2008

Fort Lee avian inventory report

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Recommended Citation

Smith, F. M. and B. J. Paxton. 2008. Fort Lee avian inventory report. CCBTR-08-07. Center for Conservation Biology Technical Report Series. College of William and Mary, Williamsburg, VA. 37 pp.

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Project Funded By:

The Directorate of Public Works and Logistics, Environmental Management Office, Fort Lee

Versar, Inc.

The Center for Conservation Biology
College of William and Mary

Versar, INC

This paper is funded by a grant from The Directorate of Public Works and Logistics, Environmental Management Office, Fort Lee through Versar, Inc. The views expressed herein are those of the authors and do not necessarily reflect the views of Fort Lee or Versar, Inc.

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The Center for Conservation Biology is an organization dedicated to discovering innovative solutions to environmental problems that are both scientifically sound and practical within today's social context. Our philosophy has been to use a general systems approach to locate critical information needs and to plot a deliberate course of action to reach what we believe are essential information endpoints.

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SUMMARY

The Directorate of Public Works and Logistics, Environmental Management Office (EMO), Fort Lee, is responsible for implementing requirements of the Sikes Act as indicated in the Installation's Integrated Natural Resource Management Plan, and ensuring adherence to Executive Order 13186 which outlines responsibilities of federal agencies to protect migratory birds. In order to comply with these regulations, periodic surveys of the installation's migratory bird populations are necessary, and have been previously conducted on four to five year cycles. In 2008, EMO contracted with Versar Inc. and the Center for Conservation Biology at The College of William and Mary to repeat winter and breeding season bird surveys of the installation. This avian inventory report presents the results of a survey of wintering and breeding birds found within the Fort Lee. The study was conducted in accordance with the Scope of Work that was developed by EMO. The primary objective identified in the Scope of Work was to conduct an installation-wide survey of migratory birds during winter and summer to generate a year-round profile of species abundance and distribution.

The focus of this study was to survey habitats within the installation for all birds. Priority was given to documenting species of management interest or species already listed by state or federal authorities. Emphasis was also placed on documenting all bird species that breed in the area. The habitats surveyed were prioritized according to the EMO and the Partners in Flight (PIF) Plan for the Mid-Atlantic Coastal Plain Region (Watts 1999a). The habitats found in the installation that were the focus of surveys include:

1) Forest interior, including pine, hardwood, and mixed pine/hardwood dominated stands;

2) Grassland habitat;

3) Shrub-scrub habitat associated with early successional clear-cut areas and wetlands; and

4) Urban habitat, typically dominated by large pine and hardwood trees and an open, mowed understory.

Birds were surveyed using a variety of methods including point counts, line transects, recorded playback, and area searches. Priority habitats within the installation area support a diverse array of species (Watts 1999b). A total of 3,419 birds comprised of 87 species were detected at 89 survey points during the 2008 breeding season. A total of 1,410 birds comprised of 63 species were recorded during the 2008 winter surveys. No birds were detected during the spring marsh bird playback survey.

INTRODUCTION

The Directorate of Public Works and Logistics, Environmental Management Office (EMO), Fort Lee, is responsible for implementing requirements of the Sikes Act as indicated in the Installation's Integrated Natural Resource Management Plan, and ensuring adherence to Executive Order 13186 which outlines responsibilities of federal agencies to protect migratory birds. In order to comply with these regulations, periodic surveys of the installation's migratory bird populations are necessary, and have been previously conducted on four to five year cycles. In 2008, EMO contracted with Versar Inc. and the Center for Conservation Biology at The College of William and Mary (CCB) to repeat winter and breeding season bird surveys of the installation. This avian inventory report presents the results of a survey of wintering and breeding birds found within the Fort Lee. The study was conducted in accordance with the Scope of Work that was developed by EMO and CCB. The primary objective identified in the Scope of Work was to conduct an installation-wide survey of migratory birds during winter and summer to generate a year-round profile of species abundance and distribution.

Of particular importance in this survey are the forest and grassland species of Neotropical and temperate migratory birds that breed on the base. Many species within the Mid-Atlantic Coastal Plain are experiencing large or significant declines in population (Watts 1999a). There is increasing evidence that habitat loss and fragmentation are two of the leading causes for the observed population declines of these groups of birds (Hagen and Johnson 1992, Faaborg et al. 1995, Robinson et al. 1995). A high percentage of birds experiencing population declines in the Mid-Atlantic region are breeding or wintering on the installation. The population levels of migratory and resident birds are now under scrutiny with the formation of the Partners in Flight (PIF) program in 1990. This program is international in scope and has the support of all 50 states. PIF has developed priority species lists for each physiographic region of the country. These lists are based on breeding distribution, habitat stability, population size and trends, threats to wintering sites, etc. (Carter et al., 2000). As a result, the lists have been adopted by most state and federal regulatory agencies as legitimate "watch" lists for species of management interest. This information can be used to direct habitat management within a regional context as well as on a local scale. Included in the breeding season survey data of Fort Lee are 22 species comprised of 619 individuals that PIF have designated as "watch" species or species of concern in the Mid-Atlantic Coastal Plain Region (Table 1).

At least one state listed species, the Loggerhead Shrike, was well documented as breeding on the installation (Watts 1999b). The Loggerhead Shrike has experienced a dramatic range contraction recently (Yosef 1996), and there no longer appears to be enough habitat to support the Loggerhead Shrike on the installation. In addition, the federally protected Bald Eagle has not been observed nesting on the installation since 2001 (Watts, personal communication). However, due to the presence of birds nesting on channel islands within the Appommatox River adjacent to Fort Lee, Bald Eagles are commonly seen on Fort Lee.

Study Objectives

The primary objective of this study is to conduct an installation-wide survey of migratory birds during the winter and summer breeding season to generate a year-round profile of species abundance and distribution. Priority is given to documenting species of management interest or species already listed by state or federal authorities. Emphasis is also placed on documenting all species that breed in the area. Non-breeding (winter) season surveys provide insight into use of the Fort Lee by temperate migratory birds.

All habitats within the Fort Lee were analyzed by the Environmental Management Office and by CCB staff scientists. This work included reviewing aerial photos, past survey reports, and ground-truthing. A study plan was then devised by EMO and CCB to sample all major habitats within the installation. Habitats within Fort Lee that received the most attention during surveys include the following:

1) Forest interior, including pine and mixed pine/hardwood dominated stands.

2) Grassland habitat.

3) Urban habitat, typically dominated by hardwood trees and an open, mowed understory.

4) Shrub-scrub habitat associated with early successional clear-cut areas and wetlands.

METHODS

Study Area

Fort Lee is located within the outer portion of the Atlantic Coastal Plain (Figure 1). The installation encompasses roughly 2480 hectares of land. There is little topographic relief on the installation. Elevations in the area range from approximately 15 to 30 meters above sea level. Land cover at Fort Lee is a mix of forested, open, and developed land. Many of the open habitats consist of grasslands kept in a long mowing rotation. As was the case in previous surveys, a portion of the open habitats are intensely managed with short mowing rotation; including the golf course, baseball diamond, and many training areas. Forested lands on the installation are mostly pine-dominated, with pockets of hardwood and mixed pine-hardwood habitats. These forest tracts span a wide range of ages.

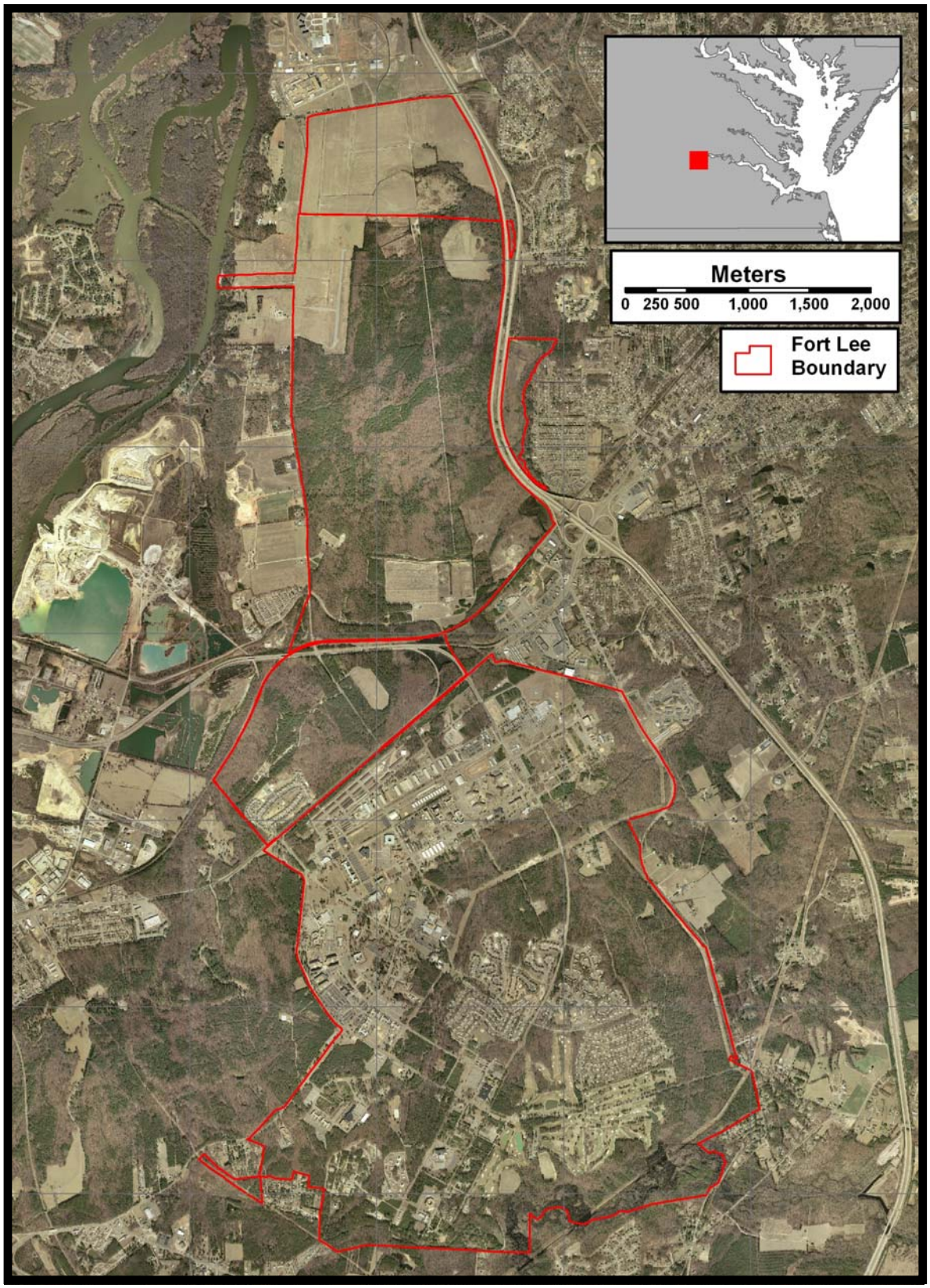

Figure 1. Map outlining the Fort Lee boundary.

