et al. 2001). Yahner et al. (2005) surveyed mammal communities at Valley Forge NHP, but did not attempt to survey bat species occurrence due to the intensive nature of conducting these types of surveys and the need for specially trained personnel. Prior to the present study there has been no research on Chiropteran communities at Valley Forge NHP. This study was initiated to assess bat species occurrence within Valley Forge NHP but not to establish population numbers.

Predicted Species Occurrence

Eleven species of bats have been reported historically from Pennsylvania (Merritt 1987). Of these, the Seminole bat (*Lasiurus seminolis*) is considered an "accidental," most likely having

entered the state from farther south during periods of stormy weather (Doutt et al. 1977). There are currently only a few historic records of this species from the southeastern portion of the state (Roberts and Early 1952). Poole (1932) reported on a capture of this species by Wishnieski during surveys conducted at the Hopewell Dam (Berks County) in 1931. No current records exist for the Seminole bat in Pennsylvania. Another species, the silver-haired bat (*Lasionycteris noctivagans*) is considered a “migratory” species, only occurring within the state during its migration to and from Canada and the New England states (Whitaker and Hamilton 1998). Although there are several current records from the interior portion of Pennsylvania (Kirkland and Hart 1999; C. Butchkoski, unpublished data, Pennsylvania Game Commission), all of these are during the migratory period and it remains unknown whether this species breeds in Pennsylvania or is resident during the summer months. Historical records from the southeastern portion of Pennsylvania are reported by Poole (1932) and Roberts and Early (1952) from the vicinity of Hopewell Furnace National Historic Site in Berks and Chester counties. The evening bat (*Nycticeius humeralis*) has been reported from the southwestern (Grimm and Roberts 1950) and the southeastern (Rhoads 1903) portions of Pennsylvania, but there are no recent records for this species and it is believed to have been extirpated from Pennsylvania (Genoways and Brenner 1985).

The remaining eight species have all been recently reported from many portions of Pennsylvania and include the little brown bat, northern long-eared bat (*M. septentrionalis*), eastern small-footed bat (*M. leibii*), Indiana bat, big brown bat (*Eptesicus fuscus*), eastern pipistrelle (*Pipistrellus subflavus*), eastern red bat (*Lasiurus borealis*), and hoary bat (*L. cinereus*). Of these eight species, it is unlikely that the Indiana bat would form summer colonies within Valley Forge NHP, due to an appreciable lack of adequate forest roosting habitat and large blocks of unaltered floodplain foraging habitat; although there is the possibility that migrating individuals may show up during spring or fall. Recently, Veilleux (2005) discovered that the small-footed bat forms maternity roost sites in rock outcrops. An appreciable lack of such habitat in and around Valley Forge NHP would most likely exclude the small-footed bat or limit populations to dispersing males and subadults in low numbers.

Historical Information

Other than what is noted under predicted species there is no recent information on the bat community of Valley Forge NHP. Natural Resource Management files include anecdotal reports of bats roosting in various houses in the park and in the breezeway between Washington’s Headquarters and the Bake House. Prior to this inventory only little brown and big brown bats had been reported at Valley Forge NHP; however, species identifications were unconfirmed because bats were not handled or closely examined.

Although Valley Forge NHP is not known for having any well known caves, there is some information on a cave located within the park boundaries. During cave surveys conducted on October 15, 1987 within Fowler Cave, a single bat (either a little brown or eastern pipistrelle) was noted (Murphy 1987). This is the only record of any hibernacula surveys done on park property, although there have been several done in an abandoned copper mine on the Audubon Sanctuary approximately 4 km (2.5 mi) to the northeast.

Although bats have suffered from an unjustified reputation because of a wealth of bad press, the truth is that Pennsylvania's bat fauna is wholly beneficial to agriculture as well as to visitors at Valley Forge NHP. Able to consume upwards of 30 percent of its body weight in small insects, a little brown bat can consume as many as 150 mosquitoes in less than 15 minutes (Fenton 1983; Tuttle 1988). It has been reported that large concentrations of bats are capable of controlling agricultural pests by consuming upwards of 250,000 lbs of insects in a single evening's foraging period (Tuttle 1988), as is the case at Bracken Cave, Texas. Although the species of bats found in Pennsylvania differ significantly from those occurring in Texas, they are still capable of having a substantially positive economic impact on agriculture, if conserved in sufficient numbers.

Study Area

General Description of Study Area

Valley Forge NHP lies along the Chester County and Montgomery County borders, about 20 km (12 mi) northwest of Philadelphia. Encompassing approximately 1,600 ha (3,900 ac), it is primarily drained by Schuylkill River and Valley Creek and is located in the Triassic Lowland Section of the Piedmont Province (Yahner et al. 2001).

Preliminary analysis of the landscape reveals that over 43% of the park consists of old fields and highly managed grasslands, 31% consists of forest, and less than 10% consists of some form of wetland or seasonally flooded habitat. The remainder is either in development or contained within the transportation corridor (Podniesinski et al. 2005).

Within much of the central portion of Valley Forge NHP the topography consists of gently rolling uplands and fields along with several low hills, with elevations ranging from under 20 m (65 ft) to over 150 m (492 ft). The highest point in the park is Mount Misery at 161 m (528 ft).

Yahner et al. (2001) noted that vegetation consisted primarily of early successional forests, floodplain forests, and mature forests with several small conifer plantations occurring in some areas. Some of the dominant components of the forests include red maple (*Acer rubrum*), box-elder (*Acer negundo*), tulip poplar (*Liriodendron tulipifera*), sycamore (*Platanus occidentalis*), chestnut oak (*Quercus prinus*), northern red oak (*Quercus rubra*), and sassafras (*Sassafras albidum*). Shrubs were predominantly poison ivy (*Toxicodendron radicans*), mapleleaf viburnum (*Viburnum acerifolium*), mountain laurel (*Kalmia latifolia*), greenbrier (*Smilax* sp.) and multiflora rose (*Rosa multiflora*). Comprehensive vegetation maps for Valley Forge NHP can be found in Podniesinski et al. (2005).

Mean rainfall is 117 cm (46 in) with a mean annual snowfall of 76 cm (30 in). Mean annual temperatures range from 0°C (32°F) in winter to 23°C (73°F) in summer with extremes of -27°C (-17°F) to 44°C (111°F) (Tiebout 2003).

One of the major impacts to habitats in and around Valley Forge NHP remains the significant white-tailed deer (*Odocoileus virginianus*) population. Lovallo and Tzilkowski (2003) estimated the deer population at 70 deer per km² (38/mi²); although current estimates are higher, at around 98 per km² (27/mi²). At present, it is unknown what impact large deer herds have on bats, but the effects on forest habitat is recognizable and these, in the long run, may affect both bat community structure and population densities.

