

**Guide for Surveying Bird Populations at
Valley Forge National Historical Park**

Richard H. Yahner and Bradley D. Ross

Technical Report

School of Forest Resources
The Pennsylvania State University
University Park, PA 16802

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Summary

National parks are becoming more insular due to increased habitat fragmentation in the surrounding landscape. These parks are becoming increasingly valuable for the long-term maintenance of bird diversity and the functional integrity of ecosystems. The National Park Service has determined the need for in-depth inventorying and monitoring of bird populations at national parks in Pennsylvania, including Valley Forge National Historical Park (VAFO). The objectives of “The Guide for Surveying Bird Populations at Valley Forge National Historical Park” are to (1) describe how to conduct point-count, vehicular-road, diurnal raptor and vulture, owl, and riparian bird surveys, (2) provide a detailed description of survey stations for each survey protocol, and (3) provide recommendations for monitoring bird populations at VAFO.

Based on field-testing of survey protocols and conducting 2 years of inventories at six national parks in Pennsylvania, we developed recommendations for monitoring bird populations at VAFO. We recommend conducting point-count, vehicular-road, and diurnal raptor and vulture surveys twice a season during all seasons for 2 consecutive years out of every 5-year period. Owl surveys should be conducted three times each winter season for two consecutive winters every 5 years. Riparian birds should be surveyed a minimum of eight times between October and April for 2 consecutive years during each 5-year period.

The implementation of bird survey recommendations will create an extensive long-term database of birds and add to information already accumulated on presence, relative abundance, and distribution of species within the park. Based on knowledge and information derived from this database, resource management specialists will be able to make informed decisions on how best to manage the natural resources at VAFO.

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Introduction

The National Park Service (NPS) has determined the need for in-depth inventorying and monitoring of birds at Valley Forge National Historical Park (VAFO). During a previous study, investigators inventoried birds for two consecutive years at VAFO (Yahner et al. 2001). However, additional information is needed on long-term population trends of bird species at the park. Long-term information on presence, relative abundance, and distribution of birds is important to NPS personnel (hereafter referred to as resource management specialists) who are mandated to manage natural resources. Studying the diversity of bird populations and biodiversity in national parks such as VAFO is important because these public lands represent large parcels of land within a matrix of fragmented land-uses and private landowners. These large tracts of public lands are becoming more insular due to increased habitat fragmentation because of agricultural development, urbanization, or other land use and will be increasingly valuable for the long-term maintenance of faunal diversity and the functional integrity of landscapes and ecosystems in the eastern United States (Ambrose and Bratton 1990; Yahner et al. 1998). VAFO is an especially important public land and natural reserve due to its large size (1,400-ha) and location within a highly urbanized landscape. Additionally, the park had the highest bird species richness ($n = 163$) and one of the highest numbers of species of special concern ($n = 22$) of any national park in Pennsylvania we inventoried (Yahner et al 2001).

Birds are an important group of organisms to study because they are good indicators of environmental change, have been extensively studied (e.g., Christmas Bird Count [CBC] and Breeding Bird Survey [BBS]), and have well understood natural histories. A diverse bird community suggests a healthy ecosystem. For example, the presence or absence of certain species or groups of bird species within a geographic location can depict unsuitable habitat or indicate possible environmental factors restricting birds and possibly other flora and fauna. A high number of species and especially high numbers of certain species, such as grassland associates or forest interior birds, suggest that a given area or park provides an abundance and variety of habitats and associated food and nesting resources for many different birds. It is important for resource management specialists to monitor birds at the population level such as VAFO in order to determine increasing or decreasing trends of certain groups of bird species (i.e., forest associates or grassland obligates). Monitoring birds over time will allow resource management specialists to compare population changes within the park to those within the surrounding landscape using existing long-term data sets such as CBC and BBS, and therefore enable them to make an educated assessment of past, current, and possibly future management practices within the park and the possible effect of management on ecosystem health within and surrounding the park. Thus, a major goal of the proposed study and that of resource management specialists is to periodically update and add to the information collected during the comprehensive inventory program for birds by regularly monitoring bird populations at VAFO.

This “Guide for Surveying Bird Populations at Valley Forge National Historical Park” is to be used by biologists qualified to identify birds both visually and vocally. Appendix A contains a list of the equipment necessary for conducting the point-count, vehicular-road, diurnal raptor and vulture, owl, and riparian bird surveys at Valley Forge National Historical Park. This document was designed for establishing and beginning a long-term monitoring program for birds and is not designed to address specific cases or scenarios for monitoring species of special concern (SSC). Each SSC should be reviewed on an individual case basis to determine if behavioral and productivity surveys, or habitat improvement for the species is necessary. For additional information concerning the comprehensive inventory program and/or monitoring program for birds at VAFO consult Yahner et al. (2001).

Study Area

Valley Forge National Historical Park (VAFO) is located in Montgomery and Chester Counties, southeastern Pennsylvania, approximately 20 km northwest of Philadelphia. The 1,400-ha park is surrounded by urban-suburban land-use types (Appendices B-D) (Lundgren et al. 2002).

The topography of VAFO is relatively gentle, consisting of rolling uplands and low hills, with elevations ranging from 10 to 150 m. The Schuylkill River and Valley Creek are the major river drainages for the park. Approximately 57 percent of the park is composed of old-fields, fields mowed annually, and fields mowed biweekly; 38 percent is woodlands. The remaining five percent of VAFO includes developed areas (e.g., buildings), barren areas (e.g., paved and dirt parking lots), and wetlands (e.g., small ponds) (Yahner et al. 2001).

The woodlands at VAFO were classified into six different categories including white pine (*Pinus strobes*) plantation, tuliptree (*Liriodendron tulipifera*) forest, dry oak-heath forest, modified successional forest, silver maple (*Acer saccharinum*) floodplain forest, mixed floodplain forest, and scree slope (Lundgren et al. 2002). White pine plantations are dominated by white pine, though a few stands contain European larch (*Larix decidua*). Tuliptree forest is dominated by tuliptree with black oak (*Quercus velutina*) and white ash (*Fraxinus americana*) being co-dominant in some stands. The dry oak-heath forest canopy is most common on the slopes of Mount Joy and Mount Misery and is dominated by chestnut oak (*Quercus prinus*) and black oak, with black gum (*Nyssa sylvatica*) and scarlet oak (*Quercus coccinea*) being co-dominants. Modified successional forest is variable in composition, but generally is dominated by early successional species such as white ash, black walnut (*Juglans nigra*), American elm (*Ulmus americana*), and black locust (*Robinia pseudoacacia*). Silver maple floodplain forest occurs along the Schuylkill River floodplain and is dominated by silver maple but includes other hardwoods such as river birch (*Betula nigra*), box elder, American elm, and sycamore (*Platanus occidentalis*). The mixed floodplain forest occurs within the Schuylkill River floodplain and along small streams. This forest type is dominated by green ash (*Fraxinus pennsylvanica*), sycamore, and silver maple with black walnut, box elder, river birch, and tree-of-heaven (*Ailanthus altissima*) sparsely scattered throughout the stand. Scree slope areas are sparsely vegetated upland talus slopes dominated by black cherry (*Prunus serotina*), red maple (*Acer rubrum*), sweet birch (*Betula lenta*), black gum, black oak, serviceberry (*Amelanchier arborea*), witch-hazel (*Hamamelis virginiana*), and mountain laurel (*Kalmia latifolia*).

The early successional and grassland habitat at VAFO were classified into three different categories including successional old field/shrubland, grassland, and wet meadow (Lundgren et al. 2002). Successional old field/shrubland contains greater than 30% shrub cover consisting of autumn olive (*Elaeagnus umbellata*), honeysuckle (*Lonicera spp.*), multiflora rose, and wineberry and is co-dominated by grasses. The Grasslands at VAFO contain less than 25% shrub cover and are dominated by fescue (*Festuca spp.*) and orchard-grass (*Dactylis glomerata*). Wet meadows are seasonally or temporarily flooded and are dominated by reed canary-grass (*Phalaris arundinacea*) and wetland species such as rice cut-grass (*Leersia oryzoides*).

Methods

We surveyed birds for two years (May 1999 - May 2001) at Valley Forge National Historical Park (VAFO) using point-count, vehicular-road, diurnal raptor and vulture, owl, and riparian bird survey protocols. Each year, birds were surveyed during four seasons: spring-migratory (15 April-25 May), breeding (25 May-15 July), fall-migratory (25 August-10 October), and winter (1 December-15 March). For all bird-survey protocols, investigators must visit all sampling points or survey stations once per survey, however, investigators do not need to visit the survey locations in sequential order.

Point-count Surveys

We surveyed birds for 2 years using the point-count survey protocol at 60 sampling points located in VAFO (Appendix E) (Yahner et al. 2001). Each year, birds were surveyed two times per season during each of the four seasons: spring-migratory, breeding, fall-migratory, and winter seasons. The two surveys were spaced at regular intervals throughout each season. In order to conduct surveys when bird activity was at optimal levels, surveys were conducted in the morning (sunrise to 5 hours following sunrise) during the spring-migratory and breeding seasons and throughout the day (30 minutes after sunrise to 30 minutes before sunset) during the fall-migratory and winter seasons. In order to maximize visual and vocal identification of birds, surveys were conducted on days with little or no precipitation and wind less than 15 mph. Habitat information (i.e., cover type, spatial location, and elevation), universal transverse mercator (UTM) coordinates, and verbal directions for each bird point-count sampling point are presented in Appendices F-H.

Prior to conducting bird point-count surveys, the investigator recorded the season, date, visit number, temperature (degrees F), wind velocity (mph), cloud cover (%), notes on precipitation, and their name at the top of the data sheet titled "Bird Point-count Survey for Valley Forge National Historical Park" (Appendix I). Upon arriving at a sampling point to conduct a survey, the investigator waited for a 1-minute equilibrium period before identifying any birds. During the equilibrium period, the investigator recorded the number of the sampling point they were surveying and the beginning time for the survey. Following the 1-minute equilibrium period, the investigator recorded (1) 4-letter species code for each bird (Appendix J), (2) number of individuals, and (3) distance in meters from the investigator to each bird for all birds seen or heard during a 10 minute time period. Birds were observed in three overlapping time periods: 3 minutes, 5 minutes, and 10 minutes as indicated on the data sheet in Appendix I. Observations were separated into three time periods for possible comparison to studies that use different time durations. We recorded the distance to each bird for comparison to studies that use different radii for point-count surveys. When recording information for the surveys, investigators were conservative in estimates of the number of individual birds and the distance from the investigator to the bird(s). For example, if the investigator encountered a flock of European starlings (scientific names given in Appendix J) numbering between 60-80 birds at a distance of 50-100 meters, the investigator recorded 60 individuals at 75 meters (the minimum number of individuals located at the median distance or middle of the flock).

When conducting the point-count survey protocol, investigators occasionally encountered birds that were not identifiable. After the survey time expired (10 minutes), investigators were permitted to leave the point-count location and use vocalizations (i.e., pishing or alarm calling) to try and attract and identify any individuals that could not be identified during the survey. Only unidentified individuals initially detected during the 10-minute time period of the survey were included in the survey data. Bird species detected prior to or during the equilibrium period but not during the designated time of the survey were recorded as supplemental observations. Additional birds attracted and identified after the designated time period of the survey were recorded as supplemental observations and were not included in the survey. Unidentified birds were excluded from the surveys and supplemental observations.

Vehicular-road Surveys

Investigators used a vehicular-road survey route at VAFO to locate stations for the vehicular-road survey protocol, diurnal raptor and vulture survey protocol, and owl survey protocol. For safety reasons and to avoid excessive distractions and traffic noise, the route was designed for use on secondary roads. Additionally, the route encompassed a variety of habitats represented within the park in an attempt to encounter as many different bird species as possible at VAFO. The vehicular-road survey route contained 18 vehicular-road survey stations, 10 diurnal raptor and vulture survey stations, and 10 owl survey stations at VAFO (Appendices K-M).

Birds were surveyed at VAFO using the vehicular-road survey protocol (Yahner et al. 2001). Information derived from the vehicular-road surveys complemented the information obtained from point-count surveys by increasing the number of habitats, regions, and sampling points covered within VAFO. Birds were surveyed for 2 years and each year, birds were surveyed two times per season during each of the four seasons (spring-migratory, breeding, fall-migratory, and winter seasons). The two vehicular-road surveys were spaced at regular intervals throughout each season. Surveys were conducted in the morning (sunrise to 5 hours following sunrise) during the spring-migratory and breeding seasons and throughout the day (30 minutes after sunrise to 30 minutes before sunset) during the fall-migratory and winter seasons. Surveys were conducted on days with little or no precipitation and wind less than 15 mph. Habitat information (i.e., cover type, spatial location, and elevation), UTM coordinates, and verbal directions for each of the 18 vehicular-road survey stations are presented in Appendices N-O.

Prior to conducting vehicular-road surveys, the investigator recorded the season, date, visit number, temperature (degrees F), wind velocity (mph), cloud cover (%), notes on precipitation, and their name at the top of the data sheet titled “Vehicular-road Survey for Valley Forge National Historical Park” (Appendix P). When conducting a vehicular-road survey, the investigator stopped the engine and exited the vehicle at each station along the vehicular-road survey route. Upon arriving at a survey station, the investigator waited for a 1-minute equilibrium period before identifying any birds. During the equilibrium period, the investigator recorded the number of the survey station and the beginning time for the survey. Following the 1-minute equilibrium period, the investigator recorded the 4-letter species code for each bird (Appendix J) and the number individuals for all birds seen or heard during a 5-minute time period. The investigator separated bird observations into two time periods: the first 3 minutes and the total 5 minutes of the survey as indicated on the data sheet in Appendix P. Observations were separated into two time periods for possible comparison to studies that use different time durations. When recording information for the surveys, investigators were conservative in their estimate of the number of individual birds. For example, if the investigator encountered a flock of European starlings numbering between 60-80 birds, the investigator recorded 60 individuals (minimum number of individuals).

When conducting the vehicular-road survey protocol, investigators occasionally encountered birds that were not identifiable. After the time period (5 minutes) for the survey had expired, investigators used vocalizations (i.e., pishing or alarm calling) to attract and identify any unknown individual(s). Only unidentified individuals initially detected during the 5-minute time period of the survey were included in the survey data. Bird species detected during the equilibrium period but not during the designated 5 minutes of the survey were recorded as supplemental observations. Additional birds attracted and identified after the designated time period of the survey were recorded as supplemental observations, but were not included in the survey. Unidentified birds were excluded from the surveys and supplemental observations.