Survey Techniques Overview

Survey locations and methods were duplicated from the 1997-1998 and 2002-2003 surveys (Watts 1999b and AH Environmental 2004). During the winter survey period, birds within targeted habitats were surveyed using a variety of methods, including point counts, line transects, recorded playback, and area searches. Winter point counts were restricted to the bottomland swamp forest located in the Blackwater River headwaters. All line transects were performed twice during the winter survey period. The areas around Blackwater Swamp, the borrow pit, the farm fields bordering River Road, and TA-29 were searched during the winter of 2008.

Summer Count Overview

Point Counts

A combination of fixed-radius and unlimited-radius point count techniques were used to measure bird density and frequency of occurrence. A total of 89 point counts were established within the study area: 34 within pine-dominated forest, 18 within mixed pine-hardwood forest, 16 within grassland, 9 within early successional shrub-scrub dominated habitat, 8 within urban areas, and 4 within hardwood dominated forest (Figures 2 and 3, Appendix I).

Bird surveys were conducted by a single observer standing at the point center and counting all birds seen or heard within a 5-minute time period. Survey points were conducted on foot and points were marked with Garmin GPSmap 76 units. Birds detected were stratified according to time period and location; the count period was subdivided into 0-3 minute and 3-5 minute time periods, and birds were recorded as either within or beyond a 50-meter radius from the point center. The order in which points were surveyed changed each round to reduce the impact of time-of-day effects.

Birds were surveyed between 24 May and 16 June 2006. To reduce the effects of seasonal bias, censuses were conducted within rounds such that all transects were surveyed before the beginning of the subsequent round. Each point was surveyed twice during the study period. All surveys were conducted between 0.5 hours before sunrise and 4.5 hours after sunrise.

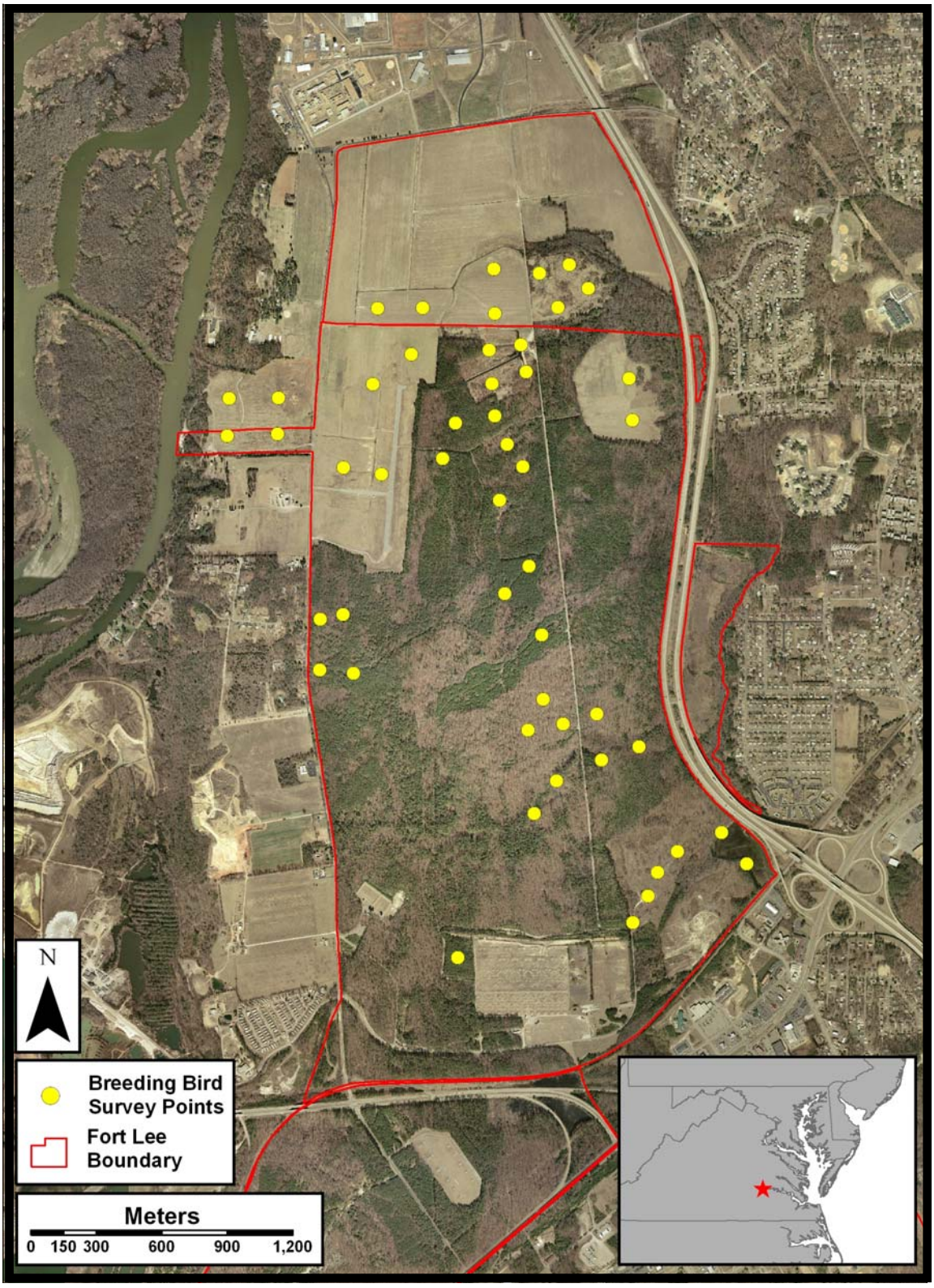

Figure 2. Map of survey points conducted during the 2008 breeding bird season. Map depicts all points surveyed in the Range Training Area of Fort Lee.

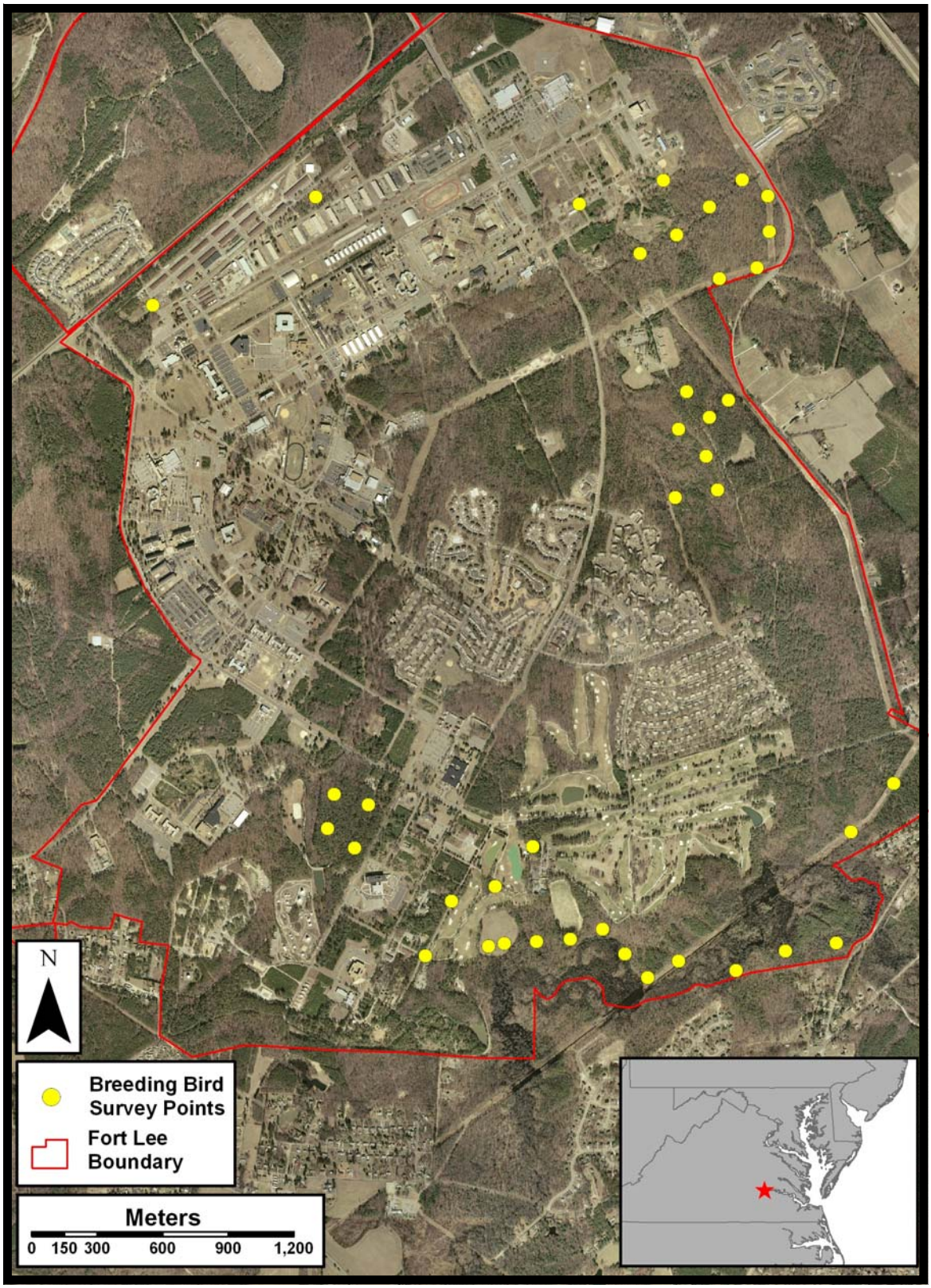

Figure 3. Map of survey points conducted during the 2008 breeding bird season. Map depicts all points surveyed in the Cantonment Area of Fort Lee.