Site Selection

Site selection was begun during late winter and early spring by reviewing ArcGIS layers, including the Mr. SID views, digital ortho-quarter quads (DOQQ), and relative vegetation layers as compiled by Pennsylvania Natural Heritage Program personnel (Podniesinski et al. 2005). This resulted in the description of several possible survey sites as depicted in Figure 1. Survey sites were then selected based on site visits and general guidelines established by Kunz and Kurta (1988). Mist-netting of bats is more productive when canopy closure is between 50–

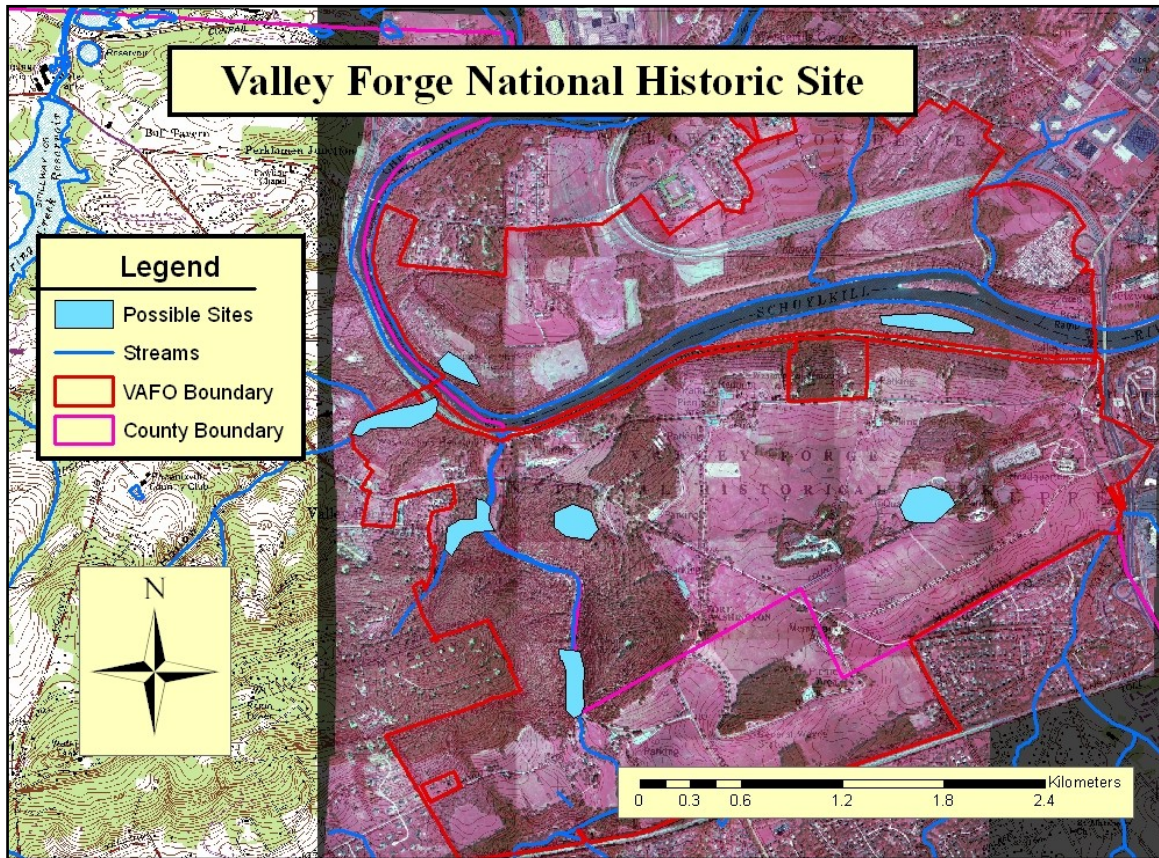


Figure 1. Potential sampling sites for the 2005 Valley Forge NHP bat inventory.

100%, shrub cover along the banks is appreciably thick, and there is some form of vegetative structure to the area where the net will be placed. This structure can take the form of either downed trees or tree limbs, or shrubs hanging over the stream and serving to break up the outline of the nets. Figure 2 shows an example of such a survey site along Valley Creek, Valley Forge NHP. There is greater than 60% canopy closure above the net and many branches hang down and serve to break up the net outlines. This site proved to be very successful during the first night of netting, but no bats were captured here during the second night. Upon completion of site visits several of the proposed sites were deemed not suitable due to either an appreciable lack of canopy or because access to the site would be problematic.

Sites were also selected where an elevated netting system could be used. In this case, canopy height was higher and more open than at sites using single high nets. Figure 3 is an unobstructed view of the elevated- or canopy-netting system, and is intended as an illustrative example of the placement of the system. Upon completion of site inspections five sites were selected for sampling. Table 1 lists the sampling locations along with general habitat and stream descriptions. This information can be accessed in an accompanying database, as mentioned under the Methods section of the report.



Figure 2. An example of a site along Valley Creek, Valley Forge NHP, where mist nets were placed. The canopy closure for this site is approximately 40-60% and tree limbs overhang the net system and serve to funnel bats into the nets.



Figure 3. Example of a 9 m high elevated/canopy system erected with three 6 m wide nets attached. This is similar to how the system was set up at a predetermined mist-netting site.

Table 1. Habitat and stream descriptions for all sites surveyed at Valley Forge NHP during 2005 bat inventory.

Site Number	Lat/Long, Elevation	Cardinal Directions	Basic Habitat Description	Habitat Formation	Stream Description
VAFO_BATS_VAFO001 Valley Creek #1 (Lafayette's Quarters)	40-04-48.6/ 75-27-39.4 ele- 35 m	Chester Co., 3.6km N., 1.5km W., Berwyn	A moderate-sized stream approximately 9 m wide and up to 0.5 m deep. Vegetation bordering the stream is mostly successional with many invasive species, such as tree of heaven, tulip poplar, sycamore, box elder, ash, and black walnut, in overstory with mostly Japanese honeysuckle and box elder and saplings of the overstory trees in shrub cover.	I.B.2.N.a Lowland/ submontane cold- deciduous forest	The stream is a moderate sized stream with banks ranging from 0.25-1 m high and fairly steep. Banks are moderately eroded. Banks are mostly open with a sparse shrub cover. They range from gently sloping on the east bank to steep on the west bank.
VAFO_BATS_VAFO002 Valley Creek #2 (Knox's Quarters)	40-05-03.8/ 75-27-14.9 ele- 35 m	Chester Co., 4.1km N., 1.0km W., Berwyn	Partially forested riparian corridor running between two meadow/agricultural fields. The stream creates a "valley" between the fields. Sycamore, red maple, hickory, willow, box elder, and a few ash occur in the canopy with shrubs mostly composed of saplings of the overstory trees with some small willows.	I.B.2.N.d Temporary flooded cold-deciduous forest	Stream is around 9-10 m wide and flow is moderate. Prior to the netting period there had been short periods of rain that brought the stream up rapidly. Banks are steep and very slippery and covered with grasses and shrubs in most spots and heavily eroded in others.
VAFO_BATS_VAFO003 Valley Creek #3 (Washington's Headquarters at RR Bridge)	40-06-08.2/ 75-27-43.7 ele- 25 m	Chester Co., 6.0km N., 1.9km W., Berwyn.	A moderate-to-wide, rocky stream exiting from under a railroad underpass. To the south, Valley Creek is tree-lined and moderately quick flowing with heavily eroded banks. Sycamore, elm, and hickory are the dominants canopy trees. Some of the trees are very old, although sparsely situated. Shrub cover is mostly poison ivy and tree of heaven with saplings of the overstory trees.	I.B.2.N.a Lowland/Submontane cold-deciduous forest	A very rocky stream of moderate to great width. To the south of the bridge the stream is a mixture of tree-lined banks and open floodplain areas. Banks very steep to the south and flat where the stream exits from under the railroad bridge.
VAFO_BATS_VAFO004 Impoundment Basin Ponds	40-06-24.3/ 75-27-55.6 ele- 25 m	Montgomery Co., 1.8km S., 2.3km W., Wetherills Corners.	These are manmade retention ponds surrounded by a variety of wetland vegetation. Small woodlots and agricultural fields are interspersed amongst the various ponds which range from moderate in size to fairly large (approx. 1-2 ha). Eastern red cedar, sycamore, silver maple, black locust, crabapple, willow, and alder. Some <i>Cretagus</i> sp. also occur although not too much. Reeds, multi-flora rose, greenbrier, and saplings of overstory trees occur in the shrub layer.	I.B.2.N.e Seasonally flooded cold-deciduous forest	Ponds are around 20 m x 4 m wide with unconsolidated shorelines of mud and silt. All ponds lie in a mostly SE to NW direction with very little slope except to the north where small rises occur. There are no consolidated banks.
VAFO_BATS_VAFO005 Waggonseiler Farm	40-06-59.5/ 75-26-00.8 ele- 40 m	Montgomery Co., 0.8km S., 0.2km E., Wetherills Corners	This is an old farmstead with many buildings and scattered ornamental trees surrounded by an old nursery. Walnut, locust, cherry, tulip poplar, black and pin oak, red and silver maple, and a few scattered sweet gums, and many ornamentals are scattered throughout the area. A small drainage swale occurred to the south.	Nursery-Developed Developed land surrounded by old nursery site.	No stream present although a shallow drainage swale occurs to the south of the farmstead. A manmade pond occurs just to the east of the main house and is approximately 10-15 m in area.