Diurnal Raptor and Vulture Surveys

Diurnal raptors and vultures were surveyed for 2 years using the diurnal raptor and vulture survey protocol at 10 vehicular-road survey stations in VAFO (Appendix L) (Yahner et al. 2001). Approximately one-half of the survey stations used for the vehicular-road survey protocol were used for raptor and vulture surveys to prevent double counting birds. Surveys were conducted twice per season (spring-migratory, breeding, fall-migratory, and winter), with the two surveys spaced at regular intervals throughout each season. Surveys were started between 1000 and 1500 hours EST on days with little or no precipitation and wind less than 15 mph. To expedite surveys during the fall-migratory and winter seasons, diurnal raptor and vulture surveys were conducted at the same time as vehicular-road surveys; during spring-migratory and breeding seasons, these two types of surveys were conducted separately. Habitat information (i.e., cover type, spatial location, and elevation), UTM coordinates, and verbal directions for each of the 10 diurnal raptor and vulture survey stations are presented in Appendices Q-R.

Prior to conducting diurnal raptor and vulture surveys, the investigator recorded the season, date, visit number, temperature (degrees F), wind velocity (mph), cloud cover (%), notes on precipitation, and name at the top of the data sheet entitled “Diurnal Raptor and Vulture Survey for Valley Forge National Historical Park” (Appendix S). When conducting a diurnal raptor and vulture survey, the investigator stopped the engine and exited the vehicle at designated stations along the survey route. The investigator waited for a 1-minute equilibrium period before identifying birds. During the equilibrium period, the investigator recorded the number of the survey station and the beginning time for the survey. Following the 1-minute equilibrium period, the investigator recorded the 4-letter species code for each raptor and vulture (Appendix J) and the number individuals for all raptors and vultures seen or heard during a 5-minute time period. When recording information for the diurnal raptor and vulture surveys, investigators were conservative in estimating of the number of individual birds. For example, if the investigator encountered vultures numbering between 20-25 birds, the investigator recorded 20 individuals (minimum number of individuals).

When conducting the diurnal raptor and vulture survey protocol, investigators occasionally encountered birds that were not identifiable. Unidentified birds were excluded from the surveys and supplemental observations. While traveling between stations, the investigator slowly traversed the vehicular-road survey route, with velocity depending on road type and traffic volume. Raptors and vultures detected while traveling between survey stations or during the equilibrium period but not during the survey were recorded as supplemental observations.

Owl Surveys

Owl populations were surveyed for two winter seasons (1 December 1999-15 March 2001) using the owl survey protocol at 10 survey stations in VAFO (Appendix M) (Yahner et al. 2001).

Owls were surveyed three times during each winter season with surveys spaced at regular intervals throughout the time period. Each survey included a subset of the stations located along the vehicular-road survey route for VAFO and within or proximal to coniferous forest. Surveys were conducted between 1 hour after sunset and 1 hour before sunrise on nights with little or no precipitation, wind less than 15 mph, and cloud cover less than 50%. Habitat information (i.e., cover type, spatial location, and elevation), UTM coordinates, and verbal directions for each of the 10 owl survey stations are presented in Appendices T-U.

Prior to conducting owl surveys, the investigator recorded date, visit number, temperature (degrees F), wind velocity (mph), cloud cover (%), notes on precipitation, snow depth (cm), and name at the top of the data sheet titled "Owl Survey for Valley Forge National Historical Park" (Appendix V). When conducting an owl survey, the investigator stopped the engine and exited the vehicle at each owl survey station. Upon arriving at a survey station, the investigator waited for a 1-minute equilibrium period. During the equilibrium period, the investigator recorded the number of the survey station and the beginning time for the survey.

Following the 1-minute equilibrium period, the investigator played the calls of five owl species at an audio level between 90-110 decibels. Calls of the five owl species were played in the following order: northern saw-whet, eastern-screech, barred, long-eared, and great horned owls. Owl calls were played in the following sequence consecutively for each owl species at each sampling point: first call period = play owl call for 15 seconds, then pause for 45 seconds; second call period = play owl call for 15 seconds, then pause for 45 seconds; third call period = play owl call for 15 seconds, then pause for 45 seconds; fourth call period = play owl call for 15 seconds, then pause for 2 minutes. To complement surveys of these five owl species, additional owl calls were played for short-eared owls and barn owls at VAFO. Short-eared owl calls were played only at station eight following calls of the great-horned owl. Barn owl calls were the only owl calls played at Station 10.

Investigators recorded the 4-letter species code for each owl (Appendix J) and number of individuals of all owls identified during the surveys. Owl species detected while traveling between survey stations or during the equilibrium period but not during the survey were recorded as supplemental observations. When conducting the owl survey protocol, investigators occasionally encountered birds that were not identifiable. Unidentified birds were excluded from the surveys and supplemental observations.

Riparian Bird Surveys

Birds associated with riparian areas (e.g., waterfowl, waders, and shorebirds) were surveyed for 2 years at VAFO. Surveys were conducted three times during each winter season; one survey was conducted in December, one in January, and one between 1 February-15 March. Each survey included a visit to 9 stations easily accessible from the river trail located along the north side of the Schuylkill River (Appendices W-Y). The initial station was located so that the most northwest portion of the Schuylkill River within the park could be observed. The remaining eight stations were spaced approximately 0.8-km (0.5-mile) apart along the riverbank to assure complete coverage of the Schuylkill River located within the park. Surveys were conducted in the morning (sunrise to 5 hours following sunrise) on days when visibility was not limited by precipitation.

Prior to conducting riparian bird surveys, the investigator recorded date, visit number, temperature (degrees F), wind velocity (mph), cloud cover (%), notes on precipitation, and their name at the top of the data sheet titled “Riparian Bird Survey for Valley Forge National Historical Park” (Appendix Z). When conducting a riparian bird survey, the investigator stopped the engine, exited the vehicle, and walked to the designated station located on the north shoreline of the Schuylkill River. Upon arriving at a survey station, the investigator recorded the number of the survey station and the beginning time for the survey and immediately began identifying riparian birds. We surveyed the river and adjacent habitat for approximately 5 minutes (time depending on the number and activity of riparian birds) at each station using binoculars and spotting scopes. Between stops at each survey station, the investigator slowly traversed the Schuylkill River trail. Birds detected while traveling between survey stations were included with the list of observations from the previous station. No equilibrium period was incorporated into the riparian bird survey protocol because all riparian birds detected at and between stations were included in the survey. During the riparian bird surveys, the investigator recorded the 4-letter species code for each riparian bird (Appendix J), number of individuals, and sex of all waterfowl, waders, and shorebirds identified at each survey station and between stations. Unidentified birds were excluded from surveys and supplemental observations.

Monitoring Recommendations

The main goal of the bird monitoring program and that of resource management specialists is to periodically update and add to the information collected during the comprehensive inventory program for birds by regularly surveying bird populations at VAFO. Monitoring birds over time will allow resource management specialists to compare population changes within VAFO to those within the surrounding landscape, and therefore enable them to make an educated assessment of management practices within the park. Based on testing of protocols for surveying birds and conducting inventories of birds in Pennsylvania national parks from 1992-2001 (Yahner et al. 1998; Yahner et al. 2001), we recommend that two qualified biologists conduct point-count, vehicular-road, and diurnal raptor and vulture surveys during all four seasons each year; owl surveys during each winter season; and riparian bird surveys from October-April each year. However, given labor and time constraints (Table 1), we recommend that a single biologist conduct point-count, vehicular-road, and diurnal raptor and vulture surveys during all seasons and owl surveys during winter seasons for 2 consecutive years every 5-year period at each park. In addition, riparian-bird surveys should be conducted a minimum of eight times between October and April for 2 consecutive years every 5-year period.

Proposed Schedule for Monitoring Birds

The following is a proposed schedule that will provide necessary monitoring coverage of birds over a 5-year time period, as well as providing time to manage and analyze bird survey data.

Year 1: Point-count Surveys.

Year 2: Point-count Surveys.

Year 3: Vehicular-road, Diurnal Raptor and Vulture, Owl, and Riparian Bird Surveys.

Year 4: Vehicular-road, Diurnal Raptor and Vulture, Owl, and Riparian Bird Surveys.

Year 5: Data Management and Analysis

Table 1. Description of labor and time requirements for each of the bird survey protocols at Valley Forge National Historical Park.

Survey Protocol	No. Person Hours Needed to Complete One Survey	No. Surveys per Season	Seasons
Point-count	16.5	2	Spring Migratory, Breeding, Fall Migratory, & Winter
Vehicular-road	4	2	Spring Migratory, Breeding, Fall Migratory, & Winter
Diurnal Raptor and Vulture	2	2	Spring Migratory, Breeding, Fall Migratory, & Winter
Owl	6.5	3	Winter
Riparian Bird	2	8	October - April

Point-count Surveys

A bird-monitoring program at VAFO should primarily involve point-count surveys. Results from point-count surveys provide the most comprehensive information on bird species richness and abundance and can be compared among years, seasons, protocols, different parks, and, if conducted at previously established point-count sampling locations, to results from Yahner et al. (2001) because of a standard time length and survey protocol. We recommend conducting point-counts during each season (spring migration, breeding, fall migration, and winter) for at least 2 consecutive years out of every 5 years. This will provide the most reliable data, increase the likelihood of incorporating an irruptive year for wintering species, and provide enough information to track long-term trends in bird populations.

Vehicular-road Surveys

If labor and time are available, vehicular-road surveys should be conducted for 2 consecutive years during each 5-year period to increase information on species richness and abundance as a supplement to point-count surveys. Vehicular-road surveys may be conducted during the same years as point-count surveys or in place of them during 2 of the 3 years when point-count surveys are not conducted. However, because this survey protocol is not particularly suitable for inventorying and monitoring forest-interior species, vehicular-road surveys should not replace point-count surveys unless time and labor are severely limited.

Diurnal Raptor and Vulture Surveys

Diurnal raptor and vulture surveys require little time and effort, and should continue at each park for 2 consecutive years out of every 5-year period. Although year-round surveys are recommended to maximize species richness and abundance estimates for raptors and vultures, emphasis should be placed on fall migration and winter seasons when species are most conspicuous.

Owl Surveys

Surveys using taped-playbacks of owl vocalizations are the only protocol that provides an accurate estimate of species richness and abundance for owls. Because owls rarely vocalize during the day and are inconspicuous, point-count and vehicular-road surveys will considerably underestimate the abundance of these species. Therefore, we recommend owl surveys be conducted for 2 consecutive years out of every 5-year period.

Riparian Bird Surveys

Riparian bird surveys should be conducted during winter, and if possible, be expanded to include additional months in the spring and fall seasons during peak migration times for riparian birds. Increasing the number and time period of surveys will allow investigators to more accurately determine the species richness and abundance of riparian birds throughout the year. Although the previous inventory (Yahner et al. 2001) conducted riparian bird surveys three times during the winter months, we recommend a minimum of eight surveys from October through early April because of the dynamic and transient nature of these populations. This also will improve the chances of increasing the species richness of riparian birds by documenting rare species (e.g., sea ducks and shorebirds) that may be present within the park for only a short time. As with point-count, vehicular-road, diurnal raptor and vulture, and owl surveys, riparian bird surveys should be conducted at least 2 years out of every 5-year period.

Conclusions

National parks are becoming more insular due to increased habitat fragmentation in the surrounding landscape. They thus become more valuable for the long-term maintenance of bird diversity and diversity of other fauna. The National Park Service determined the need to obtain a comprehensive inventory database on birds and to develop recommendations for establishing a long-term monitoring program for bird populations at Valley Forge National Historical Park. Based on testing of protocols for surveying birds and conducting inventories of birds in Pennsylvania national parks from 1992-2001 (Yahner et al. 1998; Yahner et al. 2001), we recommend conducting point-count, vehicular-road, and diurnal raptor and vulture surveys during all seasons and owl surveys during winter seasons for 2 consecutive years every 5-year period at each park. In addition, riparian-bird surveys should be conducted a minimum of eight times between October and April for 2 consecutive years every 5-year period.

By implementing these recommendations, resource management specialists will be creating an extensive long-term database and adding to information already accumulated on presence, relative abundance, and distribution of birds within VAFO. Data collected by Yahner et al. (2001) combined with information from future monitoring efforts will be valuable, especially if long-term trends in bird populations continue to decline in the eastern United States. Information available in long-term databases will enable resource management specialists to make informed decisions on how best to manage the natural resources within the national parks.

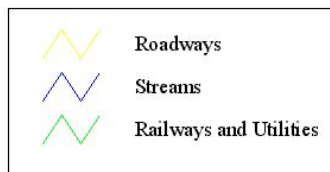
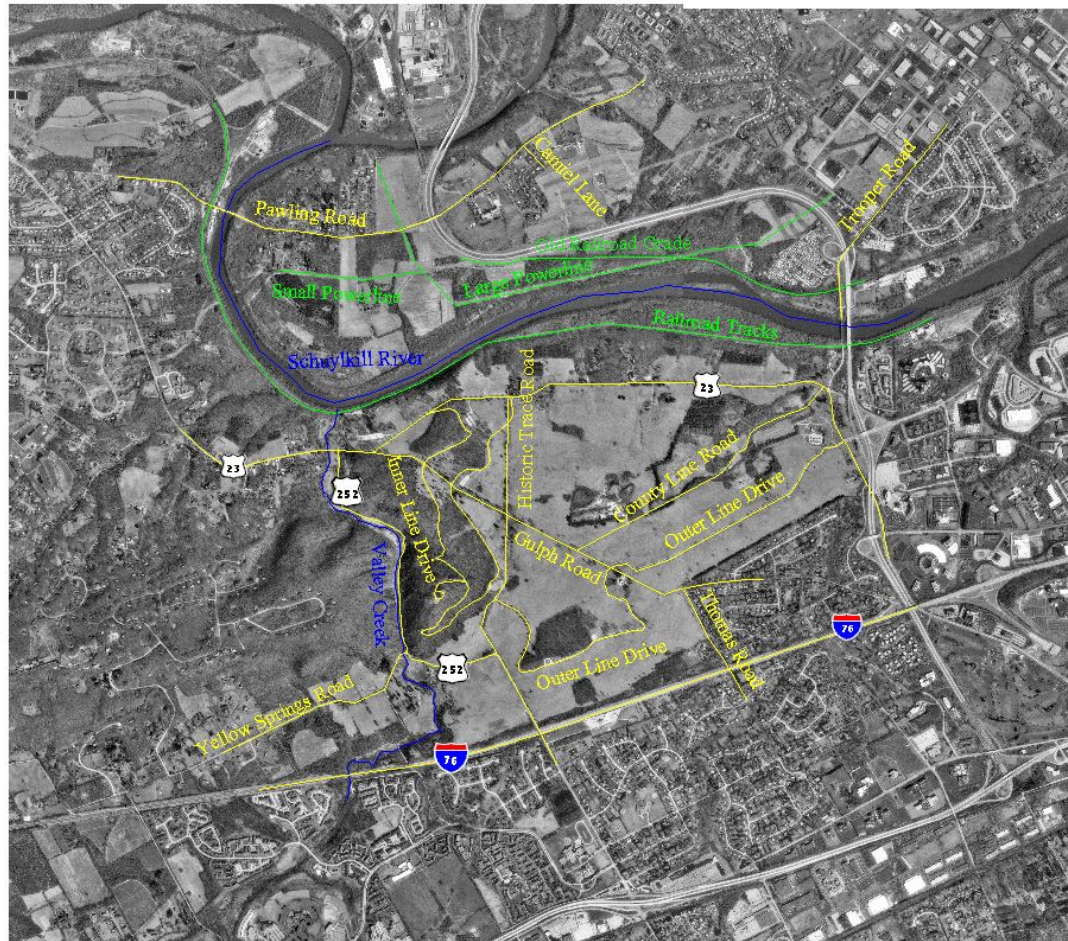
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- Yahner, R. H., B. D. Ross, G. S. Keller, and D. S. Klute. 2001. Comprehensive inventory program for birds at six Pennsylvania national parks. National Park Service, Technical Report NPS/PHSO/NRTR-01/085. 232pp.