Winter Survey Overview

Transect Counts

Transect counts were conducted twice between 17 February and 26 March 2008 within the grassland areas of the installation during the winter survey time period. A total of 4000 meters of transects were established within TA-17 (Figure 4). Birds were surveyed along marked transects using a variation of the standard, variable-width transect technique (Emlen 1974). Transect counts were conducted by a single observer walking slowly from transect start to transect end, recording all species heard or seen on either side of the transect. Only birds within 25 meters perpendicular to the transect line were recorded. A buffer of 50 meters was placed between all transects. When possible, all detected birds were identified to species. Initial detection type (aural, visual, or flushed) and estimated distance between the observer and the bird were recorded using Paxton Distance Index, 2007. For birds believed to be within 10 m of the observer, distances were estimated to 1 m resolution. For birds believed to be within 10 and 50 m away, distances were estimated to the nearest 5 m. For birds between 10 and 100 m away, distances were estimated to the nearest 10 m, and for birds greater than 100 m away distances were estimated to the nearest 50 m.

Area Searches

The wet, shrubby areas within the borrow pit and TA-29 (Figure 4) were searched twice each during the winter survey period (between 23 February and 27 March 2008). A single observer walked slowly throughout the area recording numbers of birds and identifying each species encountered.

Waterfowl Survey

Waterfowl surveys were conducted along the edges of the Blackwater River headwaters (Figure 5). Access to the southern section of Blackwater Swamp was obtained via the gate located at Bull Hill Rd. The northern section was accessed via the golf course. All waterfowl were identified to species and recorded.

Point Counts

A limited number of fixed radius point counts were conducted during the winter survey time period (Figure 5, Appendix II). Surveys were conducted on 26 and 27 March 2008.

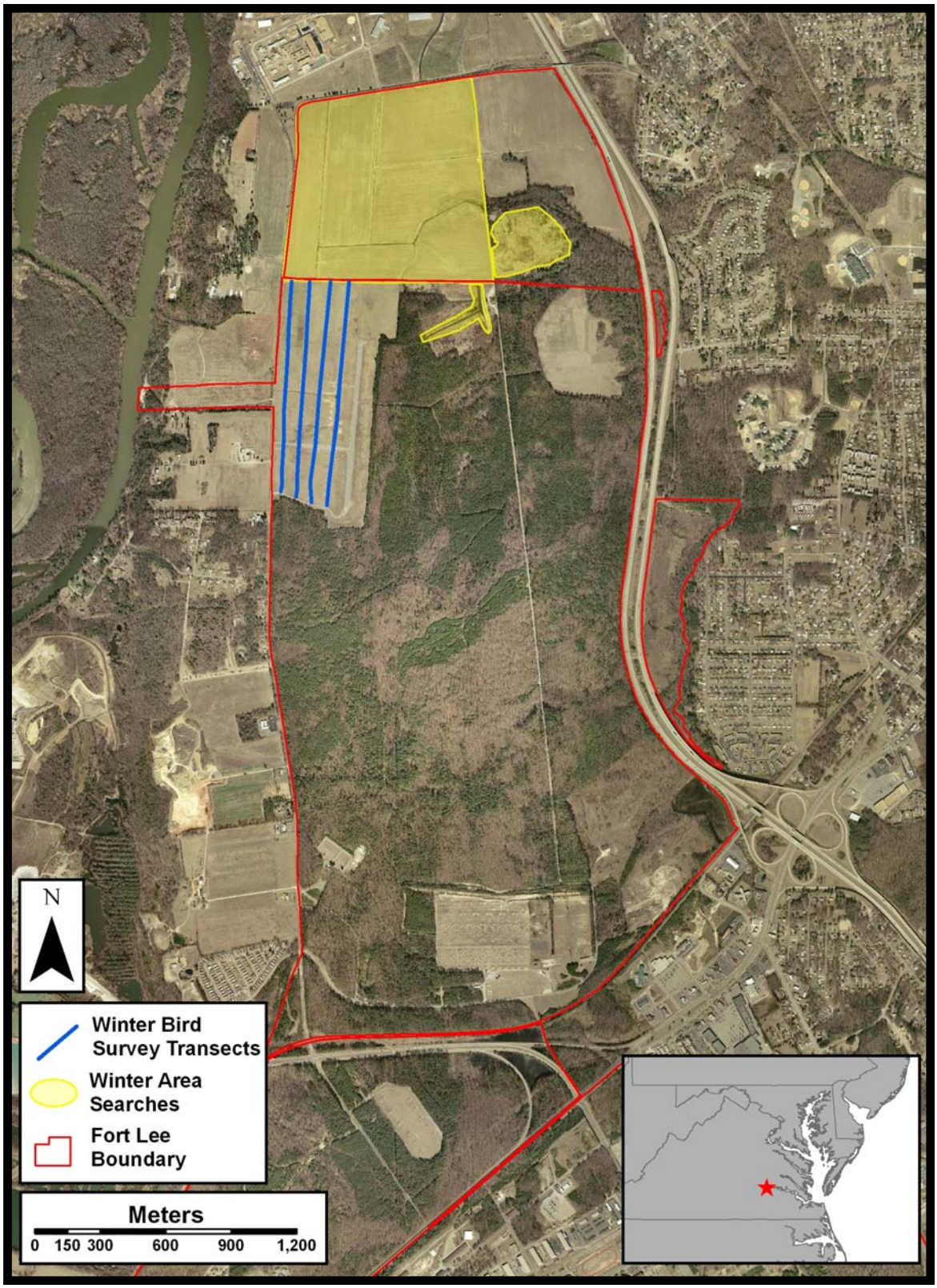

Figure 4. Map of survey transects and area searches conducted during the 2008 winter survey season. Map depicts all transects and area searches in the Range Training Area of Fort Lee.

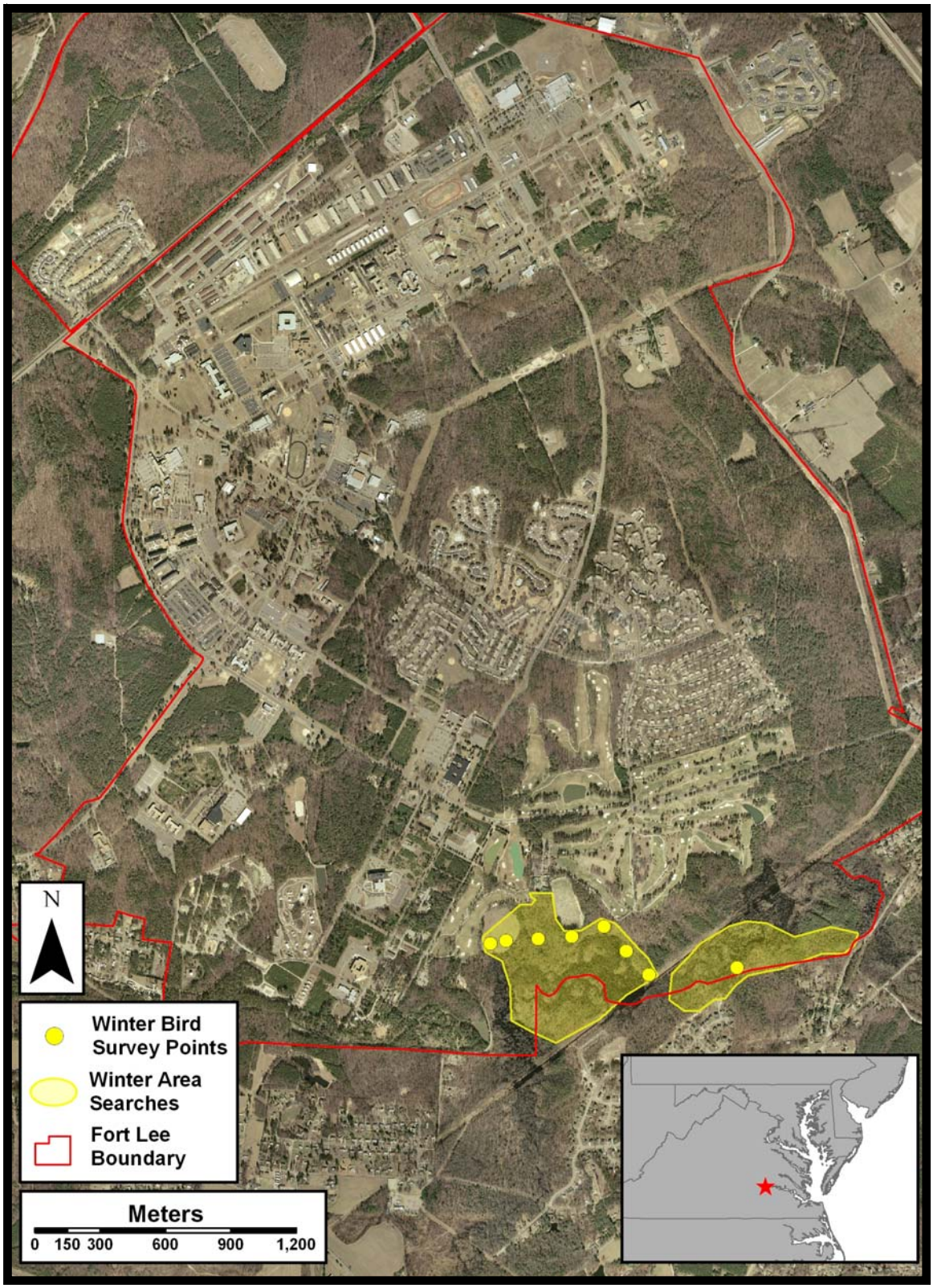

Figure 5. Map of point counts and area searches conducted during the 2008 winter survey season. Map depicts all points and area searches in the Cantonment Area of Fort Lee.