Methods

USFWS Guidelines and Basic Netting Protocols

The United States Fish and Wildlife Service (USFWS 1999) created specific guidelines for the survey of Indiana bats (See Appendix A). Due to the nature of this particular survey, however, these guidelines were modified to suit a basic inventory of bat species occurrence.

Field sampling was conducted between July and September of 2005. Two to four ground net sets, as well as either stacked (two or more nets stacked one above the other) or elevated nets (extended poles with a pulley system as depicted in Figure 3), were employed in places where the canopy closure permitted set up of a higher system. The nets were 50 denier and ranged in size from 4–9 m (13–30 ft) in width. The nets were opened at dusk and closed no later than 2400 hrs. Each site was surveyed for two nights. Presence of bats was confirmed as either seen foraging in the vicinity of the netting site or heard on a Skye[®] (Skye Instruments Ltd.) bat detector. The nets were checked every 10 minutes or less, depending on the activity level of the bats and the number being captured. Bats were put into holding bags after being identified as to species, sex, age, and reproductive condition. Bats were held until the end of the evening to preclude the chances of being recaptured. Prior to release, all bats were measured and weighed.

Although this method of survey basically followed the accepted protocols used by the USFWS in surveying for the federally endangered Indiana bat, it differed somewhat in that mist netting was not extended past 2400 hrs. Also, it is unlikely that the Indiana bat occupies any permanent roosts during the summer due to a lack of available summer roosting habitat at Valley Forge NHP, as the forest is primarily early- to mid-successional with an open understory due to heavy and persistent browse by deer.

It should be noted that the use of an Anabat[®] (Titley Electronics) bat detecting system was not employed. The goal of this project was to provide an inventory of species occurring within the park. The Anabat[®] system is unable to differentiate between the *Myotis* species that occur in Pennsylvania without the creation of an extensive call database with which statistical comparisons can be made. Since the cost of the system and the creation of the call library would be prohibitive for this study, it was decided that traditional methods using mist nets would produce adequate results.

Data Acquisition and Recording

Habitat data, weather information, site location, and other pertinent information was recorded on standard forms created by the Wildlife Diversity Section of the PGC's Bureau of Wildlife Management. The survey sites were GPS'd with a Garmin GPS III+ to an estimated precision of 3–9 m and Positional Dilution Of Precision of 1.5–2.0. All GIS information was saved in UTM NAD 83, Zone 18. The nature of these surveys did not require any closer precision than mentioned, so acquired GPS points were not differentially corrected.

Individual bats were measured with digital calipers (Sylvac S.A., Switzerland) and data directly input into an Excel spreadsheet (Microsoft Corporation) using Gagewedge[®] (Fred V. Fowler Co., Inc.) software. Just prior to release, bats were weighed on an Ohaus[®] CS 200 scales (Ohaus

Corporation, NJ) and data was hand entered into the Excel spreadsheet. Figure 4 shows a researcher taking measurements with digital calipers. Other data entered included the species captured, age (classified as either juvenile or adult based upon presence of epiphyseal closure [Anthony 1988]), sex, and reproductive condition. Reproductive condition included either active or inactive males based on the condition of the epididymis, or pregnant, lactating, post-lactating, and inactive females. Voucher digital photographs were taken of any PA State Listed species. No federal species were captured.

Habitat information collected included stream width and depth in meters, percent canopy closure, condition of stream banks, percent shrub and ground cover, description of typical vegetation, and general descriptions of habitat within 100 m (328 ft) of site and that greater than 100 m (328 ft), if different (Table 1).

Database Creation

Data collected during the surveys was entered into the PGC's Bat Trapping and Netting Database. A copy of this database was created containing only the information gathered during the present survey and accompanies this report on Compact Disk. All information entered was submitted to the Wildlife Diversity Section, Bureau of Wildlife Management, PA Game Commission, for inclusion with the PGC database and as general information for the PGC Annual Report concerning bat surveys conducted in Pennsylvania (Pennsylvania Game Commission, 1984 to present).

A habitat profile database was created using Microsoft Access XP[®] (Microsoft Corporation). This database has descriptions of the habitat surveyed as well as fields containing information on several habitat variables, such as stream width, depth, canopy closure, and vegetation types. The database is set up to be linkable with the PGC database and includes descriptive photos of the sites surveyed.

Maternity Colony Investigations

Two species expected to occur in Valley Forge NHP, little brown and big brown bats, are known to form maternity colonies in buildings. These colonies can range in size from a couple dozen to well over 20,000 bats (Pennsylvania Game Commission 1984 to present). During the course of the present investigation, barns and outbuildings were to be checked for signs of use by bats. This sign normally takes the form of large guano deposits or bats are actually seen and counted during evening counts. While the occasional "wandering" bat has been reported from several of the buildings at Valley Forge NHP, only the Knox-Tindle Farmhouse was found to have evidence of a prior colony. As this was the only site where historic sign was noted and no recent colony is expected to occur in the future, temperatures were not recorded.



Figure 4. A researcher taking the measurement of the forearm of a big brown bat (*Eptesicus fuscus*) during inventories at Valley Forge NHP, 2005.

Results

Five sites were surveyed for bats during the project (Figure 5). The disposition of nets at each site are shown in Appendix B for future reference.

Over the course of ten nights of surveys, 45 “netnights” were accumulated. A “netnight” can be described as the total number of nets put up at a site multiplied by the number of nights the site was surveyed. Table 2 depicts the results of these surveys. A total of 32 bats of four species were captured for an average of 0.7 bats per netnight (0.02 bats/net-meter hour). Two of the five big brown bats were females; 21 of the 23 little brown bats were females; the one red bat was male; and two of the three northern long-eared bats were females. The occurrence of pregnant females (25 of 32 bats captured) would appear to indicate that maternity colonies may exist within Valley Forge NHP; although, to date, none have been located.

Several structures were investigated to determine whether maternity colonies existed in them. These included the Knox-Tindle Farmhouse and an historic root cellar structure by the Philander Chase Knox Hired Hands House. Although there was sign in the form of guano scattered in many spots on the outer portions of these buildings, it was most likely from bats during their temporary night roosting behavior. There were reports of a large colony using the attic portion of the Knox-Tindle Farmhouse (Figure 6), but an investigation determined that this colony was quite likely excluded during some renovations that took place within the previous five years. Several deposits of guano were found (Figure 7), but the amount did not signify that the colony was currently very large, nor were any bats spotted. There is a plan to put a new roof on the building within five years, at which time the eviction of the remaining bats and sealing of all entry points can occur. It was decided that, at this time, no management is necessary for the bats that may occur in the structure, as they are most likely solitary individuals, based on the amount of guano present, as seen in Figure 8.

The guano present was a mixture of pellets, ranging from very old to fresh based on appearance, scattered throughout the attic rather than in large, solitary piles which would generally signify the portions of the attic where clusters of bats would roost for long periods of time. It was also scattered over the blown insulation making an actual clean-up of the guano almost impossible. Due to renovations to several other barns and outbuildings, no investigations were conducted in them. The old, partially collapsed Walnut Hill Estate Barn by the impoundment basin ponds and the barn on the Waggonseiler Farm (also known as the Schwoebel Barn) could possibly house a large colony, although no bats were seen during short-term visual surveys.