Appendix A. List of equipment necessary (indicated by an “X”) to conduct point-count (PC), vehicular-road (VR), diurnal raptor and vulture (RV), owl (OWL), and riparian bird (RB) surveys at Valley Forge National Historical Park.

Equipment	Survey Types				
	PC	VR	RV	OWL	RB
Vehicle	X	X	X	X	X
Digital Watch	X	X	X	X	X
Clip Board	X	X	X	X	X
Writing Utensils (preferably two pencils)	X	X	X	X	X
Instructions for appropriate survey protocol	X	X	X	X	X
Visual and verbal directions to sampling points or survey stations for appropriate survey protocol	X	X	X	X	X
Table containing the species codes for birds of the Eastern United States (see Appendix J)	X	X	X	X	X
Data Sheet for appropriate survey protocol	X	X	X	X	X
Access to weather information (temperature and wind velocity)	X	X	X	X	X
Bird Identification Guide	X	X	X	X	X
Binoculars (minimum of 7 times magnification)	X	X	X	X	X
Compass	X	X	X	X	X
Flashlight				X	
Tape or Compact Disk Player (preferably an MS512 Johnny Stewart Wildlife Caller, but any device that can emit 90-110 decibels of undistorted sound is adequate). Wildlife callers can be obtained from: Johnny Stewart P.O. Box 7594 Waco, TX 76714-7594 Phone: 1-800-537-0652				X	
Tape or Compact Disk (CD) containing owl calls. The recording should contain four northern saw-whet owl call periods (approximately 15 second duration per call followed by 45 seconds of silence) followed by four call periods for eastern-screech, barred, long-eared, great horned, short-eared, and barn owls. The investigator can create the recording using Peterson Field Guides, Eastern/Central Bird Songs.				X	
Spotting Scope (recommended but not essential)					X

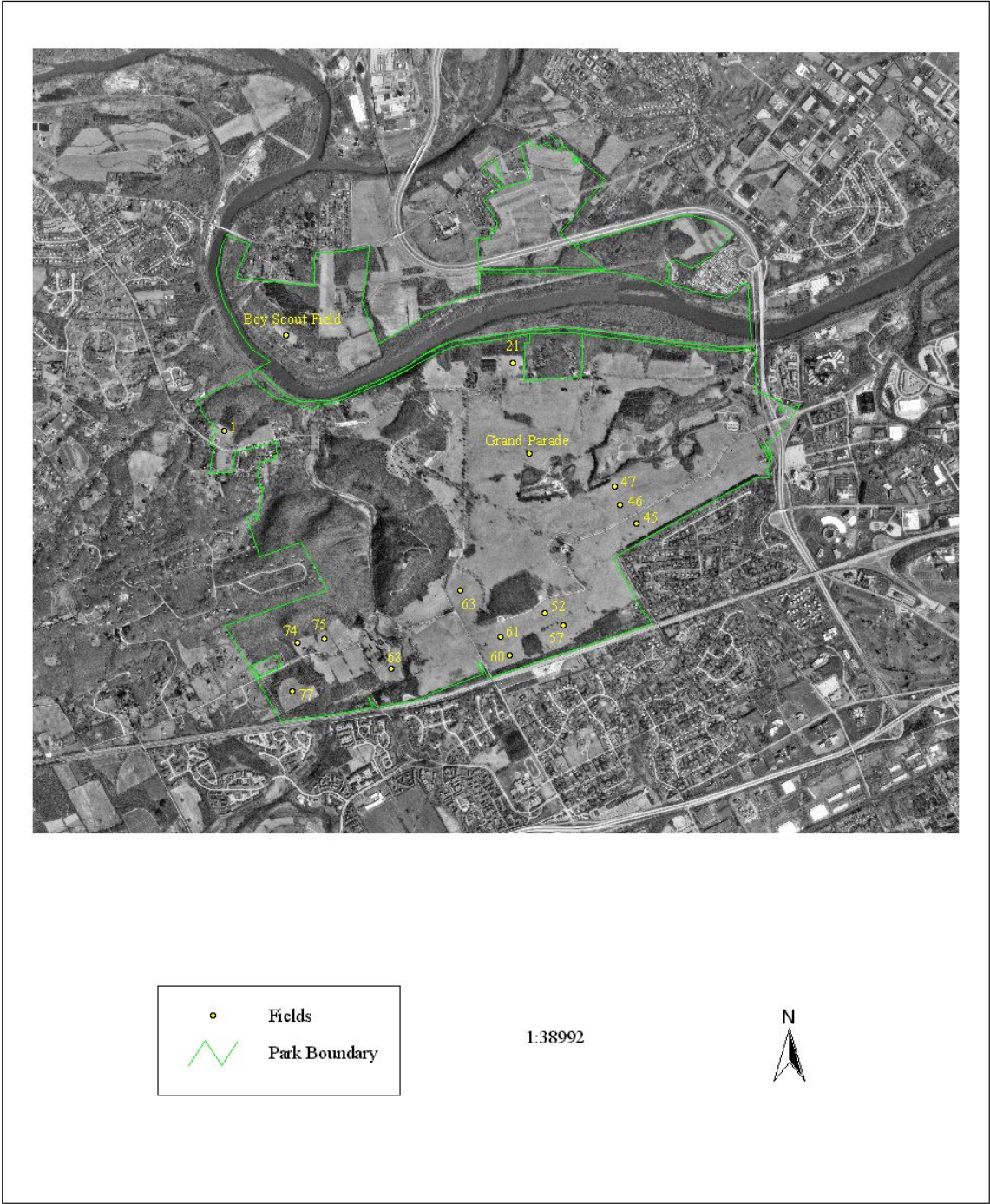
Appendix B. Aerial photograph of Valley Forge National Historical Park displaying roadways and streams within and adjacent to the park.



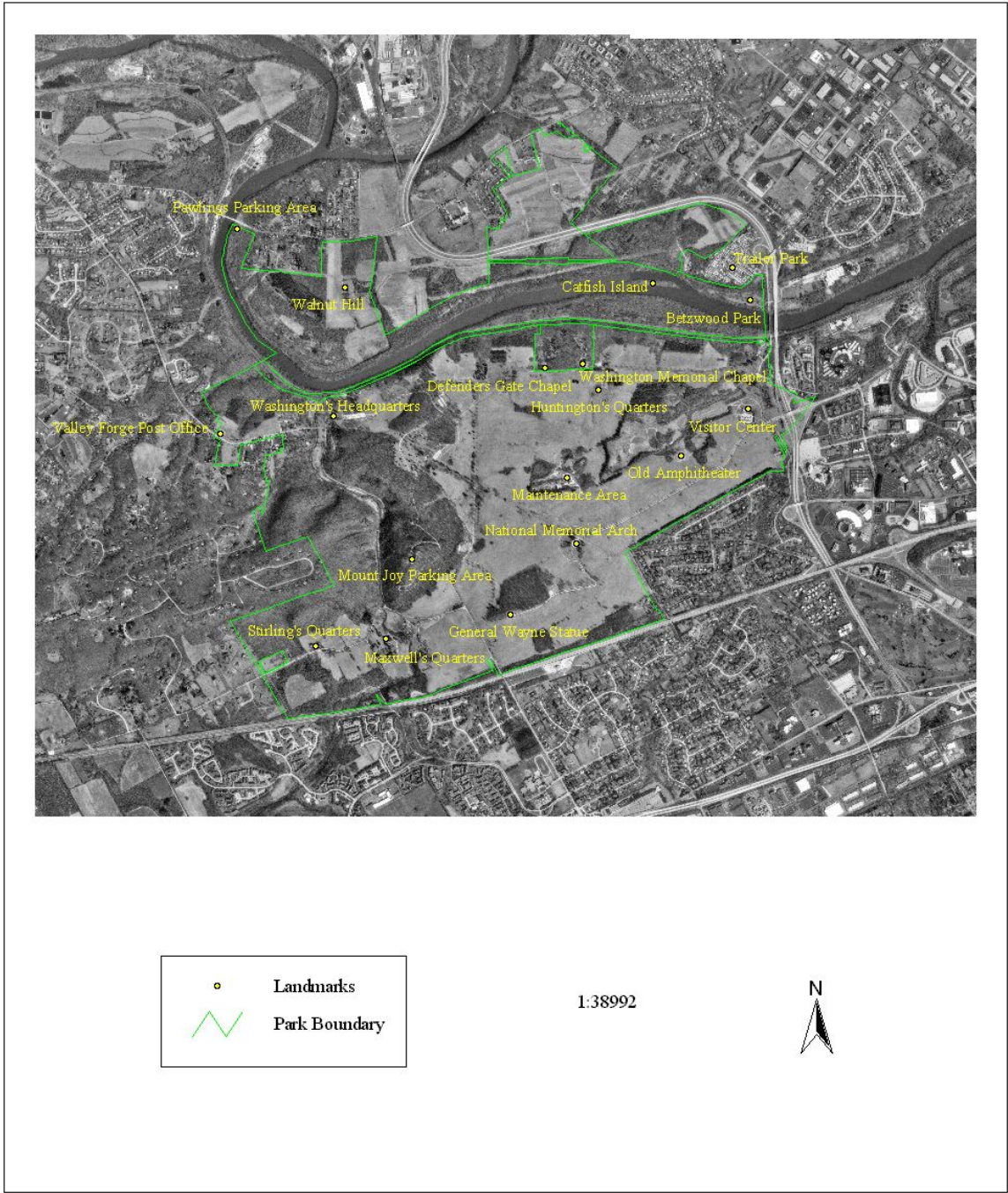
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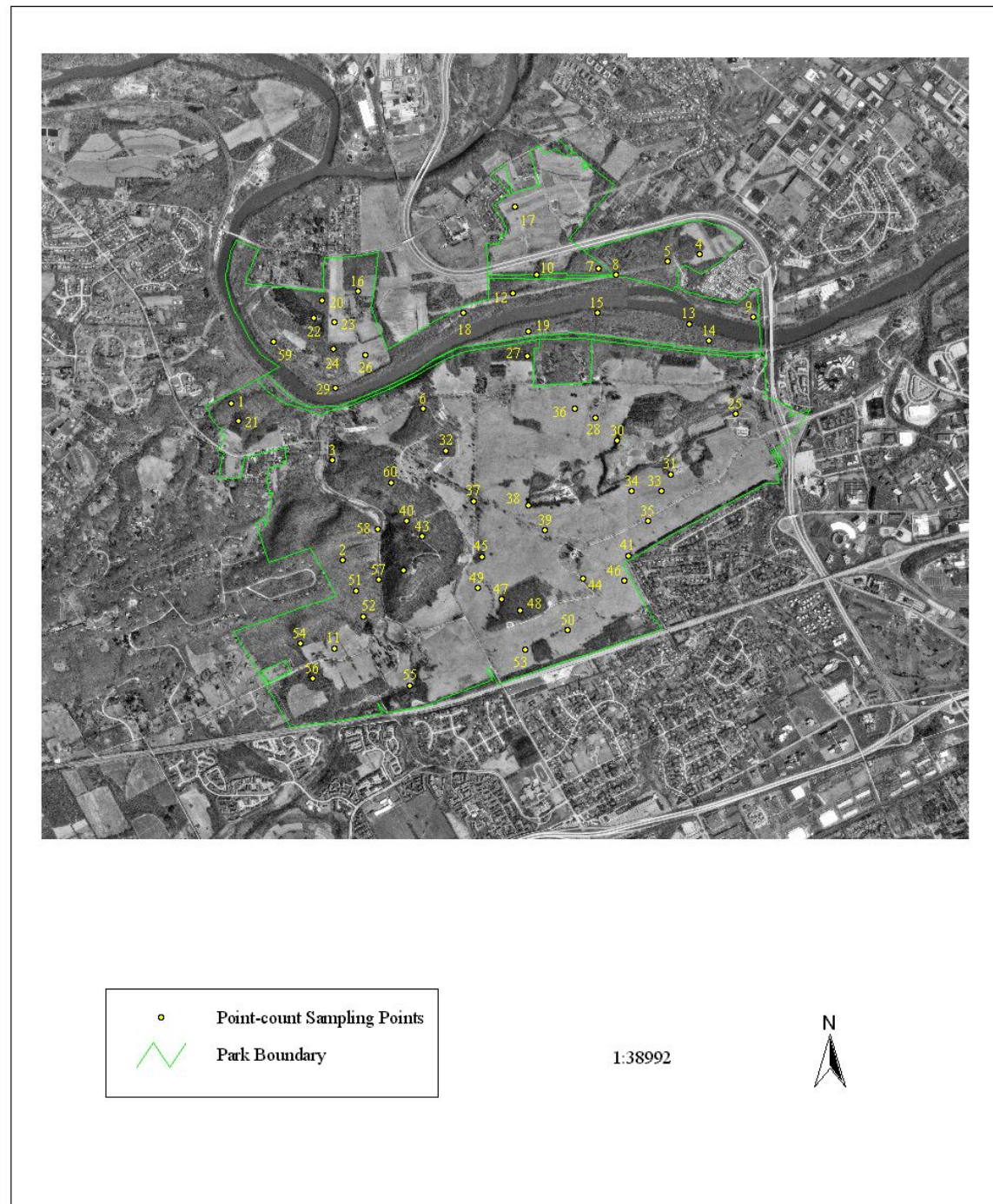
Appendix C. Aerial photograph of Valley Forge National Historical Park displaying fields within the park.