Due to the secretive nature of most birds during this time period, a 50-m fixed-radius point count was used for these surveys. A total of 8 points were surveyed using the fixed radius point count method during the winter survey season (Appendix II).

Marsh Bird Playback Survey

A standard marsh bird playback survey was conducted on 11 April 2008. A recording of American Bittern was played for 15 minutes in an effort to determine breeding presence/ absence. American Bitterns were seen the previous two years in the middle of April (Bradshaw, personal communication).

Incidental Sightings

In addition to the numerous surveys conducted within defined study areas, incidental sightings of species seen within Fort Lee were also noted. Incidental sightings included species that had not been detected at survey points or species that had been detected at low numbers and were noteworthy (i.e. Brown-headed Nuthatch, Red-headed Woodpecker). Incidental sightings generally occurred traveling between survey points. These sightings were included in the total species list but were not used for analysis purposes.

Data Summary and Analysis

Summer point count survey data were summarized to determine species richness and abundance for selected habitat types. Breeding season point count survey data were analyzed to determine density of migrants in selected habitat types. Neotropical migrants, temperate migrants, and resident species densities were calculated by using mean number of individuals detected within 50-m at each point during the two summer surveys. Differences in densities among habitat types were analyzed using non-parametric Kruskal-Wallace ANOVA tests. Mann-Whitney U significant difference tests were used in post-hoc analysis to determine which habitats contained significantly different densities. The line transect and area search data were summarized to determine frequencies of species detected during the winter survey season.

RESULTS

A total of 4,829 detections comprised of 108 species were found in the winter and breeding season surveys on the Fort Lee (Appendix III, IV, and V).

Summer Point Counts

A total of 3,419 birds comprised of 87 species were detected at 89 survey points during the 2008 breeding season (Appendix III, V). Of these, 37 species were Neotropical migrants (42.5% of total detections), 23 were temperate migrants (26.5% of total detections), and 27 were non-migratory resident species (31.0% of total detections). The composition of species are similar to previous surveys of Fort Lee (Watts 1999b and AH Environmental 2004).

For the summer breeding surveys, species richness values were calculated for each type of habitat surveyed. All birds detected at a point were included in the species richness calculations. The habitats varied in the total number of species detected. Grassland and pine-dominated habitats had the most diversity, with 64 species detected within or bordering grassland habitats, and 59 species detected within or bordering pine-dominated habitats. The lowest diversity was found within hardwood forest points (Figure 6).

Winter Counts

A total of 1,410 birds comprised of 63 species were detected during all winter surveys (Appendix III, V).

A total of 192 birds consisting of 9 species were detected on the winter grassland transect counts. The five most common birds detected totaled 95% of all birds detected on line transects. The two most common birds detected were Savannah Sparrow (40% of total detections) and Eastern Meadowlark (36% of total detections).

A total of 253 birds comprised of 51 species were detected during the winter area search surveys. The five most common birds detected were American Pipit, Savannah Sparrow, Ring-billed Gull, American Robin, and Song Sparrow. These birds accounted for 49% of total birds detected on the three area search counts.

A total of 58 ducks and 35 geese were detected during the waterfowl surveys. The vast majority of ducks were located within the headwaters of the Blackwater River. Geese were found in the ponds within the golf course area. No waterfowl were detected in TA-17.

A total of 259 birds consisting of 39 species were detected during the winter point count surveys. The five most common birds detected during these point counts were Ruby-crowned Kinglet, Cedar Waxwing, Carolina Chickadee, Tufted Titmouse, and Northern Cardinal. These birds accounted for 51% of total detections.

No birds were detected during the marsh bird playback survey.

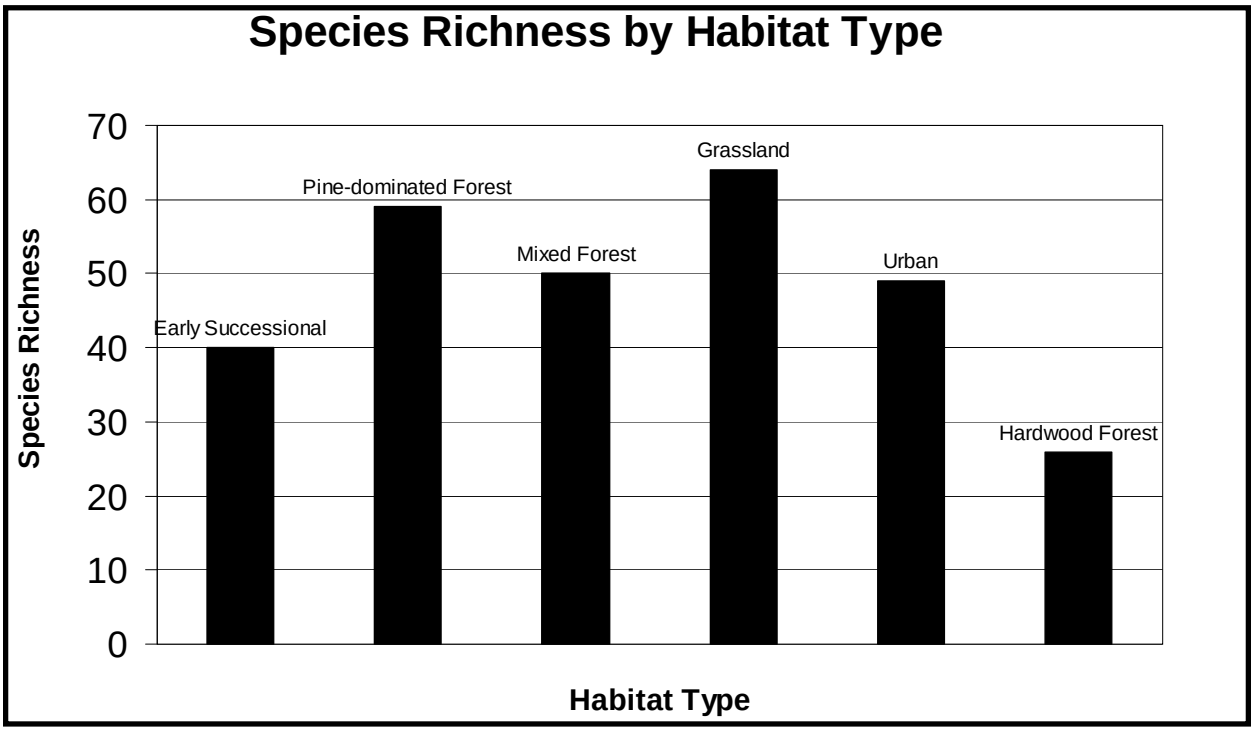

Figure 6. Species richness values for habitats within Fort Lee. Values are based on the accumulated totals of species detected at point counts over the two breeding season survey rounds (between 24 May 2008 and 16 June 2008).

A significant difference was noted in the densities of temperate migrants among habitat types (Kruskal-Wallace ANOVA H=35.73, p<.01). Post-hoc analysis showed significantly greater densities of temperate migrants within the urban (N=8 points, 5.41+/-2.26 SD) and grassland (N=16 points, 3.90+/-2.05 SD) habitat compared with the pine-dominated (N=34 points, 2.12+/-1.43 SD), mixed forest (N=18 points, 0.85+/-1.16 SD), hardwood forest (N=4 points, 0.48+/-0.95 SD), and early successional habitats (N=9 points, 1.59+/-1.36 SD) (Figure 7). A significant difference was also noted in the densities of Neotropical migratory birds on Fort Lee (Figure 8). Neotropical migrant densities were significantly higher in early successional habitat (N=9 points, 4.85+/-4.30 SD) compared to the other habitats surveyed. Neotropical migrants densities were also significantly lower within the grassland survey plots compared to the other habitats surveyed. Mann-Whitney U post-hoc analysis indicated significantly greater densities of temperate migrants (p<.01) in both

urban and grassland habitats. Post-hoc analysis also indicated greater densities of Neotropical migrants in early successional habitat and lower densities in grassland habitat ($p<.01$). Fewer resident species were found within grassland habitat on Fort Lee (Figure 9).

Table 1. All species of concern with their associated PIF scores detected in Fort Lee during the 2008 breeding season surveys.

Common Name	PIF 25	PIF 24	PIF 23	PIF 22	PIF 21	PIF 20	PIF 19
Prairie Warbler	3						
Wood Thrush		22					
Brown-headed Nuthatch			4				
Worm-eating Warbler			2				
Eastern Wood-Pewee				46			
Acadian Flycatcher				42			
Yellow-throated Vireo				9			
Louisiana Waterthrush				5			
Prothonotary Warbler				5			
Great Crested Flycatcher					85		
Northern Bobwhite					56		
Field Sparrow					46		
White-eyed Vireo					35		
Scarlet Tanager					6		
Brown Thrasher					4		
Hooded Warbler					1		
Yellow-throated Warbler					1		
Carolina Chickadee						110	
Grasshopper Sparrow						64	
Chimney Swift						35	
Yellow-breasted Chat							25
Gray Catbird							13
Total Watch Species Detected	**3**	**22**	**6**	**107**	**234**	**209**	**38**

All species of concern that were detected in the 1997-1998 survey and the 2002-2003 survey were pooled together with the data from the 2008 survey. A comparison table of the mean densities of these species of concern was constructed (Table 2). Species of concern were grouped in the five habitat categories from Watts 1999b.