The sites mist-netted for bats were mostly along Valley Creek, which ranged in width from 3–9 m (10–30 ft) with depths of from 0.5 m (1.6 ft) at the first site surveyed, Lafayette’s Quarters, to 2.5 m (8.2 ft) in the meadow between the Knox-Tindle property and the Philander Chase Knox property. Average canopy closure at the various netting sites ranged from around 50%, as with the impoundment basin ponds, to well over 80% at several sites on the Waggonseiler Farm. The only site where appreciable water, either a stream or pond, did not occur was at the Waggonseiler Farm. Information concerning the general habitat at each site can be found in Table 1.

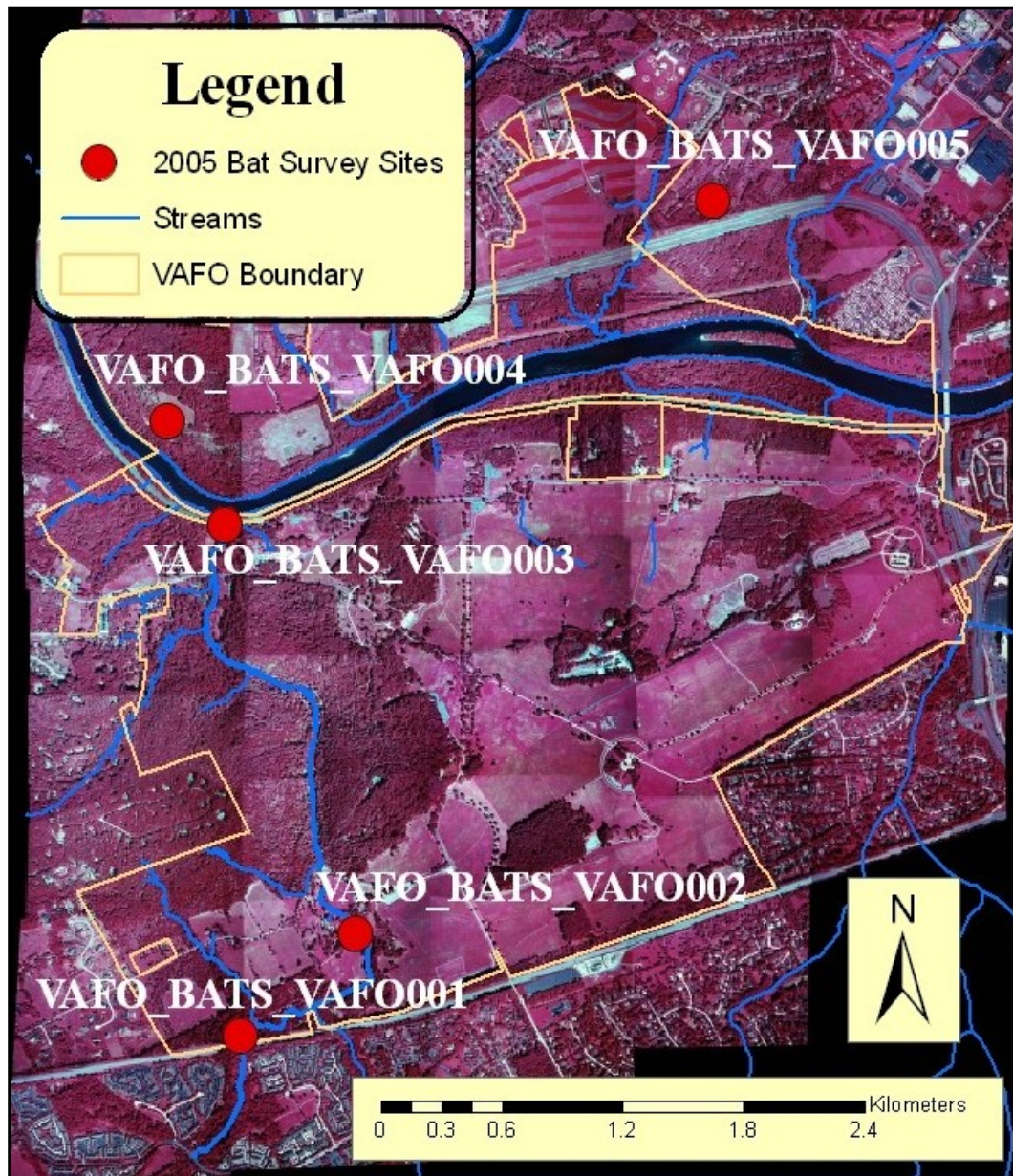


Figure 5. Location of mist-netting survey sites in Valley Forge NHP during the bat inventory of 2005.

Table 2. Results of mist-netting surveys at Valley Forge NHP during 2005.

Site Surveyed	Site #	Effort ¹	Date	Species Code ²								Total
				Labo		Mylu		Epfu		Myse		
				M	F	M	F	M	F	M	F	
Valley Creek #1 (Lafayette's Quarters)	VAFO01	121.5	5/11–5/12/2005			2	11	1	2		2	18
Valley Creek #2 (Knox's Quarters)	VAFO02	144.0	6/7–6/8/2005	1			10					11
Valley Creek #3 (Washington's Quarters at RR Bridge)	VAFO03	336.0	7/13–7/14/2005									0
Impoundment Basin Ponds	VAFO04	462.0	8/3–8/4/2005					1		1		2
Waggonseiler Farm	VAFO05	315.0	9/14–9/15/2005					1				1
Subtotals (by sex)				1		2	21	3	2	1	2	
Totals				1			23	5		3		32

¹Effort is reported as net-meter hours.

²Species Codes: Labo- *Lasiurus borealis*, Mylu- *Myotis lucifugus*, Epfu- *Eptesicus fuscus*, Myse- *M. septentrionalis*, M- Male, F- Female, Netnights are explained in the text.



Figure 6. The Knox Tindle Farmhouse, a site investigated for use as a nursery colony by bats.



Figure 7. Small guano piles found on boards in the Knox Tindle Farmhouse.



Figure 8. Small amounts of bat guano found on boards in Knox Tindle Farmhouse.

Descriptive statistics for all adult bats captured at Valley Forge NHP during the surveys conducted from May through September 2005 are in Table 3. Numbers denoted in **bold** are means that differ from those found in the literature. In all cases, these means were a bit lower than those found in the cited literature and may be accounted for by measurement error or by a lack of specimens, as in the case of the single specimen of the eastern red bat. In some cases, the means may be affected by geographical differences, but it is unknown just how much this may affect bat species at Valley Forge NHP, as the length of the project was not long enough to ascertain these differences. No measurements were included for those individuals that were seen to be either subadults or juveniles, as classified by visual inspection of the epiphysis of the wing.

Table 3. Descriptive statistics for all bat specimens captured during 2005 mist netting surveys at Valley Forge NHP.

Species	Stat	Hind Foot (mm)	Ear (from notch) (mm)	Forearm (mm)	Tragus (mm)	Weight (g)
<i>Myotis lucifugus</i> (n = 22)	Mean	6.18	11.94	37.61	6.05	8.52
	Medium	6.86	12.43	37.64	6.00	8.70
	Maximum	8.22	13.73	41.18	7.99	10.50
	Minimum	5.62	7.13	35.65	4.95	7.00
<i>Eptesicus fuscus</i> (n = 4)	Mean	7.84	13.01	45.82	7.22	15.78
	Medium	8.06	12.40	46.79	7.05	15.55
	Maximum	8.51	15.66	47.06	8.01	21.00
	Minimum	6.74	11.59	42.65	6.78	11.00
<i>Lasiurus borealis</i> (n = 1)	Mean	5.96	9.08	37.67	3.31	10.60
	Medium	5.96	9.08	37.67	3.31	10.60
	Maximum	5.96	9.08	37.67	3.31	10.60
	Minimum	5.96	9.08	37.67	3.31	10.60
<i>M. septentrionalis</i> (n = 2)	Mean	6.52	13.97	36.58	7.83	7.73
	Medium	6.43	13.45	37.03	7.86	8.40
	Maximum	6.85	15.05	37.46	8.26	8.60
	Minimum	6.27	13.41	35.02	7.37	8.20

Note: Mean measurements in bold differ from those means as listed in various publications, including Barbour and Davis 1969 (all species), Caceres and Barclay 2000, and Whitaker and Hamilton 1998 (*M. septentrionalis*), Fenton and Barclay 1980 (*Myotis lucifugus*), Kurta and Baker 1990 (*Eptesicus fuscus*), Shump and Shump 1982 (*Lasiurus borealis*).