Appendix D. Aerial photograph of Valley Forge National Historical Park displaying landmarks within and adjacent to the park.



Appendix E. Location of the point-count sampling points at Valley Forge National Historical Park.



Appendix F. Description of cover types, spatial locations, and elevations used to define habitats at Valley Forge National Historical Park.

Habitat Category	Habitat	Description
Cover type		Derived from thematic mapper imagery, 30- x 30-m resolution
	Water	Areas dominated by water
	Coniferous forest	Forested areas dominated by coniferous-tree species
	Mixed forest	Forested areas dominated by a mixture of coniferous- and deciduous-tree species
	Deciduous forest	Forested areas dominated by deciduous-tree species
	Early successional	Areas dominated by early successional habitats (e.g., successional old fields, sapling and/or shrub dominated areas)
	Perennial herbaceous	Areas dominated by perennial-herbaceous cover (e.g., pasture, lawn, grasslands)
	Annual herbaceous	Areas dominated by annual-herbaceous cover (e.g., cropland)
	Terrestrial unvegetated	Terrestrial areas dominated by lack of vegetation (e.g., urbanized land, roads, strip mines, bare ground)
Spatial location		Derived from Pennsylvania Department of Transportation digital road and stream coverage
	Interior	Areas > 50 m from a road or stream
	Road edge	Areas $\leq$ 50 m from a road
	Stream edge	Areas $\leq$ 50 m from a stream
Elevation		Derived from 100- x 100-m Digital Elevation Models (DEMs)
	Low	Areas $\leq$ mean elevation at VAFO
	High	Areas > mean elevation at VAFO

Appendix G. Habitat information and geographic coordinates for the point-count sampling points at Valley Forge National Historical Park. Definitions of habitat information are found in Appendix F. Coordinates are universal transverse mercator (UTM) projection Zone 18N projected on the North American Datum (NAD) of 1983.

Point	Point Type	Cover Type	Spatial Location	Elevation	UTM-East	UTM-North
1	Point-count	Deciduous Forest	Stream Edge	Low	459878	4439252
2	Point-count	Deciduous Forest	Interior	Low	460775	4437997
3	Point-count	Mixed Forest	Road Edge	Low	460688	4438801
4	Point-count	Perennial Herbaceous	Interior	Low	463631	4440451
5	Point-count	Deciduous Forest	Interior	Low	463377	4440398
6	Point-count	Deciduous Forest	Road Edge	Low	461419	4439211
7	Point-count	Early Successional	Interior	Low	462820	4440343
8	Point-count	Perennial Herbaceous	Interior	Low	462960	4440287
9	Point-count	Terrestrial Unvegetated	NA	Low	464062	4439948
10	Point-count	Mixed Forest	Interior	Low	462326	4440291
11	Point-count	Perennial Herbaceous	Interior	Low	460705	4437293
12	Point-count	Deciduous Forest	Interior	Low	462132	4440143
13	Point-count	Deciduous Forest	Stream Edge	Low	463549	4439895
14	Point-count	Deciduous Forest	Stream Edge	Low	463709	4439757
15	Point-count	Deciduous Forest	Stream Edge	Low	462812	4439983
16	Point-count	Perennial Herbaceous	Interior	Low	460894	4440155
17	Point-count	Annual Herbaceous	Interior	Low	462150	4440835
18	Point-count	Deciduous Forest	Interior	Low	461738	4439987
19	Point-count	Deciduous Forest	Stream Edge	Low	462261	4439836
20	Point-count	Deciduous Forest	Interior	Low	460609	4440082
21	Point-count	Coniferous Forest	Interior	Low	459937	4439118
22	Point-count	Coniferous Forest	Interior	Low	460543	4439938

Appendix G. Habitat information and geographic coordinates for the point-count sampling points at Valley Forge National Historical Park. Definitions of habitat information are found in Appendix F. Coordinates are universal transverse mercator (UTM) projection Zone 18N projected on the North American Datum (NAD) of 1983 (continued).

Point	Point Type	Cover Type	Spatial Location	Elevation	UTM-East	UTM-North
23	Point-count	Perennial Herbaceous	Interior	Low	460704	4439910
24	Point-count	Deciduous Forest	Interior	Low	460697	4439693
25	Point-count	Terrestrial Unvegetated	NA	Low	463917	4439171
26	Point-count	Perennial Herbaceous	Interior	Low	460957	4439646
27	Point-count	Coniferous Forest	Interior	Low	462252	4439635
28	Point-count	Perennial Herbaceous	Interior	High	462792	4439142
29	Point-count	Mixed Forest	Stream Edge	Low	460718	4439381
30	Point-count	Mixed Forest	Interior	Low	462973	4438959
31	Point-count	Perennial Herbaceous	Interior	High	463398	4438688
32	Point-count	Deciduous Forest	Interior	High	461602	4438879
33	Point-count	Annual Herbaceous	Interior	High	463088	4438552
34	Point-count	Perennial Herbaceous	Interior	High	463329	4438553
35	Point-count	Perennial Herbaceous	Road Edge	High	463218	4438313
36	Point-count	Perennial Herbaceous	Interior	High	462632	4439212
37	Point-count	Deciduous Forest	Road Edge	High	461823	4438474
38	Point-count	Perennial Herbaceous	Interior	High	462261	4438435
39	Point-count	Perennial Herbaceous	Road Edge	High	462393	4438241
40	Point-count	Deciduous Forest	Interior	High	461287	4438316
41	Point-count	Coniferous Forest	Road Edge	High	463062	4438037
42	Point-count	Deciduous Forest	Interior	High	461263	4437915
43	Point-count	Deciduous Forest	Road Edge	High	461409	4438187
44	Point-count	Annual Herbaceous	Interior	High	462699	4437855

Appendix G. Habitat information and geographic coordinates for the point-count sampling points at Valley Forge National Historical Park. Definitions of habitat information are found in Appendix F. Coordinates are universal transverse mercator (UTM) projection Zone 18N projected on the North American Datum (NAD) of 1983 (continued).

Point	Point Type	Cover Type	Spatial Location	Elevation	UTM-East	UTM-North
45	Point-count	Deciduous Forest	Interior	High	461889	4438028
46	Point-count	Perennial Herbaceous	Interior	High	463028	4437833
47	Point-count	Deciduous Forest	Interior	High	462045	4437688
48	Point-count	Deciduous Forest	Interior	High	462190	4437592
49	Point-count	Perennial Herbaceous	Interior	High	461855	4437779
50	Point-count	Perennial Herbaceous	Interior	High	462576	4437436
51	Point-count	Deciduous Forest	Interior	High	460877	4437755
52	Point-count	Deciduous Forest	Interior	High	460937	4437549
53	Point-count	Perennial Herbaceous	Interior	High	462237	4437283
54	Point-count	Deciduous Forest	Interior	High	460432	4437330
55	Point-count	Deciduous Forest	Stream Edge	Low	461311	4436996
56	Point-count	Coniferous Forest	Interior	High	460529	4437052
57	Point-count	Deciduous Forest	Road-Stream Edge	Low	461060	4437845
58	Point-count	Deciduous Forest	Road-Stream Edge	Low	461052	4438252
59	Point-count	Deciduous Forest	Interior	Low	460222	4439751
60	Point-count	Deciduous Forest	Interior	High	461157	4438624

Appendix H. Verbal descriptions for the point-count sampling points at Valley Forge National Historical Park.

Point	Description
1	Travel 150m at 340° from Point # 21 to reach Point # 1 (approximately 50m before reaching the stream).
2	Point # 2 is 330m further up the Mount Misery trail from Point # 51. Travel along the trail for approximately 300m until you reach the split in the trail. Continue straight past the trail closed sign for 30m to reach Point # 2 (down logs cover the old trail).
3	When traveling north on route 252 pull off to the right side of the road at the sign for the junction with route 23 East & West. The traffic light for the intersection of route 252 and 23 should be visible. Travel 40m at 150° from the route 23 East and West sign to reach Point # 3.
4	On the north side of the Schuylkill River, turn right off of Trooper Road to enter the trailer park (prior to the entrance to Betzwood Park). Travel past the trailer park, past the large powerline right-of-way, and park in the gravel turn around (dead end). Find the walking path and travel southeast (crosses the stream) until you come to the forest/powerline habitat edge. Travel northeast for 100m and Point # 4 is 15m from woodland edge to the west and even with the large powerline pole.
5	On the north side of the Schuylkill River, turn right off of Trooper Road to enter the trailer park (prior to the entrance to Betzwood Park). Travel past the trailer park until you reach the large powerline right-of-way. Turn left into onto the powerline right-of-way and park approximately 20m before the first large powerline pole. Travel 10m into the forest at 0° from the forest/powerline habitat edge to reach Point # 5.
6	Enter Inner Line Drive from route 23 across from the parking lot entrance to Wahington's Headquarters. Park at the first yellow & black colored marker signifying a curve in the road (approximately 100m before the first left turn on Inner Line Drive) Travel 30m @ 180° to reach Point # 6.
7	From Point # 5 travel east along the powerline right-of-way to the intersection with the old railroad grade. Travel approximately 150m northwest on the old railroad grade to the first walking path on the right side of the old railroad grade. Travel 50m along the path (35m into the early successional habitat) to reach Point # 7.
8	From Point # 5 travel east along the powerline right-of-way to the intersection with the old railroad grade. Point # 8 is located at the intersection of the old railroad grade and the powerline right-of-way.
9	On the north side of the Schuylkill River, travel on Trooper Road and take a right into Betzwood Park. Take the left hand split and park in the lot adjacent to the boat launch. Point # 9 is located at the large sycamore just northeast of the parking lot.
10	From Point # 7, travel northwest on the old railroad grade and Point # 10 is located directly above the second stream that crosses under the railroad grade.
11	In the southwest corner of the park, park at Stirling's Quarters. Walk to field # 75 and Point # 11 is located at the lone tree (black cherry) in the middle of the field.
12	From Point # 8, travel west along the powerline right-of-way to pole (65 220 63). Go 10m into the woods at 350° from the pole to reach Point # 12.

Appendix H. Verbal descriptions for the point-count sampling points at Valley Forge National Historical Park (continued).

Point	Description
13	If traveling east on route 23 from Huntington's Quarters, turn left on the dead end road that used to lead across the Schuylkill River to Betzwood park. Take the first left hand turn, pass through the park housing, and travel to the railroad tracks. Travel west along the railroad tracks and park at the first approximately 1m high fiber optics marker on the south side of the tracks. From the fiber optics pole, walk approximately 180m @ 10° (to within 20m of the river) to reach Point # 13.
14	If traveling east on route 23 from Huntington's Quarters, turn left on the dead end road that used to lead across the Schuylkill River to Betzwood park. Take the first left hand turn, pass through the park housing, and travel to the railroad tracks. Find the nearest approximately 1m high fiber optics marker on the far (north) side of the tracks from where you first entered the railroad right-of-way. From the fiber optics marker travel 75m @ 0° to reach Point # 14.
15	From Point # 13 travel west along the railroad tracks until you reach a 2.5m tall fiber optics pole number 22-2 with a "birdhouse like top". Go approximately 165m @ 10° (to w/in 20m of the river) from the pole to reach Point # 15.
16	On the north side of the Schuylkill River, travel east on Pawling's Road and turn right into the Walnut Hill section of the Park. Travel south on the gravel/dirt road for approximately 0.25 miles until you come to a small powerline that runs perpendicular to the gravel/dirt road. Locate the utility pole approximately 50-75m down slope from the left side of the road. From the pole travel 100m at 90° to reach Point # 16.
17	On the north side of the Schuylkill River, travel east on Pawling's Road and turn right onto Camiel Lane. From the gate at the end of Camiel Lane travel 135m at 150° to reach Point # 17.
18	From Point # 12, travel west along the powerline right-of-way to pole (63 220 63). Go 40m at 150° from the pole to reach Point # 18.
19	From Point # 15 travel west along the railroad tracks until you reach a 2.5m tall fiber optics pole number 22-3 with a "birdhouse like top". Go to within 20m of the river at 0° from the pole to reach Point # 19 (you should end up in a horseshoe gully bisected by a winding path).
20	From where you parked the vehicle to walk to Point # 16, travel across the field on the right side of the road to the south side of the small power line. From the northeastern most corner of the forested area south of the small powerline, travel 50m south along the forest/field edge. Next, walk 50m into the woods on a bearing perpendicular to the edge to reach Point # 20.
21	Travel east along route 23 from Huntington's Quarters until you reach the Valley Forge Post Office. From the northeast corner of the cemetery behind the Post Office, travel 100m at 40° to reach Point # 21.
22	On the north side of the Schuylkill River, travel east on Pawling's Road and turn right into the Walnut Hill section of the Park. Travel south on the dirt road past the park housing and park near the old barn on the right. Walk east across the field from the old barn to the large white oak snag in the Walnut Hill field. From the snag go 130m at 270° to reach Point # 22 (within the clearing between mature and pole stand conifers).

Appendix H. Verbal descriptions for the point-count sampling points at Valley Forge National Historical Park (continued).

Point	Description
23	On the north side of the Schuylkill River, travel east on Pawling's Road and turn right into the Walnut Hill section of the Park. Travel south on the dirt road past the park housing and park near the old barn on the right. Walk east across the field from the old barn to the large white oak snag in the Walnut Hill field. From the snag go 50m at 130° to reach Point # 23.
24	On the north side of the Schuylkill River, travel east on Pawling's Road and turn right into the Walnut Hill section of the Park. Travel south on the dirt road past the park housing and old barn on the right. Continue past the 90° right angle curve in the gravel road to a small gravel pull-off approximately half way across the field on the right side of the road. From the gravel pull-off, walk 65m at 210° to reach Point # 24.
25	From route 23 turn into the Visitor's Center. Make the first right and park in the Visitor's Center parking area. Walk back to the grass triangle formed by the Visitor's Center and parking lot roads to reach Point # 25.
26	On the north side of the Schuylkill River, travel east on Pawling's Road and turn right into the Walnut Hill section of the Park. Travel south on the dirt road past the park housing and old barn on the right. Park at the 90° right angle curve in the gravel road. From the turn walk 100m at 160° to reach Point # 26.
27	Traveling west on route 23 from Huntington's Quarters, turn right and park at Defenders Gate Chapel. Walk through the row of trees and into field 21. From the northeast corner of the field, go 65m at 150° to reach Point # 27 (entering into the conifer stand).
28	Behind Huntington's Quarters locate the fire hydrant near the spring house. From the fire hydrant, walk 70m at 190° to reach Point # 28.
29	On the North Side of the Schuylkill River pull into the Pawling's Parking Area (located in the northwest corner of the park). Travel East along the Schuylkill River Trail until you reach a small clump of cedar trees in the middle of the trail. From the clump of cedar trees, walk along a 20° bearing to the top of the dyke to reach Point # 29.
30	From Point # 28 walk approximately 250m at 160° to reach Point # 30. Point # 30 is at the edge of the field and a narrow strip of mature coniferous and deciduous trees.
31	From County Line Road, pull into the old amphitheater. From the west corner of the amphitheater wall, go 20m at 270° to reach point # 31.
32	Turn on to Gulph Road from route 23. From Gulph Road take the second left turn and enter the parking lot immediately on you right. From the stop sign at exit to the parking lot, walk 60m at 0° to reach Point # 32.
33	From Point # 31 walk southeast (up slope) and locate the lone tree in field 46. From the lone tree walk 20m at 290° to reach Point # 33.
34	From Point # 33 walk 150m at 290° to reach Point # 34 (near the edge of fields 46 and 47).