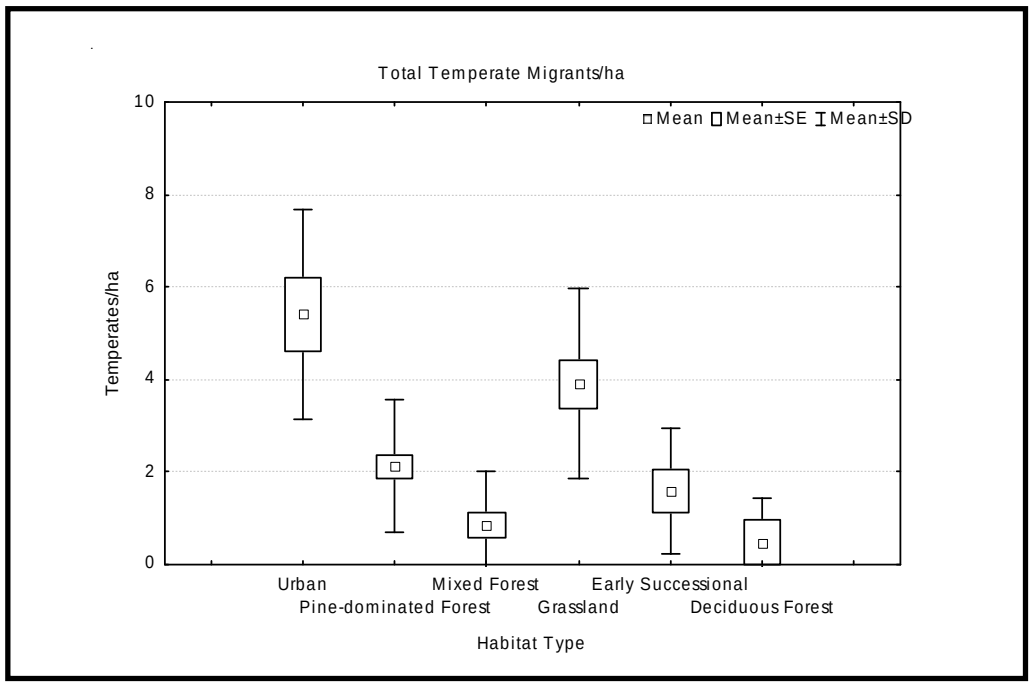

Figure 7. Total density values for temperate migrant species within the six main habitat categories on Fort Lee. Values are based on the mean densities for birds detected during the two breeding season survey rounds and within 50 m of the point count center.

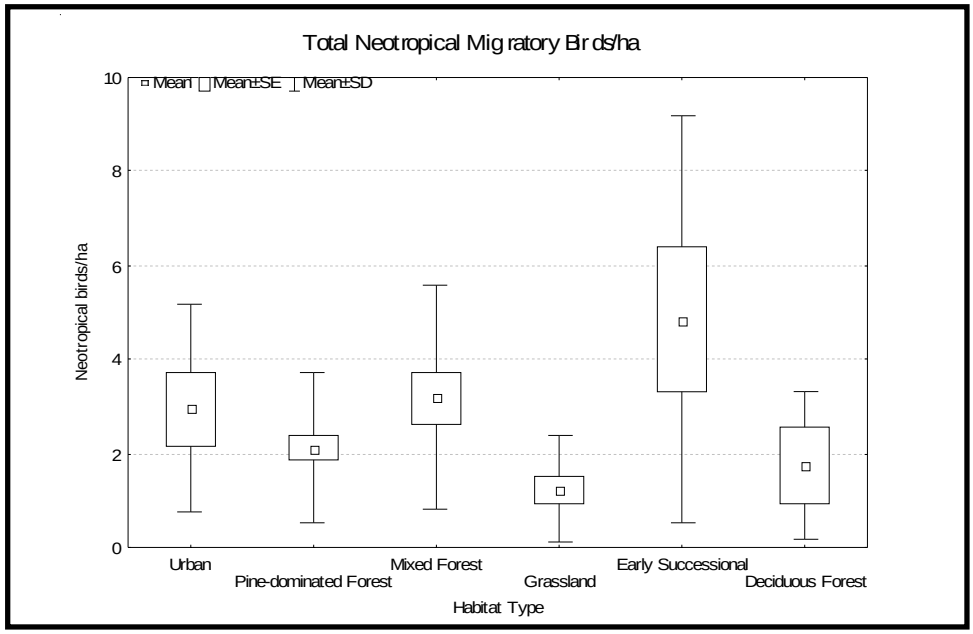

Figure 8. Total density values for Neotropical migrant species within the six main habitat categories on Fort Lee. Values are based on the mean densities for birds detected during the two breeding season survey rounds and within 50 m of the point count center.

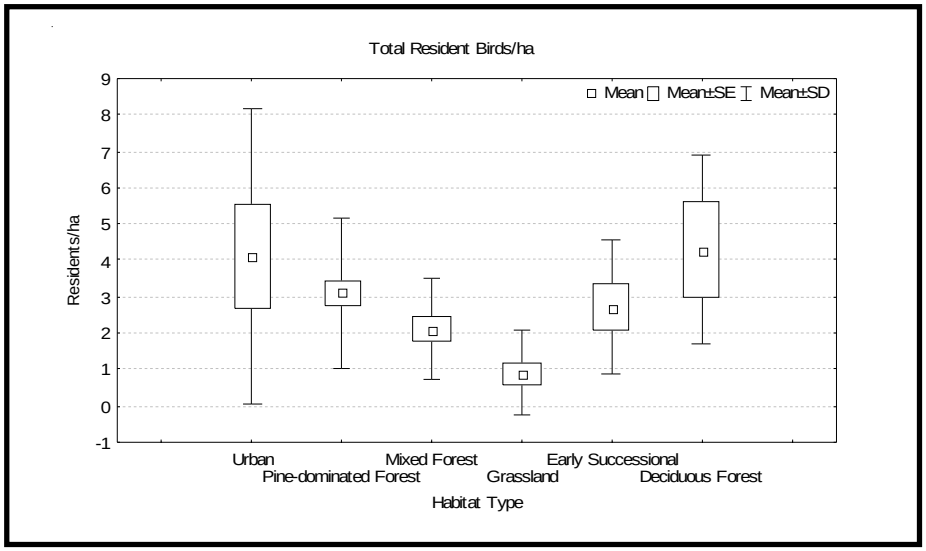

Figure 9. Total density values for resident species within the six main habitat categories on Fort Lee. Values are based on the mean densities for birds detected during the two breeding season survey rounds and within 50 m of the point count center.

Table 2. Mean density of birds within 50 meters by habitat type. For analysis purposes, all data were grouped into the five original habitat types from the 1997-1998 surveys (Watts 1999). Numbers 1,2, and 3 indicate year in which survey was conducted (1=1997-98, 2=2002, and 3=2008). Numeric values in each column indicate mean densities of birds/10 ha. Asterisk indicates that species were detected on surveys outside of the 50 meter point count radius. Number of points surveyed varied in the three years of surveys.

Species	PIF	Early Suc.			Urban			PINE			Mixed			Hardwood		
Code	Sc.	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
PRAW	25	1.9	4.2	*				0.5		*	0.1					
WOTH	24		*			0.8	*	1.6	0.7	0.4	3.8	2.0	0.4	4.7	4.4	
BHNU	23							0.2	0.8				0.4	0.2		*
KEWA[1]	23										0.3			1.2	0.8	
WEWA	23							0.5	*	*			0.4			
ACFL	22		0.4	*			*	2.0	0.3	1.0	3.5	2.0	2.8	4.7	2.8	3.2
EAWP	22		1.6	*		*	0.8	0.6	0.7	0.2	2.1	3.2	1.4	1.4	2.8	*
LOWA	22			0.3						0.2	0.4		0.8		0.4	
PROW	22								0.8			1.0	1.6	0.2		
YTVI	22		*	*				0.2	0.2	*	0.6	0.3	*		0.8	
BRTH	21	0.2			0.3		0.8	0.3		0.2	0.6	0.3		0.3		
FISP	21	4.5	1.8	1.8	0.3		0.8		0.8	0.4						
HOWA	21							0.2	*		0.3	0.3	0.4	0.2	0.8	
NOBO	21		1.6	1.2				0.2		0.6						*
SCTA	21			*				0.6	0.2		2.7	*	0.8	2.3	2.0	
WEVI	21	2.1	0.8	*				0.5		1.8	0.3		1.4	0.2		3.2
YTWA	21			*				0.5	0.8					*		
CACH	20	0.8	0.8	1.2	1.6	*	4.8	7.2	2.6	5.8	9.6	4.8	4.6	7.5	3.6	17.6
CHSW	20	0.2	1.8	1.3		7.2	9.5		0.2	0.8		0.3	*	0.2	0.8	
GRSP	20	6.4	5.7	12.5												
GCFL	20		0.4	*	*	0.4	2.4	2.0	0.7	2.4	2.7	1.0	3.9	2.4	0.8	
LOSH[2]	20				0.8											
AMKE	19	*	0.4	*												
EATO	19	1.9	5.7	0.6		1.2	4.8	3.7	0.7	5.0	3.8	0.3	1.8	0.8	*	
GRCA	19	1.2	0.4	*			4.0	0.5			1.8	*		0.3		
YBCH	19	2.6	2.8	1.3			*	0.5		0.6						
RHWO	17				0.5		*		0.2			1.0	*			
BAEA	16	*	0.4	*					*							

[1] Species not detected during 2008 survey.

[2] Species not detected during 2002 and 2008 survey.

DISCUSSION

Habitats within Fort Lee support a diverse array of species. The various survey methods used to catalog species within the project area resulted in over 4,800 detections comprised of 108 Species. The total number of species detected and densities of birds within Fort Lee is consistent with the two previous surveys of Fort Lee habitat. Habitats located within Fort Lee support at least twenty-six Partners in Flight watch species.

The early successional/grassland habitat on base continues to support a large number species of concern in the region. Fort Lee's long rotational grasslands are of regional significance (Watts 1999a) and harbor some of the highest densities of Grasshopper Sparrows in the region (Wilson, personal communication). The densities of birds using the fallow fields and wet drainage ditches during the winter months was unexpectedly high. The wet drainage ditches appeared to be especially important during this time period. The majority of winter birds detected were found within the wet drainage ditches in TA-17. These surveys were conducted before the development in the North Range Area. The loss of habitat and the reduction in size of the fallow field/wet ditch habitat in TA-17 will likely result in the reduction of breeding and wintering bird diversity and densities on Fort Lee. Maintaining the remaining grasslands and wet ditches should be a priority for Fort Lee.

