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**Avian Survey of Fort Lee, Virginia 2014**

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The Directorate of Public Works and Logistics,  
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# Contents

Introduction .....	4
Study Objectives .....	4
Methods.....	4
Study Area.....	4
Avian Survey Techniques .....	6
Breeding Season Surveys .....	6
Winter Season Surveys .....	6
Results.....	11
Breeding Season.....	11
Habitat Breakdown .....	13
Winter Season.....	19
Literature Cited .....	22
Acknowledgements.....	22
Appendix I .....	23
Appendix II .....	26

## **Introduction**

The Directorate of Public Works and Logistics, Environmental Management Office (EMO) is responsible for implementing requirements of the Sikes Act as indicated by the Installation's Integrated Natural Resource Management Plan and adherence to a responsibility to protect migratory birds through Executive Order 13186. In order to comply with these regulations, periodic surveys of the installation's bird populations are necessary and have been previously conducted on five-year intervals. The last rounds of surveys were conducted in 2008 and each year has followed the same set of protocols and survey locations to ensure comparable results. The overall objective of this project was to conduct a profile of the avian communities of Fort Lee during the breeding and winter seasons.

## **Study Objectives**

Objectives of this study were to include priority to documenting avian species of management interest and their use of habitats on Fort Lee. All habitats surveyed for this project were chosen by both the Environmental Management Office and Center for Conservation Biology staff members. Habitats that were considered priority for survey include

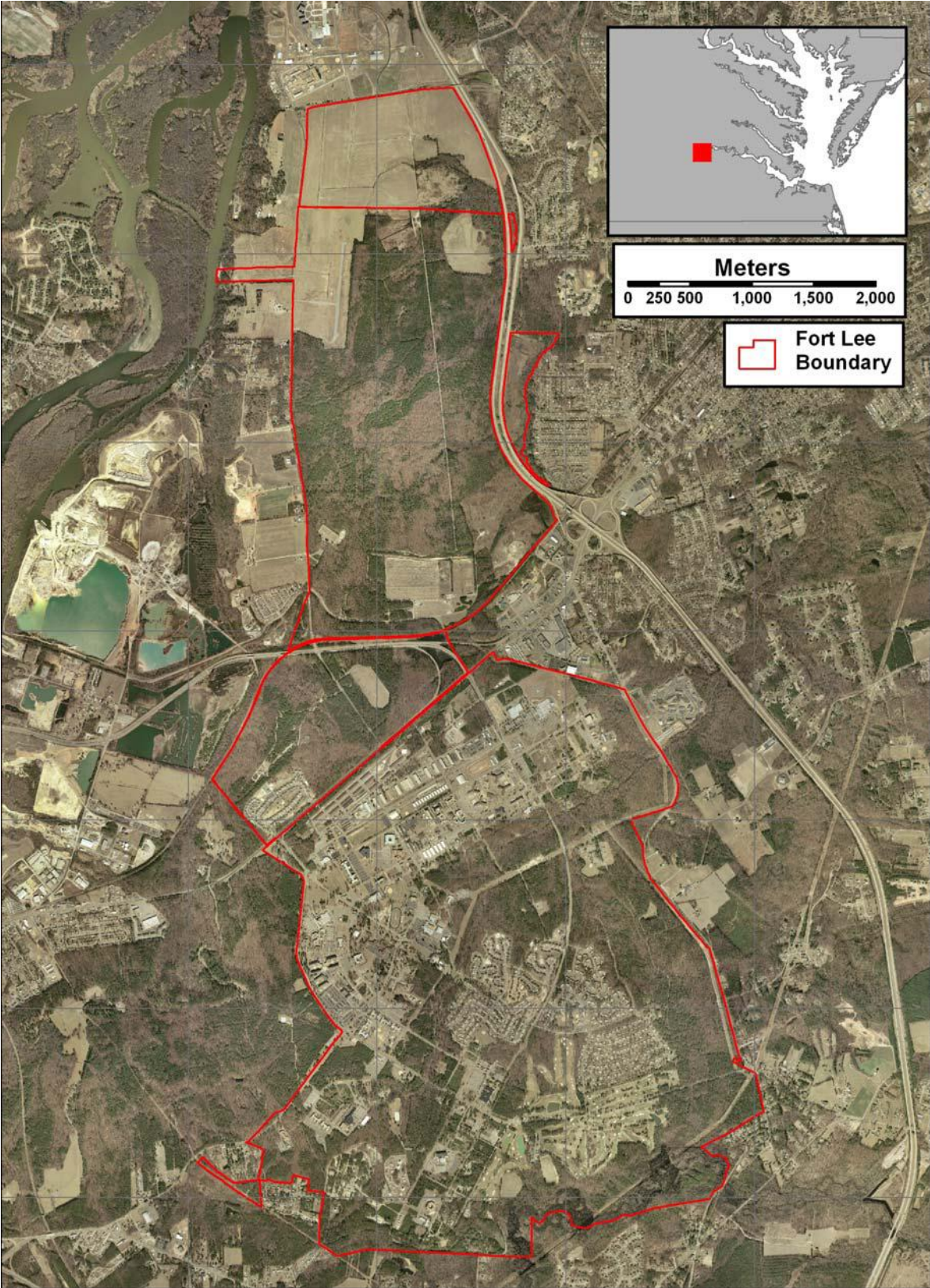
- 1) Forest interior, including deciduous, mixed pine-hardwood, and pine-dominated stands.
- 2) Grassland habitat
- 3) Urban habitat, typically dominated by sparse tree cover that is imbedded in the installation's man-made infrastructure of buildings, roads, golf courses, and other structures
- 4) Shrub-scrub habitat associated with early successional forest regeneration and emergent wetlands.