Appendix H. Verbal descriptions for the point-count sampling points at Valley Forge National Historical Park (continued).

Point	Description
35	Enter Outer Line Drive from the Visitor's Center. Travel 0.25 – 0.30 miles along Outer Line Drive. On the left side of the road you will pass a parking lot, a set of two trees in the middle of field 45, and a single tree in the middle of field 45. Point # 35 is located 15m off road and lined up between a tree by the side of Outer Line Drive and the second single tree (snag) in the middle of field 45. For further reference, there is a gap in the line of conifers located along the southern boundary to the park.
36	From the spring house behind Huntington's Quarters, walk 120m at 270° to reach Point # 36.
37	Turn on to Gulph Road from route 23. Travel southeast on Gulph Road until you come to the Historic Trace Road. Pull over and walk south along the Historic Trace Road for 20m to reach Point # 37.
38	From Point # 37 travel southeast along Gulph Road until you reach County Line Road. Point # 38 is located at the mature white pine at the point of the woodlot encircling the maintenance area (approximately 150m north-northwest of the intersection of Gulph Road and County Line Road).
39	From Point # 37 travel southeast along Gulph Road. Point # 38 is located at the first tree on your left after you pass the turn onto County Line Road.
40	Turn on to Gulph Road from route 23. From Gulph Road turn right on to Inner Line Drive (first right). Continue on Inner Line Drive for approximately 0.15-0.20 miles past where you enter the forested area on Mount Joy until you reach a pull off on the right side of the road. Locate the sign for the walking trail approximately 20m off of the right side of the road. From the trail sign walk 50m at 300° to reach Point # 40.
41	Point # 41 is in the center of the group of young white pines just north of the intersection of Gulph Road and Thomas Road.
42	Turn on to Gulph Road from route 23. From Gulph Road turn right on to Inner Line Drive (first right). Continue traveling on Inner Line Drive for approximately 1 mile and take the first right. Continue up Mount Joy and turn right into the parking area on top of Mount Joy. Walk 65m at 90° from the first bench in the parking lot to reach Point # 42.
43	Turn on to Gulph Road from route 23. From Gulph Road turn right on to Inner Line Drive (first right). Continue traveling on Inner Line Drive for approximately 0.8 miles. Park about 30m after making a sharp left curve on Inner Line Drive. Walk 20m at 45° from the first reflector on right side of the road to reach Point # 43.
44	Enter Outer Line Drive from the Visitor's Center. Travel along Outer Line Drive (past the junction of Gulph Road and Outer Line Drive) to opposite side of the National Memorial Arch. Stop at the first culvert past the end of the parking area for the National Memorial Arch (where Outer Line Drive becomes a one way road). From the culvert on left side of the road walk 50m at 50° to reach Point # 44.
45	Point # 45 is located in the middle of the small woodlot at the southern end of the Historic Trace Road.
46	Point # 46 is located 150m at 210° from the intersection of Gulph Road and Thomas Road.
47	From Point # 44 continue traveling on Outer Line Drive past the Statue of General Wayne until you reach the northwest corner of Wayne's Woodlot (forest behind the statue of General Wayne). Find the walking path that bisects the woodlot. Walk southeast along the path for 20m to reach Point # 47.

Appendix H. Verbal descriptions for the point-count sampling points at Valley Forge National Historical Park (continued).

Point	Description
48	From Point # 47 walk 150m at 150° to reach Point # 48.
49	Walk northwest for approximately 175m from where you parked for Point # 47. Locate the 0.5m tall pipe in field 63. Point # 49 is located at the pipe.
50	From Point # 44 continue traveling on Outer Line Drive until you reach the parking lot on the right side of the road. Cross the road and travel through field 52 to wooded northern boarder of field 57. Locate the white pine that juts out into field 57 about half way along the northern boarder. From the pine walk 50m at 150° to reach Point # 50.
51	Point # 51 is 250m further up the Mount Misery trail from Point # 52. Travel along the trail for 250m then travel off of the trail for an additional 30m at 40° to reach Point # 51.
52	Turn on to Yellow Springs Road from route 252. Turn right into the parking area for the Mount Misery trail (opposite the left turn for Maxwell's Quarters). From the parking area walk up the Mount Misery trail until you reach the first split in the trail. Point # 52 is located at the split in the trail.
53	From Point # 44 travel along Outer Line Drive past the parking area for Point # 50 and turn right into the parking loop for the statue of General Wayne. Walk south through field 61 to the second tree located along the boarder of fields 60 and 61. Point # 53 is located at the second tree.
54	Walk 60m at 0° from the northwest corner of field 74 (behind the Stirling's Quarters).
55	Turn on to Yellow Springs Road from route 252. Turn left and keep driving past Maxwell's Quarters until you reach the intersection with a dirt/gravel road. From the intersection walk to the southeast corner of field 68. Point # 55 is located 10m from Valley Creek in the southeast corner of the field.
56	In the southwest corner of the park, park at Stirling's Quarters. Coming from the parking lot for Stirling's Quarters, walk across Yellow Springs Road and locate the dirt road leading to field 77. Walk 80m down the road toward field 77. Take a 90° right angle turn and walk 25m into the red cedar plantation to reach Point # 56.
57	Park at the gravel turn of on the Valley Creek side of route 252 approximately half way between the junction of routes 23 and 252 and the junction of route 252 and Yellow Springs Road (at the location of the old foot-bridge that crossed Valley Creek). The Valley Creek trail is located on Mount Misery side of Valley Creek (opposite route 252). From the location of the old Valley Creek footbridge, walk southwest along the Valley Creek trail for 100m to reach Point # 57.
58	From Point # 57 walk north along the Valley Creek trail for 200m to reach Point # 58.
59	On the north side of the Schuylkill River, travel east on Pawling's Road and turn right into the Walnut Hill section of the Park. Travel south on the dirt road past the park housing and old barn on the right and then travel west on the gravel road toward the boy scout field after making the 90° right angle curve in the gravel road. From the northwest corner of the boy scout field walk 100m at 240° to reach point # 59.
60	Turn on to Gulph Road from route 23. From Gulph Road turn right on to Inner Line Drive (first right). Locate the New Jersey Brigade statue at the forest/field edge on your right. From the statue walk 125m at 240° to reach Point # 60.

Appendix I. Data sheet used when conducting point-count surveys at Valley Forge National Historical Park.

BIRD POINT-COUNT SURVEY FOR VALLEY FORGE NATIONAL HISTORICAL PARK

Season _____ Date _____ Visit # _____ Temp _____

Wind _____ Clouds _____ Precipitation _____ Observer(s) _____

[illegible]

Appendix J. Four-letter species codes for birds of the Eastern United States.

Species	Four-letter Species Code
Common Loon (<i>Gavia immer</i>)	COLO
Pied-billed Grebe (<i>Podilymbus podiceps</i>)	PBGR
Horned Grebe (<i>Podiceps auritus</i>)	HOGR
Double-crested Cormorant (<i>Phalacrocorax auritus</i>)	DCCO
American Bittern (<i>Botaurus lentiginosus</i>)	AMBI
Least Bittern (<i>Ixobrychus exilis</i>)	LEBI
Great Blue Heron (<i>Ardea herodias</i>)	GBHE
Great Egret (<i>Ardea alba</i>)	GREG
Snowy Egret (<i>Egretta thula</i>)	SNEG
Little Blue Heron (<i>Egretta caerulea</i>)	LBHE
Tricolored Heron (<i>Egretta tricolor</i>)	TRHE
Cattle Egret (<i>Bubulcus ibis</i>)	CAEG
Green Heron (<i>Butorides virescens</i>)	GRHE
Black-crowned Night-Heron (<i>Nycticorax nycticorax</i>)	BCNH
Yellow-crowned Night-heron (<i>Nyctanassa violacea</i>)	YCNH
Glossy Ibis (<i>Plegadis falcinellus</i>)	GLIB
Black Vulture (<i>Coragyps atratus</i>)	BLVU
Turkey Vulture (<i>Cathartes aura</i>)	TUVU
Tundra Swan (<i>Cygnus columbianus</i>)	TUSW
Mute Swan (<i>Cygnus olor</i>)	MUSW
Snow Goose (<i>Chen caerulescens</i>)	SNGO
Canada Goose (<i>Branta canadensis</i>)	CAGO
Wood Duck (<i>Aix sponsa</i>)	WODU
Green-winged Teal (<i>Anas crecca</i>)	GWTE
American Black Duck (<i>Anas rubripes</i>)	AMBD
Mallard (<i>Anas platyrhynchos</i>)	MALL
Northern Pintail (<i>Anas acuta</i>)	NOPI
Blue-winged Teal (<i>Anas discors</i>)	BWTE
Northern Shoveler (<i>Anas clypeata</i>)	NOSH
Gadwall (<i>Anas strepera</i>)	GADW
American Wigeon (<i>Anas americana</i>)	AMWI
Canvasback (<i>Aythya valisineria</i>)	CANV
Redhead (<i>Aythya americana</i>)	REDH

Appendix J. Four-letter species codes for birds of the Eastern United States (continued).

Species	Four-letter Species Code
Ring-necked Duck (<i>Aythya collaris</i>)	RNDU
Greater Scaup (<i>Aythya marila</i>)	GRSC
Lesser Scaup (<i>Aythya affinis</i>)	LESC
Black Scoter (<i>Melanitta nigra</i>)	BLSC
White-winged Scoter (<i>Melanitta fusca</i>)	WWSC
Oldsquaw (<i>Clangula hyemalis</i>)	OLDS
Common Goldeneye (<i>Bucephala clangula</i>)	COGO
Bufflehead (<i>Bucephala albeola</i>)	BUFF
Hooded Merganser (<i>Lophodytes cucullatus</i>)	HOME
Common Merganser (<i>Mergus merganser</i>)	COME
Red-breasted Merganser (<i>Mergus serrator</i>)	RBME
Ruddy Duck (<i>Oxyura jamaicensis</i>)	RUDU
Osprey (<i>Pandion haliaetus</i>)	OSPR
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	BAEA
Northern Harrier (<i>Circus cyaneus</i>)	NOHA
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	SSHA
Cooper's Hawk (<i>Accipiter cooperii</i>)	COHA
Northern Goshawk (<i>Accipiter gentilis</i>)	NOGO
Red-shouldered Hawk (<i>Buteo lineatus</i>)	RSHA
Broad-winged Hawk (<i>Buteo platypterus</i>)	BWHA
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	RTHA
Rough-legged Hawk (<i>Buteo lagopus</i>)	RLHA
Golden Eagle (<i>Aquila chrysaetos</i>)	GOEA
American Kestrel (<i>Falco sparverius</i>)	MAKE
Merlin (<i>Falco columbarius</i>)	MERL
Peregrine Falcon (<i>Falco peregrinus</i>)	PEFA
Ring-necked Pheasant (<i>Phasianus colchicus</i>)	RNPH
Ruffed Grouse (<i>Bonasa umbellus</i>)	RUGR
Wild Turkey (<i>Meleagris gallopavo</i>)	WITU
Northern Bobwhite (<i>Colinus virginianus</i>)	NOBO
King Rail (<i>Rallus elegans</i>)	KIRA
Virginia Rail (<i>Rallus limicola</i>)	VIRA
Clapper Rail (<i>Rallus longirostris</i>)	CLRA

Appendix J. Four-letter species codes for birds of the Eastern United States (continued).

Species	Four-letter Species Code
Sora (<i>Prozana carolina</i>)	SORA
Common Moorhen (<i>Gallinula chloropus</i>)	COMO
American Coot (<i>Fulica atra</i>)	AMCO
Semipalmated Plover (<i>Charadrius semipalmatus</i>)	SEPL
Killdeer (<i>Charadrius vociferus</i>)	KILL
Greater Yellowlegs (<i>Tringa melanoleuca</i>)	GRYE
Lesser Yellowlegs (<i>Tringa flavipes</i>)	LEYE
Solitary Sandpiper (<i>Tringa solitaria</i>)	SOSA
Spotted Sandpiper (<i>Actitis macularia</i>)	SPSA
Least Sandpiper (<i>Calidris minutilla</i>)	LESA
Western Sandpiper (<i>Calidris mauri</i>)	WESA
Upland Sandpiper (<i>Bartramia longicauda</i>)	UPSA
Semipalmated Sandpiper (<i>Calidris pusilla</i>)	SESA
Pectoral Sandpiper (<i>Calidris melanotos</i>)	PESA
Common Snipe (<i>Gallinago gallinago</i>)	COSN
American Woodcock (<i>Scolopax minor</i>)	AMWO
Laughing Gull (<i>Larus atricilla</i>)	LAGU
Bonaparte's Gull (<i>Larus philadelphia</i>)	BOGU
Ring-billed Gull (<i>Larus delawarensis</i>)	RBGU
Herring Gull (<i>Larus argentatus</i>)	HEGU
Lesser Black-backed Gull (<i>Larus fuscus</i>)	LBBG
Greater Black-backed Gull (<i>Larus marinus</i>)	GBBG
Common Tern (<i>Sterna hirundo</i>)	COTE
Rock Dove (<i>Columba livia</i>)	RODO
Mourning Dove (<i>Zenaida macroura</i>)	MODO
Black-billed Cuckoo (<i>Coccyzus erythrophthalmus</i>)	BBCU
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)	YBCU
Barn Owl (<i>Tyto alba</i>)	BNOW
Eastern Screech-owl (<i>Otus asio</i>)	EASO
Great Horned Owl (<i>Bubo virginianus</i>)	GHOW
Barred Owl (<i>Strix varia</i>)	BDOW
Long-eared Owl (<i>Asio otus</i>)	LEOW
Short-eared Owl (<i>Asio flammeus</i>)	SEOW

Appendix J. Four-letter species codes for birds of the Eastern United States (continued).