Discussion

In a landscape where habitat is being lost at alarming rates everyday (Steiner et al. 2000) any protected setting that may serve as refugia for native wildlife should be comprehensively inventoried and a plan for monitoring of the results initiated. The NPS has been charged with “preserving, conserving, and managing natural resources in all of the national parks.” Although, in some cases, various species assemblages may be overlooked due to their secretive nature or the fact that basic inventories may be difficult and time consuming. Historically, National Park Service units in Pennsylvania have not garnered the attention that National Forest lands have when it comes to inventories of the faunas occurring on them. In order to meet the requirements of future wildlife conservation of both federal and state listed species of concern, inventorying and monitoring strategies have been or are being developed for all NPS Units, including the Valley Forge NHP.

During the period between May and September of 2005 mist-netting surveys were conducted along streams in the Valley Forge NHP. Although only 32 individuals of four species were captured, the results are encouraging, on the basis that most habitat within the Valley Forge NHP is highly disturbed and somewhat fragmented with a matrix of both small forested woodlots and moderate-sized expanses of grasslands. Although the park landscape may appear as a habitat island in a sea of inhospitable habitat due to the amount of development surrounding the park, it may serve as refugia for bats that occur throughout the southeastern portion of the state where urban development has restricted bats to isolated habitats such as Valley Forge NHP.

Of particular note is the fact that 25 of the 32 bats captured were females, and a significant portion of these were pregnant or were reproductively active to some degree. This would signify that both adequate roosting and foraging habitat occurs within or very near to the park; although, competition for these limited roosting and foraging resources may currently restrict growth of the present Chiropteran community and populations. Humphrey (1975) showed that habitat structure and roost site availability were important contributing factors to maintaining a diverse bat community, as well as sound populations. In the present study, snags, in the form of retained “century trees,” were noted in several portions of the park. While snags are very important to bats as summer roosting sites, they also serve as night roosting sites when bats are foraging and needing protected sites as temporary thermal-neutral roosts (Neuweiler 2000). In several portions of the eastern United States snags have been created by girdling unwanted tree species to provide both the necessary cavities as well as flaking bark for the formation of maternity and night roosts (Saugey 1991, Noteman 1998).

Another type of roost site lacking in the vicinity of Valley Forge NHP are winter hibernacula, although there are several caves known to occur on the park. The nearest known hibernacula of substantial size occurs approximately 50+ km (31 mi) to the northeast at Durham Mine in Bucks County, a site which contains over 8,000 bats of five species. As the distance between summer and winter habitat increases, populations have greater areas to disperse across, and populations found at sites like Valley Forge NHP remain comparatively low when compared to areas where winter hibernacula are nearby. The caves in the park, and other, smaller caves and a few mines occurring in fairly close proximity to the Valley Forge NHP, are not adequate as hibernacula due

to unstable temperatures or are so disturbed that bats are excluded from them (PGC Bat Hibernacula Survey Database, Wildlife Diversity Section, Bureau of Wildlife Management).

Yahner et al. (1994) based the prediction of occurrence of a bat species on range maps found in Burt and Grossenheider (1980), a relatively poor source for this type of information due to the scale of maps used and the out-of-date nature of the publication. More current and accurate sources for information are available, including Hall (1981), Kurta (1995), and Whitaker and Hamilton (1998).

Another factor determining predicted bat community structure in a given area is the availability of both foraging and roosting habitat (Findley 1993). Although the range of a species may extend into the study area, the lack of specific temporal roost sites (maternity roosts during summer for females, temporary night roosts used between feeding bouts, winter hibernacula, etc.) serves to restrict the number of species that may occur within a specific portion of the species predicted range.

In many instances, the community present at a specific point in time will be determined by a variety of factors, including temperature, prey availability, and overall habitat structure (Barclay 1985). Because of these factors, predicting the overall bat community expected to occur within Valley Forge NHP at any given point in time may be problematical. Although this may best be overcome by increasing the number of sites surveyed and spreading the survey of a single site over an extended seasonal timeframe, varying insect hatches offsite, temperature, wind speed, and many other factors may hinder the capture of rarer species.

As mentioned in the introduction, both the Seminole bat and the silver-haired bat have previously been taken in the vicinity of the Hopewell Dam. It is likely that the Seminole bat was an “accidental” that may have come onshore and inland after heavy storms during the 1930s. It has not been reported since. The silver-haired bat, however, has been taken in several portions of Pennsylvania including the south-central and southwestern regions (Kirkland and Hart 1999) and reportedly captured during surveys conducted by consultants in the northern regions as reported in the PGC’s Bat Trapping and Netting Database maintained by the Wildlife Diversity Section. All specimens of the silver-haired bat were taken during periods when this species is most likely to be migrating through Pennsylvania either to northern summer roosts or southern winter roosts. It is unlikely that either of these species will ever be found forming permanent roosts within Valley Forge NHP although surveys during fall migration should be conducted to determine whether the silver-haired bat still uses the area as a stopover site or as a migration corridor.

Two species that are not likely to occur are the small-footed bat, listed as threatened in Pennsylvania (Genoways and Brenner 1985), and the Indiana bat, listed as federally endangered. As mentioned previously, the roosting ecology of the small-footed bat is becoming a bit clearer, with the likelihood that they use rock outcrops to form nursery colonies (Veilleux 2005). Although it remains unknown where adult males spend the majority of their summer, there is some evidence that male small-footed bats may use a variety of roost sites, including tree cavities, rock outcrops, and buildings during portions of the summer (Best and Jennings 1997), but this information remains anecdotal at best. Preferred habitat for the small-footed bat at Valley Forge NHP is limited to some rock outcrops along the Schuylkill River? and along an old

quarry on County Line Road, north of the Valley Forge NHP Visitors Center Parking Lot. It is unlikely that this species would be an important component of the present Chiropteran fauna, as the few roosting sites are surrounded by either highly disturbed habitat or by open areas exposing foraging and dispersing bats to high predation rates.

Although the northern long-eared bat has been listed in Pennsylvania as “at risk” (Genoways and Brenner 1985) and most recently as “rare” (Kirkland and Krim 1990), recent information suggests that it is much more common than formerly believed. Although it has been suggested that this species be removed from the Pennsylvania “Species of Special Concern” list, as developed by the Mammal Technical Committee of the Pennsylvania Biological Survey, the decline of bat populations in general throughout the northeastern United States warrants continued protection.

The Indiana bat is not known to ever have occurred within the vicinity of Valley Forge NHP or within the southeast portion of Pennsylvania. This species needs very specific habitat for both summer maternity roosts and winter hibernacula, none of which currently occur within or around Valley Forge NHP. Forest age and type presently do not provide adequate roost sites for this species, while the nearest winter hibernacula lies over 150 km (93 mi) to the north in Luzerne County within a coal mine (PGC Bat Hibernacula Survey Database).

Of the species taken during the survey, the one that appears to be of the most interest is the northern long-eared bat. This species is currently listed as rare in Pennsylvania (Kirkland and Krim 1990). Two of the three specimens captured were pregnant females, suggesting that adequate habitat for this species does occur at Valley Forge NHP. Caceres and Barclay (2000) report that researchers have found this species to favor early to mid-successional forests, where large diameter trees may be in an early stage of decay, with a more open canopy. Portions of the forests within the park display these types of habitat characteristics to some degree. Caceres and Barclay (2000) also reported that, in some cases, females were found roosting in small groups in buildings. It is unknown whether any northern long-eared bats occur in any structures within the park, since not all were checked. The northern long-eared *Myotis* prefers to forage along open corridors where it can either hawk prey or glean it off of some form of substrate (Kirkland 1997), of which, many such corridors occur throughout the park. It is feasible that this species would benefit by the introduction of some artificial “rocket-type” roosting boxes (Burke 1999) within the forests so that competition with other bat species for limited roosting sites does not occur.