The shrub/scrub habitat located on the installation is important for many species of concern, although it appears from survey data that fewer shrub/scrub obligates are utilizing the base during the breeding season than in past surveys (Watts 1999b and AH Environmental 2004). Most importantly, the Prairie Warbler and the Yellow-breasted Chat (species of high concern in the region), were only detected at a small number of previously occupied survey points. The paucity of quality habitat and the growth of previous clearcuts may be the reason that fewer shrub/scrub obligates breed on the installation. Optimum management for shrub/scrub obligates includes maintaining small brushy openings either within or on the edges of forest habitat (Nott et al. 2003). This can be accomplished at Fort Lee by allowing a buffer of shrub/scrub growth on mowed grass/forest edges. The borrow pit currently has the only shrub/scrub habitat on the installation. Maintaining and expanding this habitat should be a priority for Fort Lee. Without management of this habitat type, Prairie Warbler and Yellow-breasted Chat will likely be lost from the base. A minimum of 75-100 hectares should be managed for shrub/scrub habitat on Fort Lee.

Brown-headed Cowbirds were the tenth most common resident bird detected on Fort Lee during the breeding season. Brown-headed Cowbirds were shown to have elevated abundances associated with the presence of mowed grass in transmission line (T-line) corridors (Barber et al, 2001). The T-line corridors on Fort Lee likely attract disproportionate numbers of predators and cowbirds (Barber et al, 2001). Forest-interior Neotropical migrant birds nesting near these corridors are predated and parasitized at much higher rates than birds nesting in forest interiors (Mayfield, 1965; Gates and Gysel, 1978; Chasko and Gates, 1982; Brittingham and Temple, 1983; Barber et al, 2001). The effects of cow

bird parasitism increase dramatically in mowed corridors, as the grass provides food for the cowbirds and the T-lines provide an area for males to display (Barber et al 2001). The effects of nest parasitism and predation could be reduced by allowing the mowed T-line corridors to develop into a continual early successional habitat type rather than the grass dominated habitat that is present now. This could be accomplished by lengthening the mowing rotation of these corridors.

Densities of Neotropical migrants and temperate migrants were lower in hardwood habitats during this survey compared to the previous two surveys of Fort Lee. Approximately 100 hectares (and the largest two contiguous stands) of this habitat type were lost due to Base Realignment Commission (BRAC) development and residential housing development on Fort Lee. The 2008 surveys then focused on the key grassland and shrub/scrub habitats on base, and also on the pine-dominated and mixed forest habitat on the base. During the 2008 surveys only four hardwood points were surveyed. This is below the number of points in this habitat type in both the 1997-98 and 2002 surveys. In the 1997-1998 surveys, the habitat with the highest diversity was the hardwood-dominated forest (Watts 1999b). Survey data show that this habitat type is consistently more important for Neotropical migratory birds during the breeding season (Turner et al. 2002). Future surveys of Fort Lee should maximize the number of hardwood points surveyed based on amount of habitat available.

The pine-dominated habitat within Fort Lee harbors 22 of the 26 PIF watch species detected on the installation. However, the densities of birds within this habitat type are lower overall than the other forest types. The management of the pine stands on the base could increase the density and richness in these stands. The mixed pine/hardwood and hardwood-dominated forest have consistently harbored higher densities of temperate migrants, Neotropical migrants, and PIF “watch” species than the pine-dominated forests located within the installation (Watts 1999b and AH Environmental 2004). While both young (1-5 years) and old (>100 years) pine forests support large communities of birds, intermediate aged pine forests support very few species, migratory or resident (Freemark et. al. 1995). One important PIF watch species detected on Fort Lee, the Brown-headed Nuthatch, is a southeastern pine ecosystem obligate. This species was observed in greater numbers in the pine and mixed habitat near the Blackwater River headwaters. It is a species that responds well to thinning of pine-dominated forests (Wilson and Watts 1999 and Wilson and Watts 2000). The large canopy openings created during thinning allow for understory regeneration and have an overall positive influence on species richness and diversity. Management considerations (from Melchiors, in press) for pine-dominated habitat in Fort Lee include:

-Reducing intensive mechanical disturbance during site preparation to maintain rootstocks of woody shrubs and broadleaf trees.

-Reducing planting density and increasing row spacing to extend the time to canopy closure.

-Reducing or delaying hardwood control in early successional pines.

-Retaining scattered mature hardwoods in or near early successional pines.

-Thinning this habitat type early to promote shrub and hardwood development under an open pine canopy

The highest densities of temperate migrants were found in urban habitat on the base. These numbers were skewed by high counts of American Robins in these habitats. The overall use of urban habitats is much lower than all other habitat types and is of the least conservation concern in the region.

The riparian floodplain forest located within the headwaters of the Blackwater River contains many species of concern. The headwaters provide the best habitat for at least two species of concern breeding on the base: Prothonotary Warbler and Red-headed Woodpecker. These species are both dependent on snags for breeding cavities. The Prothonotary Warbler was found exclusively within this habitat type. The headwaters provided the best waterfowl habitat on Fort Lee. Training Area 17 provides very little waterfowl habitat. The use of the pond in TA-17 by waterfowl could be increased by reducing the depth and increasing the footprint of the pond thereby allowing vegetation to grow in the pond.

ACKNOWLEDGMENTS

This project would not have been possible without the help of many people. Dana Bradshaw and Alan Mills provided assistance through all aspects of the field project. Lee Bristow assisted with data collection. Finally, we gratefully acknowledge administrative support from Michael Ludwick, Mark Roberts, Gloria Sciole, Renee Peace, and Carlton Adams at the College of William and Mary. This project was funded through a cooperative agreement with Versar Inc. and Fort Lee.

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Appendix I. Description and location of points surveyed during 2008 breeding season. Criteria for habitat delineation from Watts 1999a.

Point ID	Habitat Type	Latitude	Longitude
BC-01	Deciduous Forest	37.24968790	-77.31705121
BC-02	Deciduous Forest	37.24859624	-77.31876430
BC-03	Deciduous Forest	37.24744239	-77.32046935
BC-04	Deciduous Forest	37.24670059	-77.32238310
EM-01	Early Successional	37.29208231	-77.33707130
EM-02	Early Successional	37.29242337	-77.33551478
EM-03	Early Successional	37.29141628	-77.33456796
EM-04	Early Successional	37.29064917	-77.33614770
EM-05	Early Successional	37.26885094	-77.32800066
EM-06	Early Successional	37.26754387	-77.32674371
SG-02	Early Successional	37.23829706	-77.31908642
SG-03	Early Successional	37.23689024	-77.31853003
SG-04	Early Successional	37.23660618	-77.32070630
GR-01	Grassland	37.28413115	-77.34734416
GR-02	Grassland	37.28384642	-77.34539051
GR-03	Grassland	37.28757771	-77.34575545
GR-04	Grassland	37.28879191	-77.34374581
GR-05	Grassland	37.29069955	-77.34547759
GR-06	Grassland	37.29071170	-77.34312722
GR-07	Grassland	37.29044155	-77.33942058
GR-08	Grassland	37.29228540	-77.33942041
GR-09	Grassland	37.28766907	-77.33251406
GR-10	Grassland	37.28595363	-77.33235338
GR-11	Grassland	37.28556739	-77.35073221
GR-12	Grassland	37.28551551	-77.35334116
GR-13	Grassland	37.28705518	-77.35320596
GR-14	Grassland	37.28704487	-77.35065610
GR-15	Grassland	37.21817991	-77.33065562
GR-16	Grassland	37.21827739	-77.32982473
FL-01	Mixed Forest	37.21704600	-77.31787297
FL-02	Mixed Forest	37.21764900	-77.31528100
FL-03	Mixed Forest	37.21812800	-77.31270200
FW-01	Mixed Forest	37.26972484	-77.33769919
FW-02	Mixed Forest	37.27105966	-77.33652279
FW-03	Mixed Forest	37.27190313	-77.33416563
FW-04	Mixed Forest	37.27243504	-77.33223653
FW-13	Mixed Forest	37.21835257	-77.32816913
FW-14	Mixed Forest	37.21841577	-77.32641656
FW-15	Mixed Forest	37.21881341	-77.32473884
FW-16	Mixed Forest	37.21778839	-77.32361977
MH-01	Mixed Forest	37.27341120	-77.33614485
MH-02	Mixed Forest	37.27317458	-77.33796280
MH-03	Mixed Forest	37.27445517	-77.33714682
MH-04	Mixed Forest	37.27381177	-77.33439387
MM-01	Mixed Forest	37.24097181	-77.32005939
MM-02	Mixed Forest	37.23990605	-77.31889095
MM-03	Mixed Forest	37.24059094	-77.31790951
FW-05	Pine-dominated Forest	37.27788060	-77.34863430
FW-06	Pine-dominated Forest	37.27806626	-77.34745597

Appendix I cont... Description and location of points surveyed during 2008 breeding season. Criteria for habitat delineation from Watts 1999a.

Point ID	Habitat Type	Latitude	Longitude
FW-07	Pine-dominated Forest	37.27577959	-77.34868594
FW-08	Pine-dominated Forest	37.27561782	-77.34694979
FW-09	Pine-dominated Forest	37.28445905	-77.34219884
FW-10	Pine-dominated Forest	37.28501293	-77.33886737
FW-11	Pine-dominated Forest	37.28408036	-77.33806036
FW-12	Pine-dominated Forest	37.28270916	-77.33928806
MP-01	Pine-dominated Forest	37.22228989	-77.33748738
MP-02	Pine-dominated Forest	37.22311852	-77.33888246
MP-03	Pine-dominated Forest	37.22452073	-77.33851684
MP-04	Pine-dominated Forest	37.22408186	-77.33676653
PB-01	Pine-dominated Forest	37.28592144	-77.34152863
PB-02	Pine-dominated Forest	37.28620542	-77.33947967
PI-01	Pine-dominated Forest	37.27996510	-77.33779642
PI-02	Pine-dominated Forest	37.27884435	-77.33906301
PI-03	Pine-dominated Forest	37.27711651	-77.33718127
SG-01	Pine-dominated Forest	37.23943063	-77.32051050
SS-01	Pine-dominated Forest	37.26516735	-77.33266208
SS-02	Pine-dominated Forest	37.26625968	-77.33185055
SS-03	Pine-dominated Forest	37.26722058	-77.33136264
SS-04	Pine-dominated Forest	37.26807319	-77.33031440
SS-05	Pine-dominated Forest	37.28799571	-77.33783045
SS-06	Pine-dominated Forest	37.28752306	-77.33959987
SS-07	Pine-dominated Forest	37.28912777	-77.33808828
SS-08	Pine-dominated Forest	37.28891948	-77.33972803
TL-01	Pine-dominated Forest	37.21680016	-77.32244127
TL-02	Pine-dominated Forest	37.21747465	-77.32084972
TL-03	Pine-dominated Forest	37.22271577	-77.31185745
TL-04	Pine-dominated Forest	37.22469491	-77.30961579
TL-05	Pine-dominated Forest	37.24902095	-77.31572863
TL-06	Pine-dominated Forest	37.24754398	-77.31568345
TL-07	Pine-dominated Forest	37.24605300	-77.31635517
TL-08	Pine-dominated Forest	37.24561790	-77.31830078
OP-01	Urban	37.21780960	-77.33390084
OP-02	Urban	37.22005368	-77.33251641
OP-03	Urban	37.22064058	-77.33026930
OP-04	Urban	37.22227179	-77.32830534
UR-01	Urban	37.24481056	-77.34758430
UR-02	Urban	37.24920670	-77.33910391
UR-03	Urban	37.24877134	-77.32549430
UR-04	Urban	37.24970894	-77.32112741

Appendix II. Location of points surveyed during 2008 winter survey season.