Species	Four-letter Species Code
Northern Saw-whet Owl (<i>Aegolius acadicus</i>)	NSWO
Common Nighthawk (<i>Chordeiles minor</i>)	CONI
Chuck-will's-widow (<i>Caprimulgus carolinensis</i>)	CWWI
Whip-poor-will (<i>Caprimulgus vociferous</i>)	WPWI
Chimney Swift (<i>Chaetura pelagica</i>)	CHSW
Ruby-throated Hummingbird (<i>Archilochus colubris</i>)	RTHU
Belted Kingfisher (<i>Ceryle alcyon</i>)	BEKI
Red-headed Woodpecker (<i>Melanerpes erythrocephalus</i>)	RHOW
Red-bellied Woodpecker (<i>Melanerpes carolinus</i>)	RBWO
Yellow-bellied Sapsucker (<i>Sphyrapicus varius</i>)	YBSA
Downy Woodpecker (<i>Picoides pubescens</i>)	DOWO
Hairy Woodpecker (<i>Picoides villosus</i>)	HAWO
Northern Flicker (<i>Colaptes auratus</i>)	NOFL
Pileated Woodpecker (<i>Dryocopus pileatus</i>)	PIWO
Olive-sided Flycatcher (<i>Contopus cooperi</i>)	OSFL
Eastern Wood-pewee (<i>Contopus virens</i>)	EAWP
Yellow-bellied Flycatcher (<i>Empidonax flaviventris</i>)	YBFL
Acadian Flycatcher (<i>Empidonax virescens</i>)	ACFL
Alder Flycatcher (<i>Empidonax alnorum</i>)	ALFL
Willow Flycatcher (<i>Empidonax traillii</i>)	WIFL
Least Flycatcher (<i>Empidonax minimus</i>)	LEFL
Eastern Phoebe (<i>Sayornis phoebe</i>)	EAPH
Great Crested Flycatcher (<i>Myiarchus crinitus</i>)	GCFL
Eastern Kingbird (<i>Tyrannus tyrannus</i>)	EAKI
Horned Lark (<i>Eremophila alpestris</i>)	HOLA
Purple Martin (<i>Progne subis</i>)	PUMA
Tree Swallow (<i>Tachycineta bicolor</i>)	TRSW
Northern Rough-winged Swallow (<i>Stelgidopteryx serripennis</i>)	NRWS
Bank Swallow (<i>Riparia riparia</i>)	BANS
Cliff Swallow (<i>Petrochelidon pyrrhonota</i>)	CLSW
Barn Swallow (<i>Hirundo rustica</i>)	BARS
Blue Jay (<i>Cyanocitta cristata</i>)	BLJA
American Crow (<i>Corvus brachyrhynchos</i>)	AMCR

Appendix J. Four-letter species codes for birds of the Eastern United States (continued).

Species	Four-letter Species Code
Fish Crow (<i>Corvus ossifragus</i>)	FICR
Common Raven (<i>Corvus corax</i>)	CORA
Black-capped Chickadee (<i>Poecile atricapilla</i>)	BCCH
Carolina Chickadee (<i>Poecile carolinensis</i>)	CACH
Tufted Titmouse (<i>Baeolophus bicolor</i>)	TUTI
Red-breasted Nuthatch (<i>Sitta canadensis</i>)	RBNU
White-breasted Nuthatch (<i>Sitta carolinensis</i>)	WBNU
Brown Creeper (<i>Certhia americana</i>)	BRCR
Carolina Wren (<i>Thyothorus ludovicianus</i>)	CARW
Bewick's Wren (<i>Thyothorus bewickii</i>)	BEWR
House Wren (<i>Troglodytes aedon</i>)	HOWR
Winter Wren (<i>Troglodytes troglodytes</i>)	WIWR
Sedge Wren (<i>Cistothorus platensis</i>)	SEWR
Marsh Wren (<i>Cistothorus palustris</i>)	MAWR
Golden-crowned Kinglet (<i>Regulus satrapa</i>)	GCKI
Ruby-crowned Kinglet (<i>Regulus calendula</i>)	RCKI
Blue-gray Gnatcatcher (<i>Poliophtila caerulea</i>)	BGGN
Eastern Bluebird (<i>Sialia sialis</i>)	EABL
Veery (<i>Catharus fuscescens</i>)	VEER
Gray-cheeked Thrush (<i>Catharus minimus</i>)	GCTH
Bicknell's Thrush (<i>Catharus bicknelli</i>)	BITH
Swainson's Thrush (<i>Catharus ustulatus</i>)	SWTH
Hermit Thrush (<i>Catharus guttatus</i>)	HETH
Wood Thrush (<i>Hylocichla mustelina</i>)	WOTH
American Robin (<i>Turdus migratorius</i>)	AMRO
Gray Catbird (<i>Dumetella carolinensis</i>)	GRCA
Northern Mockingbird (<i>Mimus polyglottos</i>)	NOMO
Brown Thrasher (<i>Toxostoma rufum</i>)	BRTH
American Pipit (<i>Anthus rubescens</i>)	AMPI
Cedar Waxwing (<i>Bombicilla cedrorum</i>)	CEDW
Northern Shrike (<i>Lanius excubitor</i>)	NSHR
Loggerhead Shrike (<i>Lanius ludovicianus</i>)	LOSH
European Starling (<i>Sturnus vulgaris</i>)	EUST

Appendix J. Four-letter species codes for birds of the Eastern United States (continued).

Species	Four-letter Species Code
White-eyed Vireo (<i>Vireo griseus</i>)	WEVI
Blue-headed Vireo (<i>Vireo solitarius</i>)	BHVI
Yellow-throated Vireo (<i>Vireo flavifrons</i>)	YTVI
Warbling Vireo (<i>Vireo gilvus</i>)	WAVI
Philadelphia Vireo (<i>Vireo philadelphicus</i>)	PHVI
Red-eyed Vireo (<i>Vireo olivaceus</i>)	REVI
Blue-winged Warbler (<i>Vermivora pinus</i>)	BWWA
Golden-winged Warbler (<i>Vermivora chrysoptera</i>)	GWWA
Tennessee Warbler (<i>Vermivora peregrina</i>)	TEWA
Orange-crowned Warbler (<i>Vermivora celata</i>)	OCWA
Nashville Warbler (<i>Vermivora ruficapilla</i>)	NAWA
Northern Parula (<i>Parula americana</i>)	NOPA
Yellow Warbler (<i>Dendroica petechia</i>)	YEWA
Chestnut-sided Warbler (<i>Dendroica pensylvanica</i>)	CSWA
Magnolia Warbler (<i>Dendroica magnolia</i>)	MAWA
Cape May Warbler (<i>Dendroica tigrina</i>)	CMWA
Black-throated Blue Warbler (<i>Dendroica caerulescens</i>)	BTBW
Yellow-rumped Warbler (<i>Dendroica coronata</i>)	YRWA
Black-throated Green Warbler (<i>Dendroica virens</i>)	BTNW
Blackburnian Warbler (<i>Dendroica fusca</i>)	BLBW
Yellow-throated Warbler (<i>Dendroica dominica</i>)	YTWA
Pine Warbler (<i>Dendroica pinus</i>)	PIWA
Prairie Warbler (<i>Dendroica discolor</i>)	PRAW
Palm Warbler (<i>Dendroica palmarum</i>)	PAWA
Bay-breasted Warbler (<i>Dendroica castanea</i>)	BBWA
Blackpoll Warbler (<i>Dendroica striata</i>)	BLPW
Cerulean Warbler (<i>Dendroica cerulea</i>)	CERW
Black-and-white Warbler (<i>Mniotilta varia</i>)	BAWW
American Redstart (<i>Setophaga ruticilla</i>)	AMRE
Prothonotary Warbler (<i>Prothonotaria citrea</i>)	PROW
Worm-eating Warbler (<i>Helmitheros vermivorus</i>)	WEWA
Swainson's Warbler (<i>Limnothlypis swainsonii</i>)	SWWA
Ovenbird (<i>Seiurus aurocapillus</i>)	OVEN

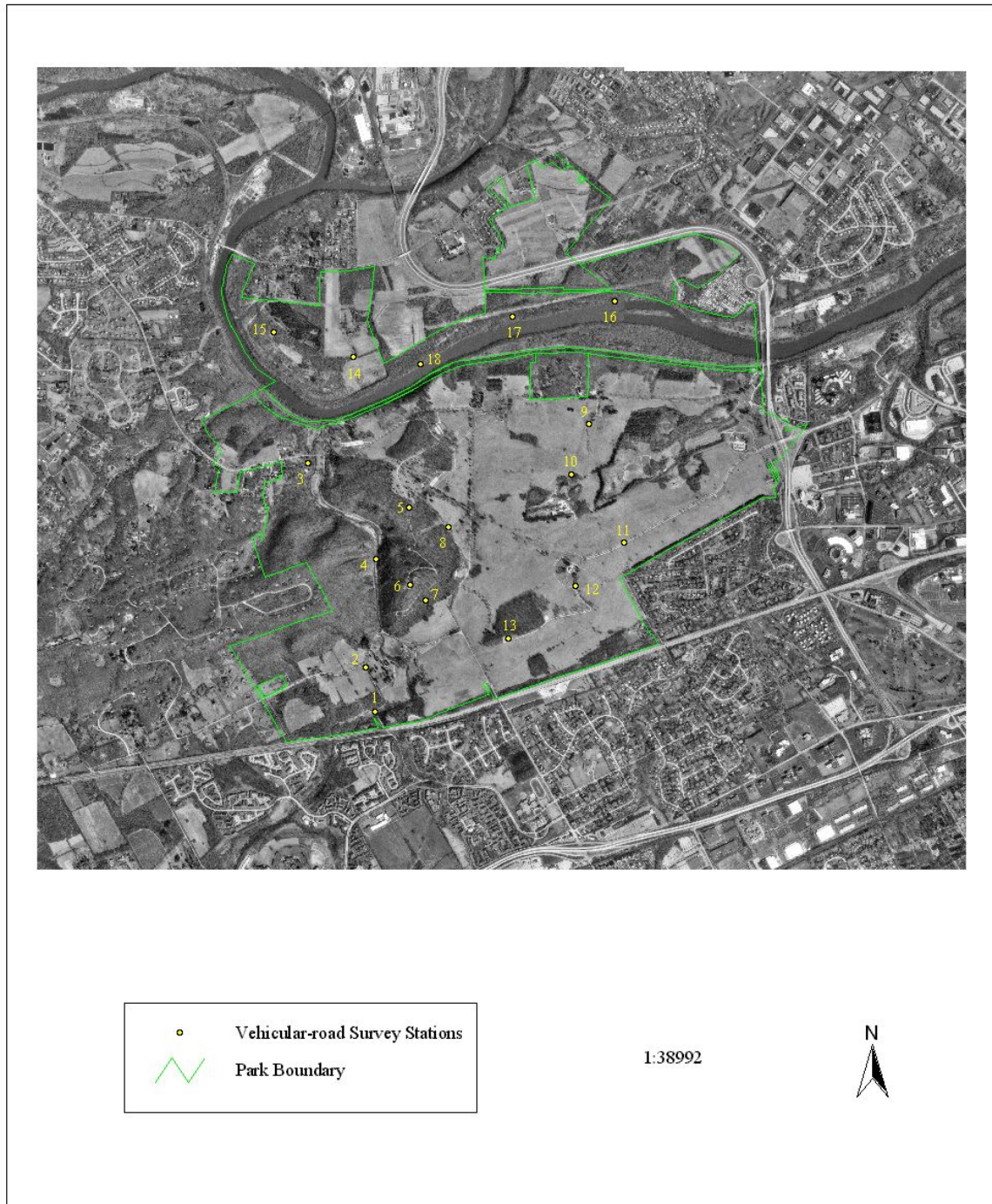
Appendix J. Four-letter species codes for birds of the Eastern United States (continued).

Species	Four-letter Species Code
Louisiana Waterthrush (<i>Seiurus motacilla</i>)	LOWA
Northern Waterthrush (<i>Seiurus noveboracensis</i>)	NOWA
Kentucky Warbler (<i>Oporornis formosus</i>)	KEWA
Connecticut Warbler (<i>Oporornis agilis</i>)	COWA
Mourning Warbler (<i>Oporornis philadelphia</i>)	MOWA
Common Yellowthroat (<i>Geothlypis trichas</i>)	COYE
Hooded Warbler (<i>Wilsonia citrina</i>)	HOWA
Wilson's Warbler (<i>Wilsonia pusilla</i>)	WIWA
Canada Warbler (<i>Wilsonia canadensis</i>)	CAWA
Yellow-breasted Chat (<i>Icteria virens</i>)	YBCH
Summer Tanager (<i>Piranga rubra</i>)	SUTA
Scarlet Tanager (<i>Piranga olivacea</i>)	SCTA
Northern Cardinal (<i>Cardinalis cardinalis</i>)	NOCA
Rose-breasted Grosbeak (<i>Pheucticus ludovicianus</i>)	RBGR
Blue Grosbeak (<i>Guiraca caerulea</i>)	BLGR
Indigo Bunting (<i>Passerina cyanea</i>)	INBU
Dickcissel (<i>Spiza americana</i>)	DICK
Eastern Towhee (<i>Pipilo erythrophthalmus</i>)	EATO
American Tree Sparrow (<i>Spizella arborea</i>)	ATSP
Chipping Sparrow (<i>Spizella passerina</i>)	CHSP
Field Sparrow (<i>Spizella pusilla</i>)	FISP
Vesper Sparrow (<i>Pooecetes gramineus</i>)	VESP
Savannah Sparrow (<i>Passerculus sandwichensis</i>)	SAVS
Grasshopper Sparrow (<i>Ammodramus savannarum</i>)	GRSP
Henslow's Sparrow (<i>Ammodramus henslowii</i>)	HESP
Fox Sparrow (<i>Passerella iliaca</i>)	FOSP
Song Sparrow (<i>Melospiza melodia</i>)	SOSP
Lincoln's Sparrow (<i>Melospiza lincolni</i>)	LISP
Swamp Sparrow (<i>Melospiza georgiana</i>)	SWSP
White-throated Sparrow (<i>Zonotrichia albicollis</i>)	WTSP
White-crowned Sparrow (<i>Zonotrichia leucophrys</i>)	WCSP
Dark-eyed Junco (<i>Junco hyemalis</i>)	DEJU
Lapland Longspur (<i>Calcarius lapponicus</i>)	LALO