## **Methods**

### **Study Area**

Fort Lee is located on the outer portion of the Atlantic Coastal Plain (Figure 1). Elevation of the installation ranges from 15-30m above sea level. The land cover of Fort Lee is a mixture of forested, open, and developed land. Many of the open habitats are maintained in a grassy condition from repeated mowing or use of fire to reset succession. Forested areas are mostly pine-dominated with some parcels of hardwood and mixed pine-hardwood habitats. Age of forested stands vary due to past history of naturally occurring stands and silvicultural management.

Figure 1. Aerial view of Fort Lee, VA.



## **Avian Survey Techniques**

Survey locations and methods were duplicated from surveys conducted in 1997-1998 (Watts 1999), 2002-2003, and 2008-2009 (Paxton and Smith 2009). Birds were sampled during the breeding season using point count surveys at chosen locations across priority habitats. Winter surveys were completed with a variety of methods to deal with the lower detection rates of birds in habitats chosen. Winter surveys included point counts, line-transects, and area searches.

### **Breeding Season Surveys**

A total of 89 stratified-radius point count stations were positioned within the study area by distributing 34 within pine-dominated forest, 10 within pine-hardwood forest, 4 within hardwood dominated forest, 16 within grasslands, 9 within early successional habitats, 8 within urban areas, and 8 within transmission line corridors (Figure 2 & 3).

Bird surveys were conducted by a single observer standing at the point center and counting all birds to species seen or heard over a 5-minute period. Birds were registered as being within 50m or beyond 50m of the point count center. All points were surveyed two times between 10 June and 19 June, 2014. The order in which points were visited were reversed to reduce the impact that time of day may have on bird detection rates.

Birds detected within 50m were used to generate density estimates. Birds detected outside 50m contributed to values of species richness for the habitat patch being surveyed but were not used for density estimation.

### **Winter Season Surveys**

#### Grassland Transects

Four line transects were established in the landing zone of the Fort Lee range. Each transect was 400m in length and located parallel to one another in 50m increments (Figure 4). Each transect was surveyed on 23 February, and 26 March, 2014. Transect surveys were conducted by a single observer that walked slowly down the transect line and recording species detected within 25m. All birds detected with 25m were used to calculate density estimates.

#### Area Searches

A number of forest and open patches were surveyed by a single observer that walked slowly throughout the chosen habitat patch. Area searches are a good technique to identify species but not a good method to determine abundance. Area searches were conducted on 23 February and 26 March, 2014.

#### Point Counts of Mixed Pine-Hardwood Forest

A total of 8 point count stations were established in the forest patch in the southern end of the Cantonment area (Figure 5). Species were detected as being within or beyond a 50m radius. All point count stations were surveyed on 23 February and 26, March, 2014.