Point	Latitude	Longitude
WI-01	37.21704600	-77.31787297
WI-04	37.21835257	-77.32816913
WI-05	37.21841577	-77.32641656
WI-06	37.21881341	-77.32473884
WI-07	37.21778839	-77.32361977
WI-02	37.21817991	-77.33065562
WI-03	37.21827739	-77.32982473
WI-08	37.21680016	-77.32244127

Appendix III. List of species detected by survey season.

Common Name	Winter Surveys	Summer Surveys
Canada Goose	x	x
Wood Duck	x	x
Mallard	x	x
Wild Turkey		x
Northern Bobwhite		x
Double-crested Cormorant		x
Great Blue Heron	x	x
Black Vulture	x	
Turkey Vulture	x	x
Osprey		x
Bald Eagle	x	
Northern Harrier	x	
Red-shouldered Hawk	x	x
Red-tailed Hawk	x	x
American Kestrel	x	x
Killdeer	x	x
Wilson's Snipe	x	
Ring-billed Gull	x	
Herring Gull	x	
Rock Pigeon	x	x
Mourning Dove	x	x
Yellow-billed Cuckoo		x
Great Horned Owl		x
Barred Owl		x
Chimney Swift		x
Ruby-throated Hummingbird		x
Belted Kingfisher		x
Red-headed Woodpecker	x	x
Red-bellied Woodpecker	x	x
Downy Woodpecker	x	x
Hairy Woodpecker	x	x
Northern Flicker	x	x
Pileated Woodpecker	x	x
Eastern Wood-Pewee	x	x
Acadian Flycatcher		x
Eastern Phoebe		x
Great-crested Flycatcher		x
Eastern Kingbird		x
White-eyed Vireo		x
Yellow-throated Vireo		x
Red-eyed Vireo		x
Blue Jay	x	x
American Crow	x	x
Fish Crow		x
Horned Lark	x	
Purple Martin		x
Tree Swallow		x

Appendix III cont... List of species detected by survey season.

Common Name	Winter Surveys	Summer Surveys
Northern Rough-winged Swallow		x
Barn Swallow		x
Carolina Chickadee	x	x
Eastern Tufted Titmouse	x	x
Red-breasted Nuthatch	x	
White-breasted Nuthatch	x	x
Brown-headed Nuthatch	x	x
Brown Creeper	x	
Carolina Wren	x	x
House Wren		x
Winter Wren	x	
Golden-crowned Kinglet	x	
Ruby-crowned Kinglet	x	
Blue-gray Gnatcatcher	x	x
Eastern Bluebird	x	x
Hermit Thrush	x	
Wood Thrush		x
American Robin	x	x
Gray Catbird		x
Northern Mockingbird	x	x
Brown Thrasher		x
European Starling	x	x
American Pipit	x	
Cedar Waxwing	x	
Northern Parula		x
Myrtle Warbler	x	
Yellow-throated Warbler		x
Pine Warbler	x	x
Prairie Warbler		x
Blackpoll Warbler		x
Black-and-white Warbler		x
Prothonotary Warbler		x
Worm-eating Warbler		x
Ovenbird		x
Louisiana Waterthrush		x
Common Yellowthroat	x	x
Hooded Warbler		x
Yellow-breasted Chat		x
Summer Tanager		x
Scarlet Tanager		x
Eastern Towhee	x	x
Chipping Sparrow	x	x
Field Sparrow	x	x
Savannah Sparrow	x	
Grasshopper Sparrow		x
Song Sparrow	x	x
Swamp Sparrow	x	

Appendix III cont... List of species detected by survey season.

Common Name	Winter Surveys	Summer Surveys
White-throated Sparrow	x	
Dark-eyed Junco	x	
Northern Cardinal	x	x
Blue Grosbeak		x
Indigo Bunting		x
Red-winged Blackbird	x	x
Eastern Meadowlark	x	x
Rusty Blackbird	x	
Common Grackle	x	x
Brown-headed Cowbird	x	x
Orchard Oriole		x
Baltimore Oriole		x
House Finch		x
American Goldfinch	x	x
Total species per survey:	**63**	**87**
Total species combined:	**109**	

Appendix IV. List of all species detected with scientific name, AOU alpha code, and migratory status.

Common Name	Genus	Species	AOU Code	Migratory Status
Canada Goose	*Branta*	*canadensis*	CAGO	Resident
Wood Duck	*Aix*	*sponsa*	WODU	Temperate Migrant
Mallard	*Anas*	*platyrhynchos*	MALL	Temperate Migrant
Wild Turkey	*Meleagris*	*gallopavo*	WITU	Resident
Northern Bobwhite	*Colinus*	*virginianus*	NOBO	Resident
Double-crested Cormorant	*Phalacrocorax*	*auritus*	DCCO	Resident
Great Blue Heron	*Ardea*	*herodias*	GBHE	Resident
Black Vulture	*Coragyps*	*atratus*	BLVU	Temperate Migrant
Turkey Vulture	*Cathartes*	*aura*	TUVU	Temperate Migrant
Osprey	*Pandion*	*haliaetus*	OSPR	Neotropical Migrant
Bald Eagle	*Haliaeetus*	*leucocephalus*	BAEA	Resident
Northern Harrier	*Circus*	*cyaneus*	NOHA	Temperate Migrant
Red-shouldered Hawk	*Buteo*	*lineatus*	RSHA	Resident
Red-tailed Hawk	*Buteo*	*jamaicensis*	RTHA	Resident
American Kestrel	*Falco*	*sparverius*	AMKE	Temperate Migrant
Killdeer	*Charadrius*	*vociferus*	KILL	Temperate Migrant
Wilson's Snipe	*Gallinago*	*delicata*	WISN	Temperate Migrant
Ring-billed Gull	*Larus*	*delawarensis*	RBGU	Temperate Migrant
Herring Gull	*Larus*	*argentatus*	HERG	Temperate Migrant
Rock Pigeon	*Columba*	*livia*	ROPI	Resident
Mourning Dove	*Zenaida*	*macroura*	MODO	Resident
Yellow-billed Cuckoo	*Coccyzus*	*americanus*	YBCU	Neotropical Migrant
Great Horned Owl	*Bubo*	*virginianus*	GHOW	Resident
Barred Owl	*Strix*	*varia*	BAOW	Resident
Chimney Swift	*Chaetura*	*pelagica*	CHSW	Neotropical Migrant
Ruby-throated Hummingbird	*Archilochus*	*colubris*	RTHU	Neotropical Migrant
Belted Kingfisher	*Ceryle*	*alcyon*	BEKI	Resident
Red-headed Woodpecker	*Melanerpes*	*erythrocephalus*	RHWO	Temperate Migrant
Red-bellied Woodpecker	*Melanerpes*	*carolinus*	RBWO	Resident
Downy Woodpecker	*Picoides*	*pubescens*	DOWO	Resident
Hairy Woodpecker	*Picoides*	*villosus*	HAWO	Resident
Northern Flicker	*Colaptes*	*auratus*	NOFL	Temperate Migrant
Pileated Woodpecker	*Dryocopus*	*pileatus*	PIWO	Resident
Eastern Wood-Pewee	*Contopus*	*virens*	EAWP	Neotropical Migrant
Acadian Flycatcher	*Empidonax*	*virescens*	ACFL	Neotropical Migrant
Eastern Phoebe	*Sayornis*	*phoebe*	EAPH	Temperate Migrant
Great-crested Flycatcher	*Myiarchus*	*crinitus*	GCFL	Neotropical Migrant
Eastern Kingbird	*Tyrannus*	*tyrannus*	EAKI	Neotropical Migrant
White-eyed Vireo	*Vireo*	*griseus*	WEVI	Neotropical Migrant
Yellow-throated Vireo	*Vireo*	*flavifrons*	YTVI	Neotropical Migrant
Red-eyed Vireo	*Vireo*	*olivaceus*	REVI	Neotropical Migrant
Blue Jay	*Cyanocitta*	*cristata*	BLJA	Temperate Migrant
American Crow	*Corvus*	*brachyrhynchos*	AMCR	Resident

Appendix IV (continued). List of all species detected with scientific name, AOU alpha code, and migratory status.