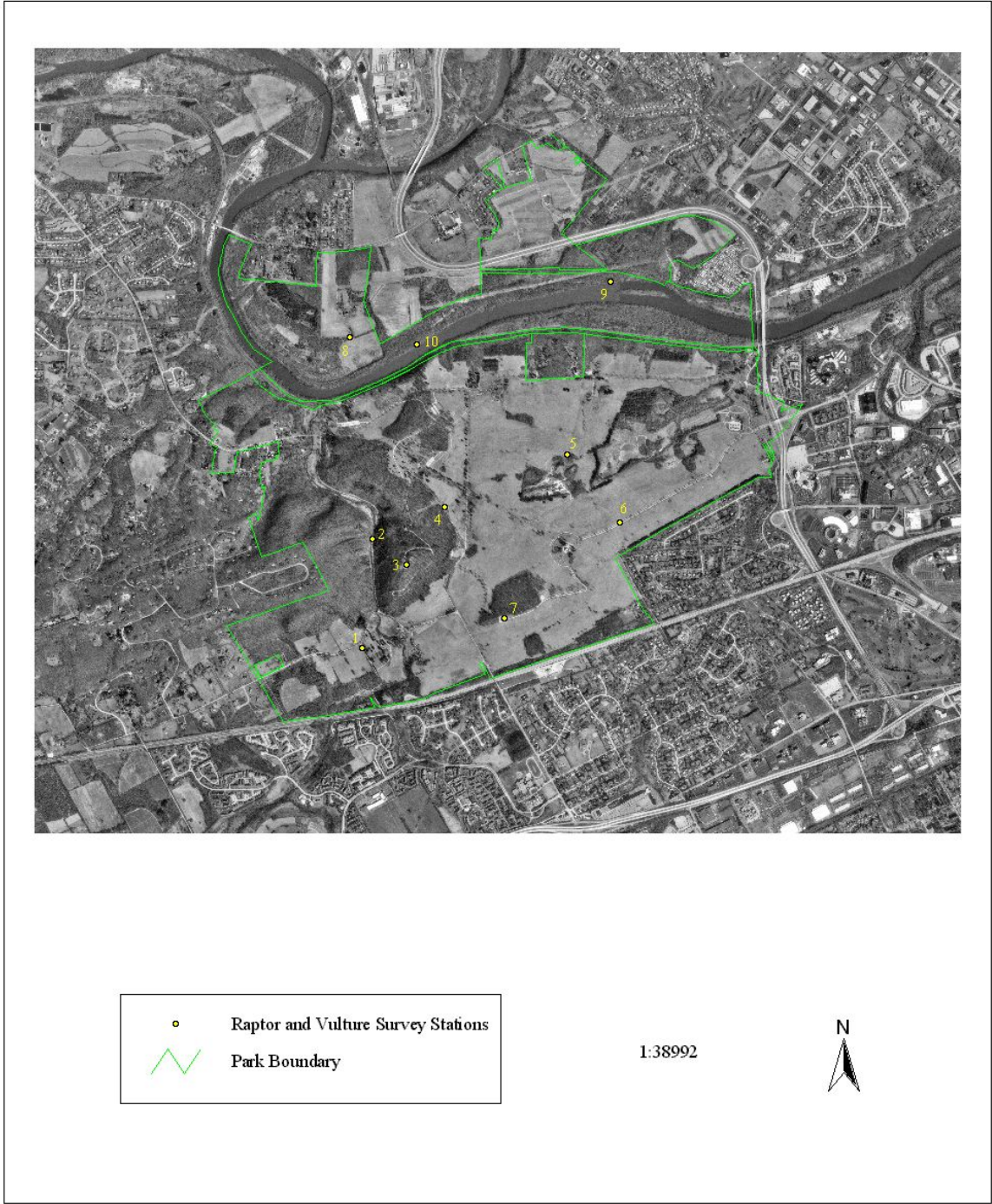
Appendix J. Four-letter species codes for birds of the Eastern United States (continued).

Species	Four-letter Species Code
Snow Bunting (<i>Plectrophenax nivalis</i>)	SNBU
Bobolink (<i>Dolichonyx oryzivorus</i>)	BOBO
Red-winged Blackbird (<i>Agelaius phoeniceus</i>)	RWBL
Eastern Meadowlark (<i>Sturnella magna</i>)	EAME
Rusty Blackbird (<i>Euphagus carolinus</i>)	RUBL
Common Grackle (<i>Quiscalus quiscula</i>)	COGR
Brown-headed Cowbird (<i>Molothrus ater</i>)	BHCO
Orchard Oriole (<i>Icterus spurius</i>)	OROR
Baltimore Oriole (<i>Icterus galbula</i>)	BAOR
Pine Grosbeak (<i>Pinicola enucleator</i>)	PIGR
Purple Finch (<i>Carpodacus purpureus</i>)	PUFI
House Finch (<i>Carpodacus mexicanus</i>)	HOFI
Red Crossbill (<i>Loxia curvirostra</i>)	RECR
White-winged Crossbill (<i>Loxia leucoptera</i>)	WWCR
Common Redpoll (<i>Carduelis flammea</i>)	CORE
Pine Siskin (<i>Carduelis pinus</i>)	PISI
American Goldfinch (<i>Carduelis tristis</i>)	AMGO
Evening Grosbeak (<i>Coccothraustes coccothraustes</i>)	EVGR
House Sparrow (<i>Passer domesticus</i>)	HOSP

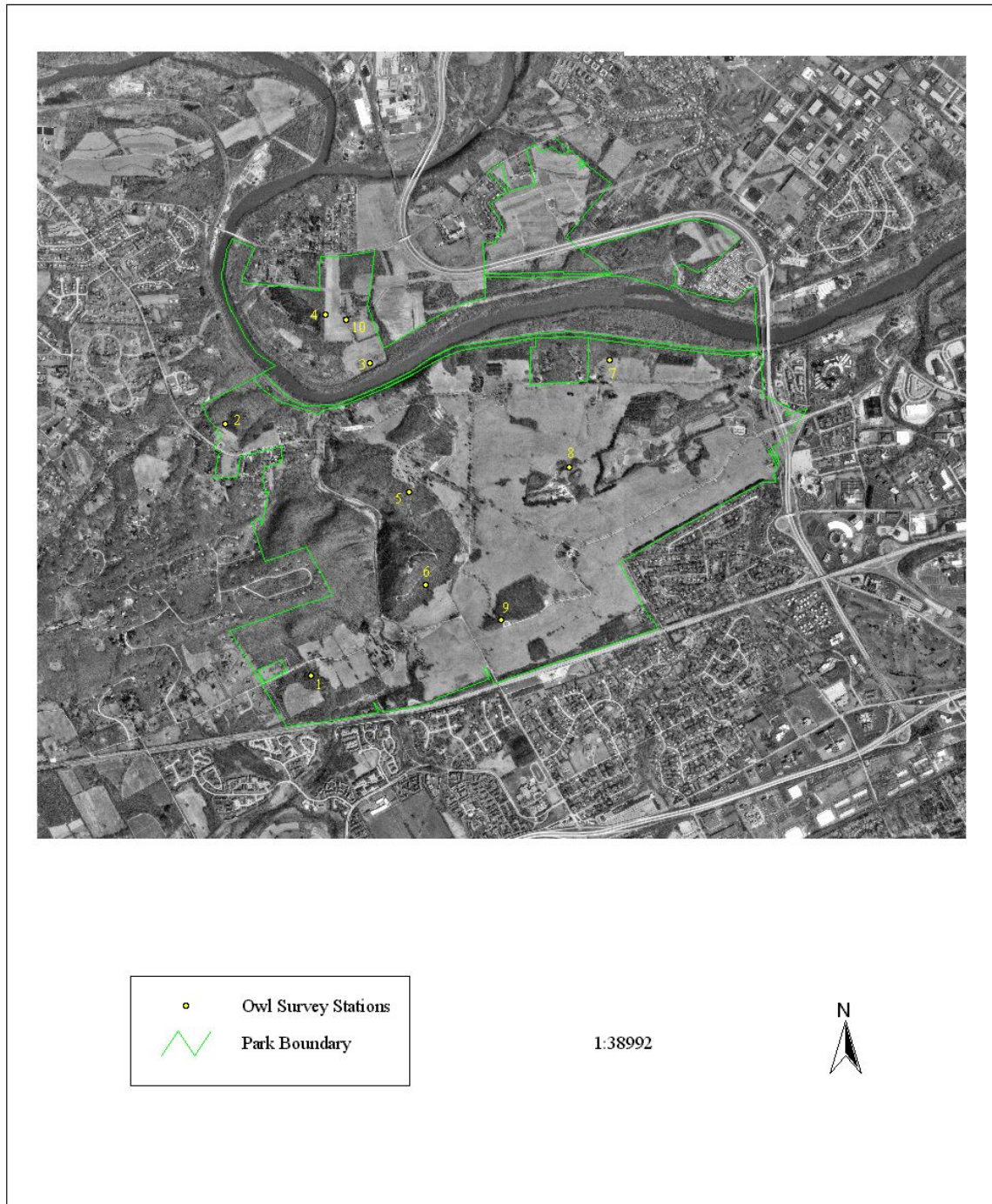
Appendix K. Location of the vehicular-road survey stations at Valley Forge National Historical Park.



Appendix L. Location of the diurnal raptor and vulture survey stations at Valley Forge National Historical Park.



Appendix M. Location of the owl survey stations at Valley Forge National Historical Park.



Appendix N. Habitat information and geographic coordinates for the vehicular-road survey stations at Valley Forge National Historical Park. Definitions of habitat information are found in Appendix F. Coordinates are universal transverse mercator (UTM) projection Zone 18N projected on the North American Datum (NAD) of 1983.

Point	Point Type	Cover Type	Spatial Location	Elevation	UTM-East	UTM-North
1	Vehicular-road	Mixed Forest	Road-Stream Edge	Low	461061	4436899
2	Vehicular-road	Perennial Herbaceous	Road Edge	High	460986	4437253
3	Vehicular-road	Terrestrial Unvegetated	NA	Low	460526	4438896
4	Vehicular-road	Mixed Forest	Road-Stream Edge	Low	461071	4438125
5	Vehicular-road	Deciduous Forest	Road Edge	High	461336	4438534
6	Vehicular-road	Mixed Forest	Road Edge	High	461340	4437921
7	Vehicular-road	Deciduous Forest	Road Edge	High	461463	4437793
8	Vehicular-road	Deciduous Forest	Road Edge	High	461646	4438384
9	Vehicular-road	Perennial Herbaceous	Road Edge	High	462772	4439209
10	Vehicular-road	Perennial Herbaceous	Road Edge	Low	462634	4438799
11	Vehicular-road	Perennial Herbaceous	Road Edge	High	463051	4438254
12	Vehicular-road	Annual Herbaceous	Road Edge	High	462662	4437911
13	Vehicular-road	Annual Herbaceous	Road Edge	High	462131	4437490
14	Vehicular-road	Perennial Herbaceous	Road Edge	Low	460891	4439747
15	Vehicular-road	Deciduous Forest	Road Edge	Low	460252	4439945
16	Vehicular-road	Deciduous Forest	Stream Edge	Low	462980	4440189
17	Vehicular-road	Deciduous Forest	Stream Edge	Low	462156	4440062
18	Vehicular-road	Deciduous Forest	Stream Edge	Low	461428	4439686

Appendix O. Verbal descriptions for the vehicular-road survey stations at Valley Forge National Historical Park.

Station	Description
1	In the Southwest corner of the park turn on to Yellow Springs Road from Route 252. Turn left (second left) onto the dirt/gravel road just past the left turn to Maxwell's Quarters. Travel approximately 0.3 miles. Station # 1 is located 20m from the far side of the bridge that crosses Valley Creek (between Valley Creek and the Pennsylvania Turnpike).
2	In the Southwest corner of the park turn on to Yellow Springs Road from Route 252. Turn left (second left) onto the dirt/gravel road just past the left turn to Maxwell's Quarters. Station # 2 is located 75m from the junction of Yellow Springs Road and the dirt/gravel road. Approximately 0.3 miles from Station # 1.
3	When traveling west on Route 23 from Huntington's Quarters, turn left onto the Valley Creek Trail access (first left after the light at the junction of routes 23 & 252). Station # 3 is located 50m along the gravel road from turn off of route 23.
4	Station # 4 is located on the Valley Creek side of route 252 approximately half way between the junction of routes 23 and 252 and the junction of route 252 and Yellow Springs Road (at the location of the old foot-bridge that crossed Valley Creek).
5	Turn on to Gulph Road from route 23. From Gulph Road turn right on to Inner Line Drive (first right). Station # 5 is located at the junction of the forest field habitat interface approximately 0.2 miles from the junction of Inner Line Drive and Gulph Road.
6	Continue traveling on Inner Line Drive and take the first right turn. Station # 6 is located approximately 0.5 miles from station # 5 in the parking area on top of Mount Joy.
7	Return to the junction of the turnoff to Mount Joy parking area and Inner Line Drive. Station # 7 is located along Inner Line Drive 0.5 miles from the stop sign at the junction of the turnoff to Mount Joy parking area and Inner Line Drive.
8	Continue traveling along Inner Line Drive for 0.5 miles. Station # 8 is located adjacent to the far end of the parking lot just before Inner Line Drive becomes a two-way road.
9	Station # 9 is located 25m South of the spring house Behind Huntington's Quarters on the grass fire road that crosses the Grand Parade.
10	Travel approximately 0.3 miles along the grass fire road from station # 9 toward the maintenance area. Station # 10 is located at the junction of the field and tree line habitat on the left side of the fire road.
11	Enter Outer Line Drive from the Visitor's Center. Travel approximately 0.4 miles along Outer Line Drive. Station # 11 is located at the low point between rolling hills before approaching the National Memorial Arch.
12	Travel approximately 0.5 miles from station # 11 along Outer Line Drive (past the junction of Gulph Road and Outer Line Drive) to opposite side of the National Memorial Arch. Station # 12 is located at the end of the parking area for the National Memorial Arch where Outer Line Drive becomes a one-way road.

Appendix O. Verbal descriptions for the vehicular-road survey stations at Valley Forge National Historical Park (continued).

Station	Description
13	Travel approximately 0.5 miles from station # 12 along Outer Line Drive. Station # 13 is located at the first parking spot in the parking loop at the statue of General Wayne.
14	On the north side of the Schuylkill River, travel east on Pawling's Road and turn right into the Walnut Hill section of the Park. Travel south on the dirt road past the park housing and old barn on the right. Station # 14 is located at the 90° right curve in the gravel road overlooking the wetland fields.
15	From Station # 14, travel west on the gravel road toward the boy scout field. Station # 15 is 0.5 miles from Station # 14.
16	In the northeast corner of the park enter Betzwood Park. Begin traveling west along the Schuylkill River Trail. Station # 16 is located on the Schuylkill River Trail even with the far end of Catfish Island.
17	Continue traveling west along the Schuylkill River Trail. Station # 17 is located 0.5 miles from Station 16 at the monument to General Sullivan's Brigade.
18	Continue traveling west along the Schuylkill River Trail. Station # 18 is located 0.5 miles from Station 17.