One species missing from the list of captured bats is the eastern pipistrelle. This species is widespread throughout much of Pennsylvania, but is less likely to be captured in mist nets than the species taken during this survey. Although Fujita and Kunz (1984) note that this species forms maternal colonies in buildings, none are known to occur in Pennsylvania except for a number very small colonies at several state parks located in forested areas (Pennsylvania Game Commission 1984–present), and the majority of these occur in small non-residential outbuildings. Although it remains unknown what the primary foraging habitat is for this species, it is most often caught over water in areas where canopy cover is fairly dense. It is a slow, fluttery flier and its ability to detect and maneuver around nets often precludes its capture (Barbour and Davis 1969). Several eastern pipistrelles, however, were captured in the Eisenhower National Historic Site during this project in mist nets set along Marsh Creek (Hart 2005). This was a very wide stream with a moderate canopy except in the area where this

species was captured, where overhanging branches and background shrubs served to break up the outline of the nets. Valley Forge NHP has similar habitat along much of Valley Creek where eastern pipistrelle could occur and further surveys would likely capture this species.

The remaining three species, eastern red bat, little brown bat, and big brown bat, are all species that have a widespread occurrence throughout Pennsylvania. During this entire project in Valley Forge NHP, Hopewell Furnace National Historic Site, Gettysburg National Military Park, and Eisenhower National Historic Site, these species accounted for over 85% of the bats captured. All of these species are listed as secure in Pennsylvania, but as with other species of bats, populations are believed to be depressed compared to likely historical numbers (Mohr 1972).

When comparing the sites investigated, Valley Creek produced the most bats and the highest diversity, with the site located at Washington's Quarters having no bat captures at all. It is likely that habitat structure along the upstream portions of the creek played a role in providing both foraging corridors and roosting sites within those areas. The canopy at both sites was moderately closed and full, and mid- to upper-canopy structure was diverse. Although shrub cover was low to moderate within the forest, along the streams it was appreciably higher. It is likely that some form of forest management at these sites, as well as other sites throughout the park, can improve habitat for bats over time as the forest matures.

Prey base for foraging bats is an item that was not studied in this present project. Relationships between the existing habitat and biomass of prey available to the present bat community may be a factor in limiting what bat species and populations exist within Valley Forge NHP over time. One question that remains unasked is, what impact do large deer populations have on insect prey populations and availability? It is likely that low ground and shrub cover limit both insect species diversity and biomass, and this, in turn, may limit the Chiropteran species community. Capture rates may be affected appreciably by bats searching for viable foraging areas that lie off of the project site. Long-term, quantifiable studies comparing changes in deer population size to insect biomass using off-park control sites may serve to explain possible differences in bat community structure and numbers within Valley Forge NHP and produce a better understanding of how to provide adequate habitat for bat communities in southeastern Pennsylvania. Studies that incorporate measures of insect availability, deer herd size, changes in vegetation, and long-term monitoring of bat populations and communities need to be designed to further understand the ecology of the bats that occur at Valley Forge NHP.

It should be noted that several areas remain unsurveyed. These areas lie mostly in parts of the park that are inaccessible due to hazardous conditions created by historic asbestos dumping. Of these areas, however, it is unlikely that the community differs substantially from what was found during this project.

Conclusions

It is likely that the limiting cause for the low capture rates and diversity at Valley Forge NHP is a combination of factors; limited roost site availability and habitat disturbance both from natural (overbrowse by deer) and manmade (heavy visitation and habitat alteration) origins. Both of these will be very hard to manage, given the historical significance of the park and its nearness to urban/suburban areas. Management options are available to park managers that could promote both natural and artificial roost sites and can be initiated in areas not heavily visited by the public.

The open fields along Valley Creek just east of Lafayette's Quarters provide the space needed to erect a "bat condo" (such as that shown in Appendix C). These "condos" have been set up at several sites throughout Pennsylvania and provide maternity housing for over 2,000 bats, including both big brown and little brown bats. They have also served as points of educational interest and have garnered support from the public as awareness of bat conservation increases. Also in the forests surrounding these out-of-the-way sites, large unwanted trees could be girdled so that, as they die they provide roosting space as bark separates from the tree and cavities form.

Another form of artificial roosting habitat is the "rocket box" (Burke 1999); these are narrow, deep boxes set on 3–4 m (10–13 ft) poles amid forested patches of the landscape. These boxes can serve as maternal roosting sites for northern long-eared bats, as well as night roosts for bats during dispersal or while they are foraging.

Basic artificial bat boxes like those designed by the PGC can be set up on various barns in the appropriate manner and painted to be unobtrusive to the cultural landscape and historical integrity of the structures. These boxes are extremely successful when placed properly and can house between 500–1,000 bats, including the northern long-eared, little brown, and big brown bats. These boxes may also serve as habitat for the eastern pipistrelle.

Management Recommendations

Enhance roost site availability within the various forest tracts of Valley Forge NHP. This can include both the creation of natural and manmade roost sites, as well as the girdling of unwanted trees during thinning processes.

Build artificial bat roosts. A “bat condo” such as the one in Appendix C could be built to hold a population in excess of 1,500 bats, including both little and big brown bats. Other types of artificial habitat, such as smaller bat boxes and “rocket boxes,” could also be used within forested areas.

Install conventional bat boxes built to Bat Conservation International, Inc. and PGC standards on any structure that exhibits usage by bats, both past and present. These boxes can be painted in such a manner as to be unobtrusive to the cultural landscape and have a negligible impact on the historical integrity of the structures.

Begin a long-term bat and insect monitoring program by establishing permanent monitoring sites and several off-park control sites to investigate the impacts of severe browsing by white-tailed deer and other disturbances on the bat community at Valley Forge NHP.

Conduct early spring and mid-fall mist-netting surveys to assess use of Valley Forge NHP habitats by migrating silver-haired bats. These surveys may also produce more data concerning species not presently listed, such as the eastern pipistrelle.

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Appendix A. Indiana Bat Mist-Netting Guidelines (from Revised Recovery Plan, USFWS, 1999)

Rationale

A typical mist-netting survey is an attempt to determine presence or probable absence of the species; it does not provide sufficient data to determine population size or structure. Following these guidelines will standardize procedures for mist netting. It will help maximize the potential for capture of Indiana bats at a minimum acceptable level of effort. Although the capture of bats confirms their presence, failure to catch bats does not absolutely confirm their absence. Netting effort as extensive as outlined below usually is sufficient to capture Indiana bats. However, there have been instances in which additional effort was necessary to detect the presence of the species.

Netting Season

May 15–August 15

These dates define acceptable limits for documenting the presence of summer populations of Indiana bats, especially maternity colonies. Several captures, including adult females and young of the year, indicate that a nursery colony is active in the area. Outside these dates, even when Indiana bats are caught, data should be carefully interpreted: If only a single bat is captured, it may be a transient or migratory individual.

Equipment

Mist nets - Use the finest, lowest visibility mesh commercially available:

1. In the past, this was 1-ply, 40 denier monofilament - denoted 40/1
2. Currently, monofilament is not available and the finest on the market is 2-ply, 50-denier nylon - denoted 50/2
3. Mesh of approximately 1½ in (1¼ – 1%) (~38 mm)

Hardware - No specific hardware is required. There are many suitable systems of ropes and/or poles to hold the nets. See NET PLACEMENT below for minimum net heights, habitats, and other netting requirements that affect the choice of hardware. The system of Gardner et al. (1989) has met the test of time.