Common Name	Genus	Species	AOU Code	Migratory Status
Fish Crow	*Corvus*	*ossifragus*	FICR	Temperate Migrant
Horned Lark	*Eremophila*	*alpestris*	HOLA	Temperate Migrant
Purple Martin	*Progne*	*subis*	PUMA	Neotropical Migrant
Tree Swallow	*Tachycineta*	*bicolor*	TRES	Neotropical Migrant
Northern Rough-winged Swallow	*Stelgidopteryx*	*serripennis*	NRWS	Neotropical Migrant
Barn Swallow	*Hirundo*	*rustica*	BARS	Neotropical Migrant
Carolina Chickadee	*Poecile*	*carolinensis*	CACH	Resident
Eastern Tufted Titmouse	*Baeolophus*	*bicolor*	ETTI	Resident
Red-breasted Nuthatch	*Sitta*	*canadensis*	RBNU	Temperate Migrant
White-breasted Nuthatch	*Sitta*	*carolinensis*	WBNU	Temperate Migrant
Brown-headed Nuthatch	*Sitta*	*pusilla*	BHNU	Resident
Brown Creeper	*Certhia*	*americana*	BRCR	Temperate Migrant
Carolina Wren	*Thryothorus*	*ludovicianus*	CARW	Resident
House Wren	*Troglodytes*	*aedon*	HOWR	Neotropical Migrant
Winter Wren	*Troglodytes*	*troglodytes*	WIWR	Temperate Migrant
Golden-crowned Kinglet	*Regulus*	*satrapa*	GCKI	Temperate Migrant
Ruby-crowned Kinglet	*Regulus*	*calendula*	RCKI	Temperate Migrant
Blue-gray Gnatcatcher	*Polioptila*	*caerulea*	BGGN	Neotropical Migrant
Eastern Bluebird	*Sialia*	*sialis*	EABL	Temperate Migrant
Hermit Thrush	*Catharus*	*guttatus*	HETH	Temperate Migrant
Wood Thrush	*Hylocichla*	*mustelina*	WOTH	Neotropical Migrant
American Robin	*Turdus*	*migratorius*	AMRO	Temperate Migrant
Gray Catbird	*Dumetella*	*carolinensis*	GRCA	Neotropical Migrant
Northern Mockingbird	*Mimus*	*polyglottos*	NOMO	Resident
Brown Thrasher	*Toxostoma*	*rufum*	BRTH	Temperate Migrant
European Starling	*Sturnus*	*vulgaris*	EUST	Resident
American Pipit	*Anthus*	*rubescens*	AMPI	Temperate Migrant
Cedar Waxwing	*Bombycilla*	*cedrorum*	CEDW	Temperate Migrant
Northern Parula	*Parula*	*americana*	NOPA	Neotropical Migrant
Myrtle Warbler	*Dendroica*	*coronata*	MYWA	Temperate Migrant
Yellow-throated Warbler	*Dendroica*	*dominica*	YTWA	Neotropical Migrant
Pine Warbler	*Dendroica*	*pinus*	PIWA	Temperate Migrant
Prairie Warbler	*Dendroica*	*discolor*	PRAW	Neotropical Migrant
Blackpoll Warbler	*Dendroica*	*striata*	BLPW	Neotropical Migrant
Black-and-white Warbler	*Mniotilta*	*varia*	BAWW	Neotropical Migrant
Prothonotary Warbler	*Protonotaria*	*citrea*	PROW	Neotropical Migrant
Worm-eating Warbler	*Helmitheros*	*vermivorum*	WEWA	Neotropical Migrant
Ovenbird	*Seiurus*	*aurocapilla*	OVEN	Neotropical Migrant
Louisiana Waterthrush	*Seiurus*	*motacilla*	LOWA	Neotropical Migrant
Common Yellowthroat	*Geothlypis*	*trichas*	COYE	Neotropical Migrant
Hooded Warbler	*Wilsonia*	*citrina*	HOWA	Neotropical Migrant
Yellow-breasted Chat	*Icteria*	*virens*	YBCH	Neotropical Migrant
Summer Tanager	*Piranga*	*rubra*	SUTA	Neotropical Migrant

Appendix IV (continued). List of all species detected with scientific name, AOU alpha code, and migratory status.

Common Name	Genus	Species	AOU Code	Migratory Status
Scarlet Tanager	*Piranga*	*olivacea*	SCTA	Neotropical Migrant
Eastern Towhee	*Pipilo*	*erythrophthalmus*	EATO	Temperate Migrant
Chipping Sparrow	*Spizella*	*passerina*	CHSP	Temperate Migrant
Field Sparrow	*Spizella*	*pusilla*	FISP	Temperate Migrant
Savannah Sparrow	*Passerculus*	*sandwichensis*	SAVS	Temperate Migrant
Grasshopper Sparrow	*Ammodramus*	*savannarum*	GRSP	Temperate Migrant
Song Sparrow	*Melospiza*	*melodia*	SOSP	Temperate Migrant
Swamp Sparrow	*Melospiza*	*georgiana*	SWSP	Temperate Migrant
White-throated Sparrow	*Zonotrichia*	*albicollis*	WTSP	Temperate Migrant
Slate-colored Junco	*Junco*	*hyemalis*	SCJU	Temperate Migrant
Northern Cardinal	*Cardinalis*	*cardinalis*	NOCA	Resident
Blue Grosbeak	*Passerina*	*caerulea*	BLGR	Neotropical Migrant
Indigo Bunting	*Passerina*	*cyanea*	INBU	Neotropical Migrant
Red-winged Blackbird	*Agelaius*	*phoeniceus*	RWBL	Temperate Migrant
Eastern Meadowlark	*Sturnella*	*magna*	EAME	Temperate Migrant
Rusty Blackbird	*Euphagus*	*carolinus*	RUBL	Temperate Migrant
Common Grackle	*Quiscalus*	*quiscula*	COGR	Resident
Brown-headed Cowbird	*Molothrus*	*ater*	BHCO	Resident
Orchard Oriole	*Icterus*	*spurius*	OROR	Neotropical Migrant
Baltimore Oriole	*Icterus*	*galbula*	BAOR	Neotropical Migrant
House Finch	*Carpodacus*	*mexicanus*	HOFI	Resident
American Goldfinch	*Carduelis*	*tristis*	AMGO	Temperate Migrant
Unidentified Sparrow	*Sparrow*	*sp.*	UISP	Temperate Migrant

Appendix III. List of all birds detected during all surveys types by taxonomic order.

Common Name	Summer Point	Winter Area	Winter Line	Winter Point	Totals
Canada Goose	118	35		6	159
Wood Duck	1	20			21
Mallard	6	38		2	46
Wild Turkey	1				1
Northern Bobwhite	56				56
Double-crested Cormorant	3				3
Great Blue Heron	6	2		11	19
Black Vulture		3			3
Turkey Vulture	11	15		2	28
Osprey	1				1
Bald Eagle			1		1
Northern Harrier			3		3
Red-shouldered Hawk	13	2		3	18
Red-tailed Hawk	11	1			12
American Kestrel	2		4		6
Killdeer	8	5			13
Wilson's Snipe			9		9
Ring-billed Gull		90			90
Herring Gull		2			2
Rock Pigeon	7	26			33
Mourning Dove	37	16	2	3	58
Yellow-billed Cuckoo	6				6
Great Horned Owl	2				2
Barred Owl	2				2
Chimney Swift	35				35
Ruby-throated Hummingbird	2				2
Belted Kingfisher	1				1
Red-headed Woodpecker	10	8		9	27
Red-bellied Woodpecker	38	9		5	52
Downy Woodpecker	22	2		3	27
Hairy Woodpecker	19	4		1	24
Northern Flicker	12	8		3	23
Pileated Woodpecker	12	1		2	15
Eastern Wood-Pewee	46			3	49
Acadian Flycatcher	42				42
Eastern Phoebe	2				2
Great-crested Flycatcher	85				85
Eastern Kingbird	6				6
White-eyed Vireo	35				35
Yellow-throated Vireo	9				9
Red-eyed Vireo	81				81

Appendix III cont... List of all birds detected during all surveys types by taxonomic order.

Common Name	Summer Point	Winter Area	Winter Line	Winter Point	Totals
Blue Jay	65	12		2	79
American Crow	100	5	2	2	109
Fish Crow	3				3
Horned Lark		30			30
Purple Martin	1				1
Tree Swallow	2				2
Northern Rough-winged Swallow	2				2
Barn Swallow	43				43
Carolina Chickadee	110	21		21	152
Eastern Tufted Titmouse	118	8		14	140
Red-breasted Nuthatch		1			1
White-breasted Nuthatch	35	5		3	43
Brown-headed Nuthatch	4	6		7	17
Brown Creeper				3	3
Carolina Wren	181	17			198
House Wren	5				5
Winter Wren		1			1
Golden-crowned Kinglet				10	10
Ruby-crowned Kinglet		12		54	66
Blue-gray Gnatcatcher	89			3	92
Eastern Bluebird	7	1			8
Hermit Thrush		1		1	2
Wood Thrush	22				22
American Robin	94	77	25	6	202
Gray Catbird	13				13
Northern Mockingbird	15	2		1	18
Brown Thrasher	4				4
European Starling	416	21		8	445
American Pipit		140			140
Cedar Waxwing				30	30
Northern Parula	3				3
Myrtle Warbler		11			11
Yellow-throated Warbler	1				1
Pine Warbler	84	4		6	94
Prairie Warbler	3				3
Blackpoll Warbler	6				6
Black-and-white Warbler	2				2
Prothonotary Warbler	5				5

Appendix III cont... List of all birds detected during all surveys types by taxonomic order.

Common Name	Summer Point	Winter Area	Winter Line	Winter Point	Totals
Worm-eating Warbler	2				2
Ovenbird	66				66
Louisiana Waterthrush	5				5
Common Yellowthroat	35	2			37
Hooded Warbler	1				1
Yellow-breasted Chat	25				25
Summer Tanager	31				31
Scarlet Tanager	6				6
Eastern Towhee	82	5		1	88
Chipping Sparrow	39	28		1	68
Field Sparrow	46			2	48
Savannah Sparrow		125	77		202
Grasshopper Sparrow	64				64
Song Sparrow	18	41		1	60
Swamp Sparrow		24			24
White-throated Sparrow		20		2	22
Dark-eyed Junco		35			35
Northern Cardinal	138	7		13	158
Blue Grosbeak	19				19
Indigo Bunting	92				92
Red-winged Blackbird	30			5	35
Eastern Meadowlark	91	6	69		166
Rusty Blackbird		2			2
Common Grackle	285			3	288
Brown-headed Cowbird	47	2		1	50
Orchard Oriole	22				22
Baltimore Oriole	2				2
House Finch	8				8
American Goldfinch	84	5			89
Unidentified Sparrow		1			1
Total all surveys.	**3419**	**965**	**192**	**253**	**4829**