Appendix P. Data sheet used when conducting vehicular-road surveys at Valley Forge National Historical Park.

VEHICULAR-ROAD SURVEY FOR VALLEY FORGE NATIONAL HISTORICAL PARK

Season _____ Date _____ Visit # _____ Temp _____

Wind _____ Clouds _____ Precipitation _____ Observer(s) _____

[illegible]

Appendix Q. Habitat information and geographic coordinates for the diurnal raptor and vulture survey stations at Valley Forge National Historical Park. Definitions of habitat information are found in Appendix F. Coordinates are universal transverse mercator (UTM) projection Zone 18N projected on the North American Datum (NAD) of 1983.

Point	Point Type	Cover Type	Spatial Location	Elevation	UTM-East	UTM-North
1	Raptor & Vulture	Perennial Herbaceous	Road Edge	High	460986	4437253
2	Raptor & Vulture	Mixed Forest	Road-Stream Edge	Low	461071	4438125
3	Raptor & Vulture	Mixed Forest	Road Edge	High	461340	4437921
4	Raptor & Vulture	Deciduous Forest	Road Edge	High	461646	4438384
5	Raptor & Vulture	Perennial Herbaceous	Road Edge	Low	462634	4438799
6	Raptor & Vulture	Perennial Herbaceous	Road Edge	High	463051	4438254
7	Raptor & Vulture	Annual Herbaceous	Road Edge	High	462131	4437489
8	Raptor & Vulture	Perennial Herbaceous	Road Edge	Low	460891	4439747
9	Raptor & Vulture	Deciduous Forest	Stream Edge	Low	462981	4440189
10	Raptor & Vulture	Deciduous Forest	Stream Edge	Low	461428	4439685

Appendix R. Verbal descriptions for the diurnal raptor and vulture survey stations at Valley Forge National Historical Park.

Station	Description
1	In the Southwest corner of the park turn on to Yellow Springs Road from Route 252. Turn left (second left) onto the dirt/gravel road just past the left turn to Maxwell's Quarters. Station # 1 is located 75m from the junction of Yellow Springs Road and the dirt/gravel road.
2	Station # 2 is located on the Valley Creek side of route 252 approximately half way between the junction of routes 23 and 252 and the junction of route 252 and Yellow Springs Road (at the location of the old foot-bridge that crossed Valley Creek).
3	Turn on to Gulph Road from route 23. From Gulph Road turn right on to Inner Line Drive. Turn at the first right turn on Inner Line Drive. Station # 3 is located in the parking area on top of Mount Joy.
4	Return to the junction of the turnoff to Mount Joy parking area and Inner Line Drive. Continue traveling along Inner Line Drive for approximately 1 mile. Station # 4 is located adjacent to the far end of the parking lot just before Inner Line Drive becomes a two-way road.
5	Beginning at Huntington's Quarters, travel approximately 0.4 miles on the grass fire road that crosses the Grand Parade (travel toward the maintenance area). Station # 5 is located at the junction of the field and tree line habitat on the left side of the fire road.
6	Enter Outer Line Drive from the Visitor's Center. Travel approximately 0.4 miles along Outer Line Drive. Station # 6 is located at the low point between rolling hills before approaching the National Memorial Arch.
7	Travel approximately 1mile from station # 6 along Outer Line Drive (past the National Memorial Arch). Station # 7 is located at the first parking spot in the parking loop at the statue of General Wayne.
8	On the north side of the Schuylkill River, travel east on Pawling's Road and turn right into the Walnut Hill section of the Park. Travel south on the dirt road past the park housing and old barn on the right. Station # 8 is located at the 90° right curve in the gravel road overlooking the wetland fields.
9	In the northeast corner of the park enter Betzwood Park. Begin traveling west along the Schuylkill River Trail. Station # 9 is located on the Schuylkill River Trail even with the far end of Catfish Island.
10	Continue traveling west along the Schuylkill River Trail. Station # 10 is located 1 mile from Station 9.

Appendix S. Data sheet used when conducting diurnal raptor and vulture surveys at Valley Forge National Historical Park.

DIURNAL RAPTOR AND VULTURE SURVEY FOR VALLEY FORGE NATIONAL HISTORICAL PARK

Season _____ Date _____ Visit # _____ Temp _____

Wind _____ Clouds _____ Precipitation _____ Observer(s) _____

[illegible]

Appendix T. Habitat information and geographic coordinates for the owl survey stations at Valley Forge National Historical Park. Definitions of habitat information are found in Appendix F. Coordinates are universal transverse mercator (UTM) projection Zone 18N projected on the North American Datum (NAD) of 1983.

Point	Point Type	Cover Type	Spatial Location	Elevation	UTM-East	UTM-North
1	Owl	Coniferous Forest	Interior	High	460546	4437069
2	Owl	Mixed Forest	Interior	High	459865	4439084
3	Owl	Perennial Herbaceous	Interior	Low	461023	4439570
4	Owl	Mixed Forest	Interior	Low	460666	4439955
5	Owl	Deciduous Forest	Road Edge	High	461336	4433534
6	Owl	Deciduous Forest	Road Edge	High	461463	4437793
7	Owl	Mixed Forest	Interior	High	462933	4439593
8	Owl (including Short-eared Owl)	Deciduous Forest	Road Edge	Low	462634	4438799
9	Owl	Deciduous Forest	Road Edge	High	462123	4437503
10	Barn Owl	Terrestrial Unvegetated	NA	Low	460826	4439918

Appendix U. Verbal descriptions for the owl survey stations at Valley Forge National Historical Park.

Station	Description
1	In the southwest corner of the park, park at Stirling's Quarters. Coming from the parking lot for Stirling's Quarters, walk across Yellow Springs Road and locate the dirt access road leading to field 77. Station # 1 is located 80m down the access road.
2	Travel east along route 23 from Huntington's Quarters until you reach the Valley Forge Post Office. Travel across field 1 (behind the post office) and Station # 2 is located 30m down a jeep trail adjacent to the conifer stand on the north side of field 1.
3	On the north side of the Schuylkill River, travel east on Pawling's Road and turn right into the Walnut Hill section of the Park. Travel south on the dirt/gravel road past the park housing and old barn on the right. Park at the 90° right curve in the gravel road overlooking the wetland fields. Station # 3 is located approximately 150 meters south of the 90° right curve between the large wetland pools.
4	Travel east across the field from Station # 10 to the large white oak snag on the far side of the Walnut Hill field. Station # 4 is located between the snag and the forest/field edge.
5	Turn on to Gulph Road from route 23. From Gulph Road turn right on to Inner Line Drive. Station # 5 is located at the junction of the forest field habitat interface approximately 0.2 miles from the junction of Inner Line Drive and Gulph Road.
6	From Station # 5, continue traveling along Inner Line Drive. Station # 6 is located on Inner Line Drive 0.5 miles past the right hand turnoff to the Mount Joy parking area.
7	From route 23, turn into the parking area for Washington Memorial Chapel and park at the northern end of the parking lot. From the northern end of the Washington Memorial Chapel parking area, walk northeast for 100m along the field/forest interface to reach Station # 7.
8	From Huntington's Quarters travel approximately 0.4 miles along the grass fire road that crosses the Grand Parade (travel toward the maintenance area). Station # 8 is located at the junction of the field and tree line habitats on the left side of the fire road.
9	Travel approximately 0.5 miles along Outer Line Drive from the National Memorial Arch to the statue of General Wayne. Station # 9 is located at the edge of the woodlot north of the statue.
10	On the north side of the Schuylkill River, travel east on Pawling's Road and turn right into the Walnut Hill section of the Park. Travel south on the dirt/gravel road past the park housing to the old barn. The barn owl survey station is located at the southeast corner of the old barn.

Appendix V. Data sheet used when conducting owl surveys at Valley Forge National Historical Park.

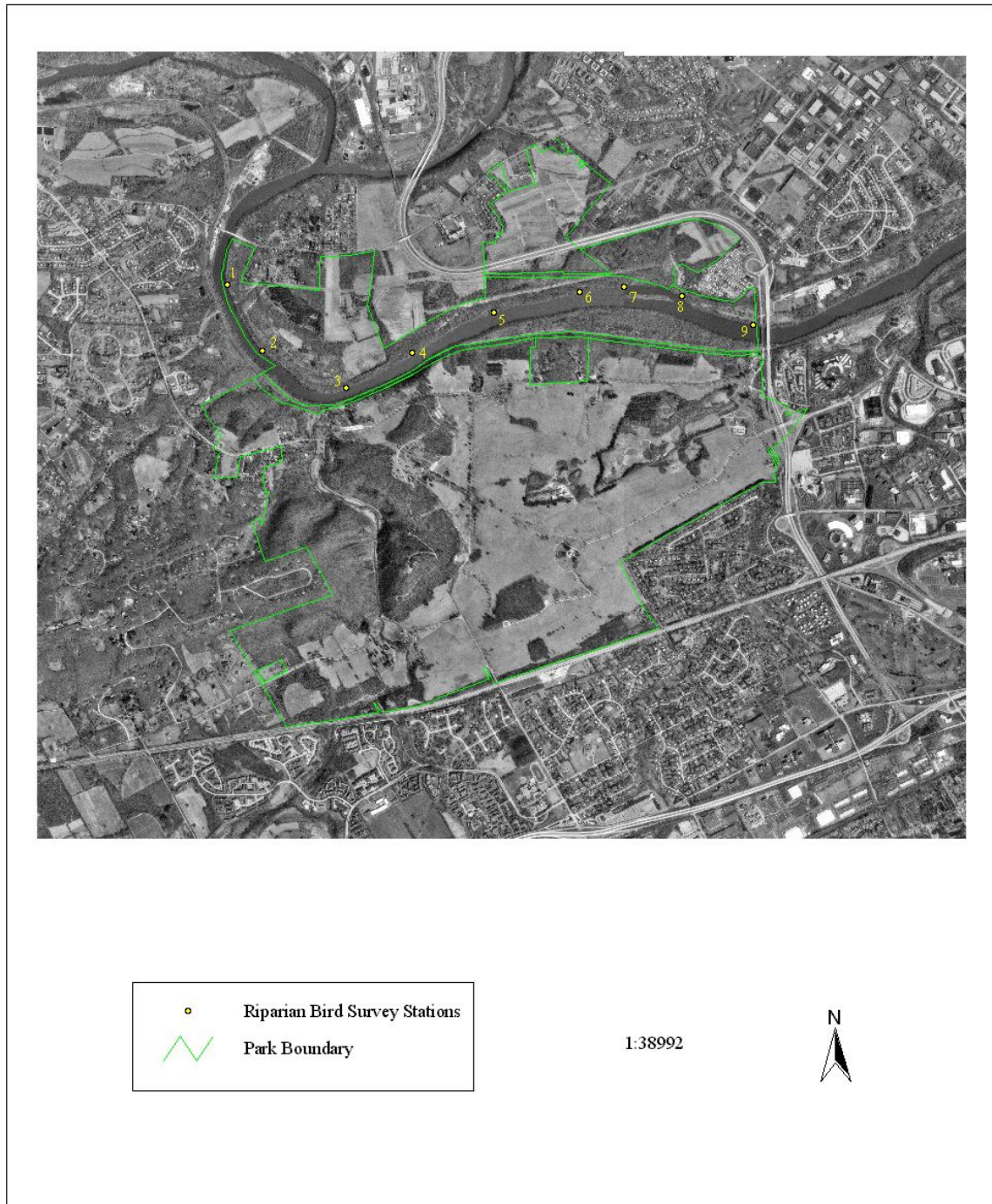
OWL SURVEY FOR VALLEY FORGE NATIONAL HISTORICAL PARK

Date _____ Visit # _____ Temp _____ Wind _____

Clouds _____ Precipitation _____ Snow Depth _____ Observer(s) _____

[illegible]

Appendix W. Location of the riparian bird survey stations at Valley Forge National Historical Park.



Appendix X. Habitat information and geographic coordinates for the riparian bird survey stations at Valley Forge National Historical Park. Definitions of habitat information are found in Appendix F. Coordinates are universal transverse mercator (UTM) projection Zone 18N projected on the North American Datum (NAD) of 1983.

Point	Point Type	Cover Type	Spatial Location	Elevation	UTM-East	UTM-North
1	Riparian Bird	Deciduous Forest	River Edge	Low	459884	4440198
2	Riparian Bird	Deciduous Forest	River Edge	Low	460163	4439667
3	Riparian Bird	Deciduous Forest	River Edge	Low	460827	4439371
4	Riparian Bird	Deciduous Forest	River Edge	Low	461429	4439685
5	Riparian Bird	Deciduous Forest	River Edge	Low	462009	4439978
6	Riparian Bird	Deciduous Forest	River Edge	Low	462694	4440142
7	Riparian Bird	Deciduous Forest	River Edge	Low	462980	4440189
8	Riparian Bird	Deciduous Forest	River Edge	Low	463516	4440107
9	Riparian Bird	Terrestrial Unvegetated	River Edge	Low	464081	4439878

Appendix Y. Verbal descriptions for the riparian bird survey stations at Valley Forge National Historical Park.

Station	Description
1	On the north side of the Schuylkill River, travel east on Pawling's Road, cross over the Schuylkill River, and make the first right into the Pawling's Parking Area (located in the northwest corner of the park). Travel East along the Schuylkill River Trail and Station # 1 is located 0.2 miles from the southwest corner of Pawling's Parking Area.
2	Continue traveling East along the Schuylkill River Trail. Station # 2 is 0.4 miles from Station # 1.
3	Continue traveling East along the Schuylkill River Trail. Station # 3 is 0.5 miles from Station # 2.
4	Continue traveling East along the Schuylkill River Trail. Station # 4 is 0.4 miles from Station # 3.
5	Continue traveling East along the Schuylkill River Trail. Station # 5 is 0.4 miles from Station # 4.
6	Continue traveling East along the Schuylkill River Trail. Station # 6 is 0.5 miles from Station # 5.
7	Continue traveling East along the Schuylkill River Trail. Station # 7 is 0.3 miles from Station # 6.
8	Continue traveling East along the Schuylkill River Trail. Station # 8 is 0.2 miles from Station # 7.
9	Continue traveling East along the Schuylkill River Trail and through Betzwood Park. Station # 9 is located at the boat launch in the southeast corner of Betzwood Park.

Appendix Z. Data sheet used when conducting riparian bird surveys at Valley Forge National Historical Park.

RIPARIAN BIRD SURVEY FOR VALLEY FORGE NATIONAL HISTORICAL PARK

Date _____ Visit # _____ Temp _____ Wind _____

Clouds _____ Precipitation _____ Observer(s) _____

[illegible]