Net Placement

Potential travel corridors, such as streams or logging trails, typically are the most effective places to net. Place the nets approximately perpendicular across the corridor. Nets should fill the corridor from side to side and from stream (or ground) level up to the overhanging canopy. A typical set is 7 m (23 ft) high consisting of three or more nets “stacked” on top one another and up to 20 m (65 ft) wide (different width nets may be purchased and used as the situation dictates). Occasionally, it may be desirable to net where there is no good corridor. Take caution

to get the nets up into the canopy. The typical equipment described in the section above may be inadequate for these situations, requiring innovation on the part of the observers.

Recommended Net Site Spacing:

- Stream corridors - one net site per km of stream.
- Non-corridor land tracts - two net sites per square km of forested habitat.

Minimum Level of Effort

Netting at each site should consist of:

- at least three net nights (unless bats are caught sooner) (one net set up for one night = one net night).
- a minimum of two net locations at each site (at least 30 m [98 ft] apart, especially in linear habitat such as a stream corridor).
- a minimum of two nights of netting.
- a sample period beginning at sunset and netting for at least 5 hr.
- checking each net approximately every 20 min.
- no disturbance near the nets, other than to check nets and remove bats.

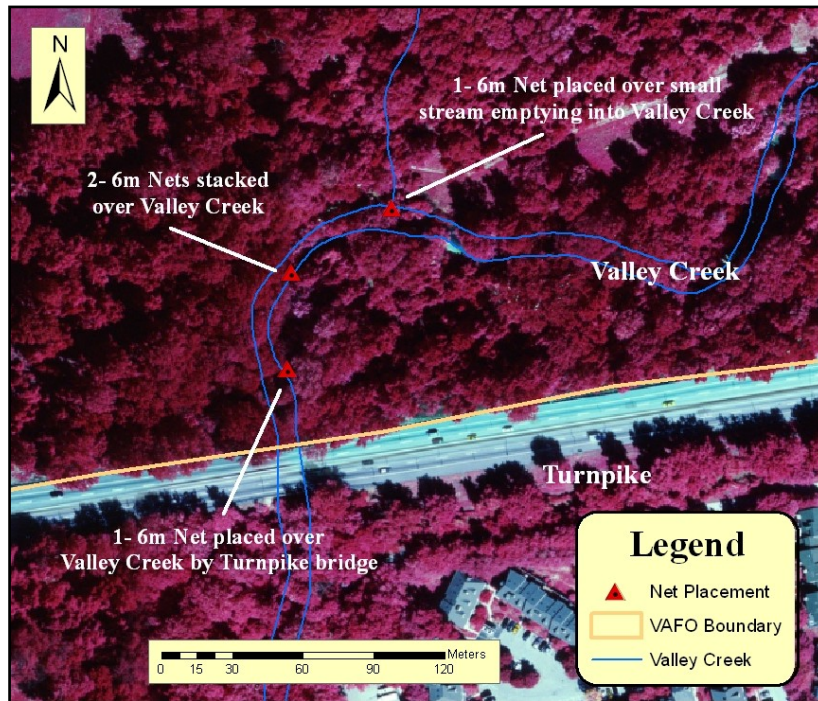
Weather Conditions

Severe weather adversely affects capture of bats. If Indiana bats are caught during weather extremes, it is probably because they are at the site and active despite inclement weather. On the other hand, if bats are not caught, it may be that there are bats at the site, but they may be inactive due to the weather. Negative results combined with any of the following weather conditions throughout all or most of a sampling period are likely to require additional netting:

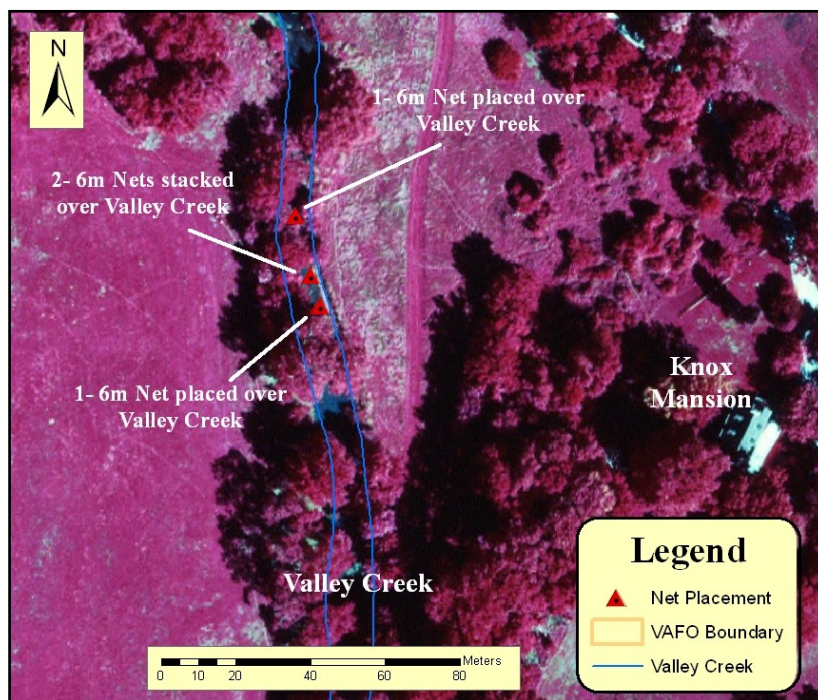
- Precipitation
- Temperatures below 10°C
- Strong winds (Use good judgment: moving nets are more likely to be detected by bats.)
- Moonlight

There is some evidence that small myotis bats avoid brightly-lit areas, perhaps as predator avoidance. It is typically best to set nets under the canopy where they are out of the moonlight, particularly when the moon is half-full or greater.

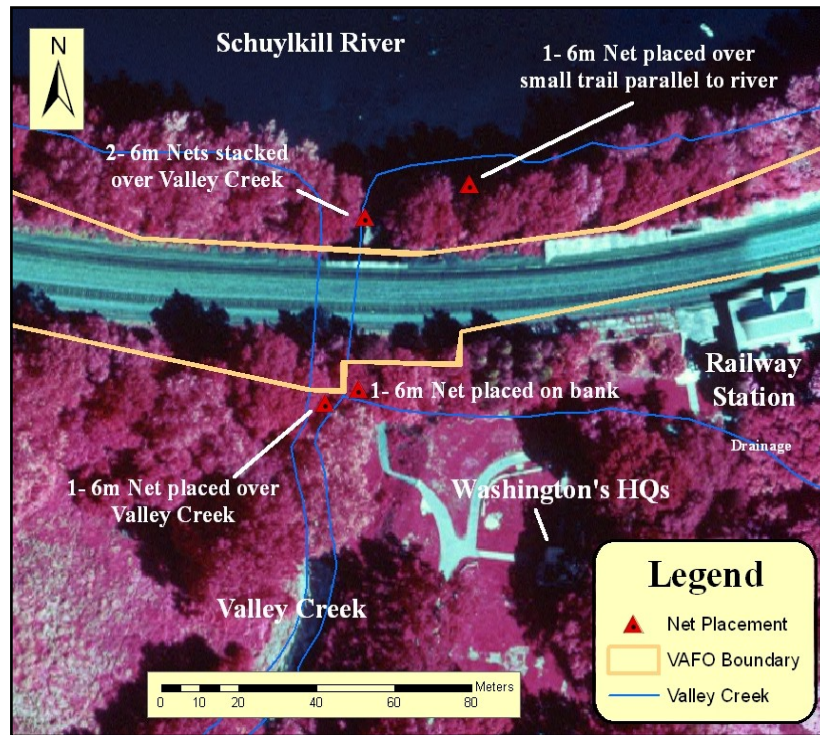
Appendix B. Placement of mist nets at the five survey sites in Valley Forge NHP.



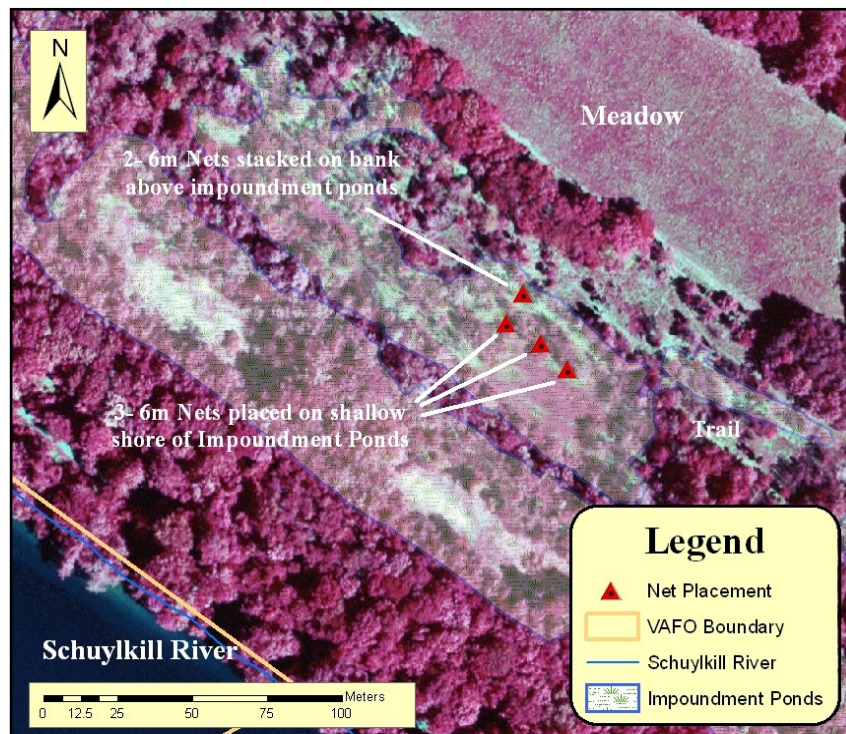
Valley Creek (Lafayette's Quarters) at site VAFO_BATS_VAFO001.



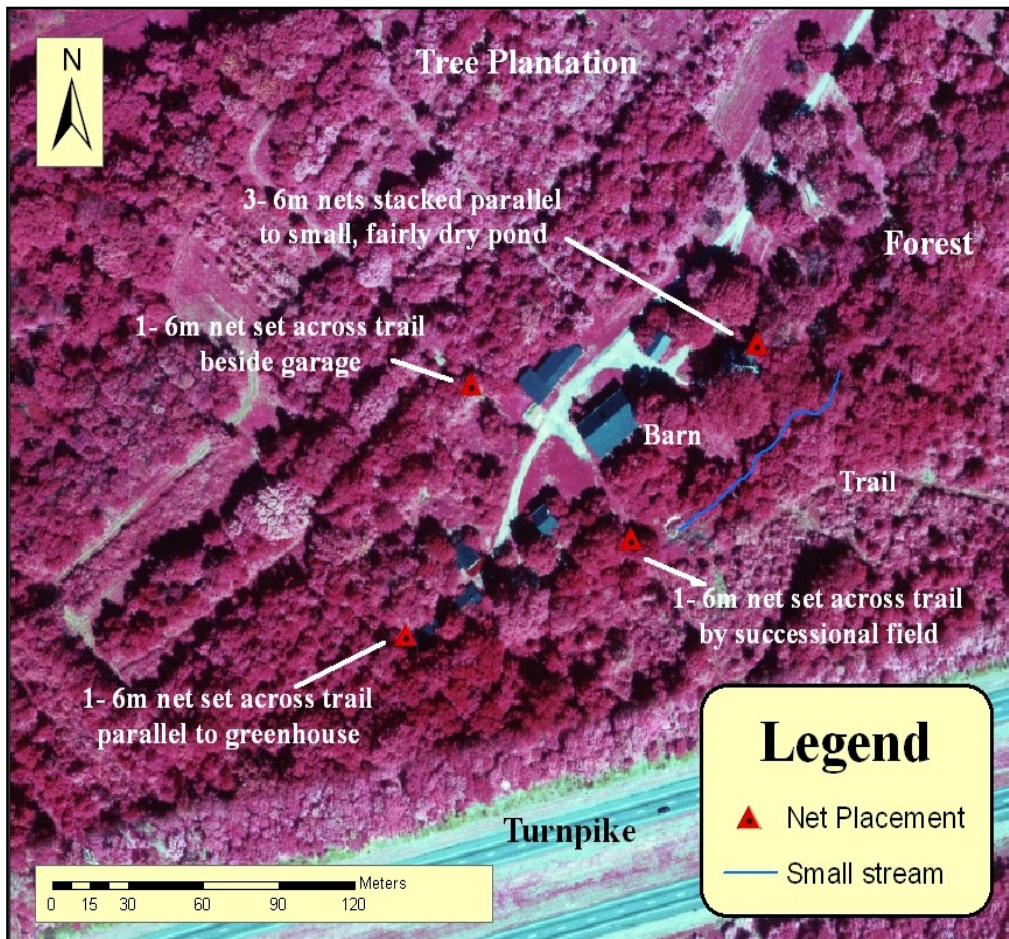
Valley Creek (Knox's Quarters) at site VAFO_BATS_VAFO002.



Valley Creek (Washington's Headquarters) at site VAFO_BATS_VAFO003.



Impoundment basin ponds at site VAFO_BATS_VAFO004.



Waggonseiler Property at site VAFO_BATS_VAFO005.

Appendix C. A photo of a "Bat Condo" built by the Pennsylvania Game Commission at Canoe Creek State Park, Blair County.



Appendix D. List of Photographs accompanying Technical Report

Folder- VAFO_Bats_VAFO001

- Eptesicus_fuscus_01- Photo of Big brown bat (*Eptesicus fuscus*)
- Eptesicus_fuscus_02- Photo of Big brown bat (*Eptesicus fuscus*)
- LongEared_CourtneyQuirin- Photo of northern long-eared bat (*Myotis septentrionalis*) and intern, Courtney Quirin
- Myotis_lucifugus_01- Photo of little brown bat (*Myotis lucifugus*)
- Myotis_lucifugus_02- Photo of little brown bat (*Myotis lucifugus*)
- Myotis_septentrionalis_01- Photo of northern long-eared bat (*M. septentrionalis*)
- Myotis_septentrionalis_02- Photo of northern long-eared bat (*M. septentrionalis*)
- Myotis_septentrionalis_03- Photo of northern long-eared bat (*M. septentrionalis*)
- Set-up_Site VAFO_Bats_VAFO001- Site set up along Valley Creek below Lafayette's Quarters, Site VAFO-BATS_VAFO001

VAFO_Bats_VAFO002

- Lasiurus_borealis_01- Photo of eastern red bat (*Lasiurus borealis*)
- Lasiurus_borealis_02- Photo of eastern red bat (*L. borealis*)

VAFO_Bats_VAFO004

- Myotis_septentrionalis_01- Photo of northern long-eared bat (*M. septentrionalis*)
- Myotis_septentrionalis_02- Photo of northern long-eared bat (*M. septentrionalis*)
- Myotis_septentrionalis_03- Photo of northern long-eared bat (*M. septentrionalis*)

Knox-Tindle House

- Guano piles- Photo of small bat guano piles on boards in attic of Knox-Tindle House
- Guano piles-Knox-Tindle- Photo of entire attic area showing the boards over the roof joists where small bat guano piles occur
- Knox-Tindle House- Photo of the exterior of the Knox-Tindle House
- Stains_peak of Knox-Tindle House- Possible staining along the peak of the attic area where bats may have roosted in the past.

As the nation's primary conservation agency, the Department of the Interior has responsibility for most of our nationally owned public land and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

National Park Service
U.S. Department of the Interior



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