Figure 2. Point count survey locations used during the breeding season on the Fort Lee Range Training Area.

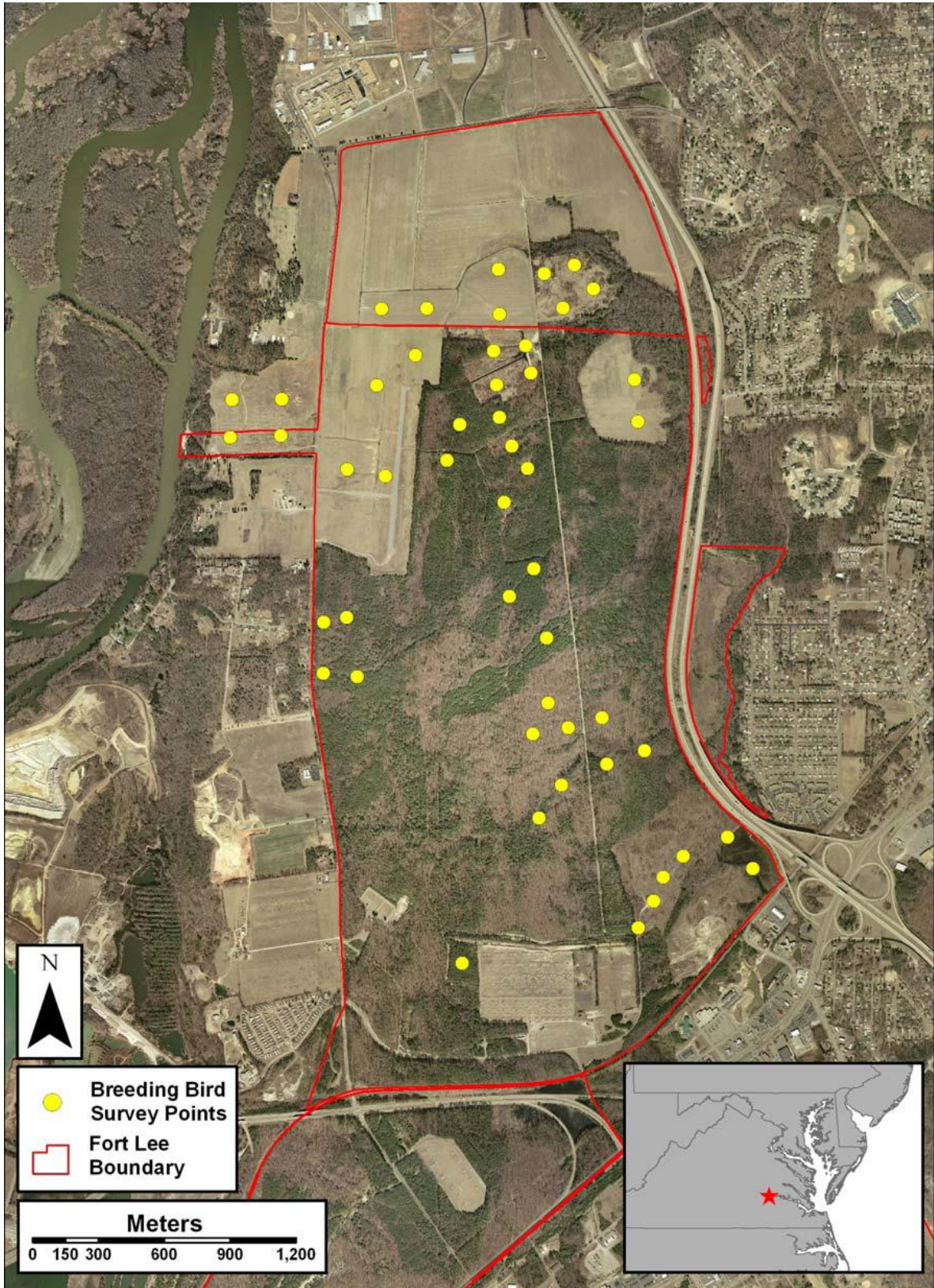


Figure 3. Point count location on the Cantonment area of Fort Lee, VA.

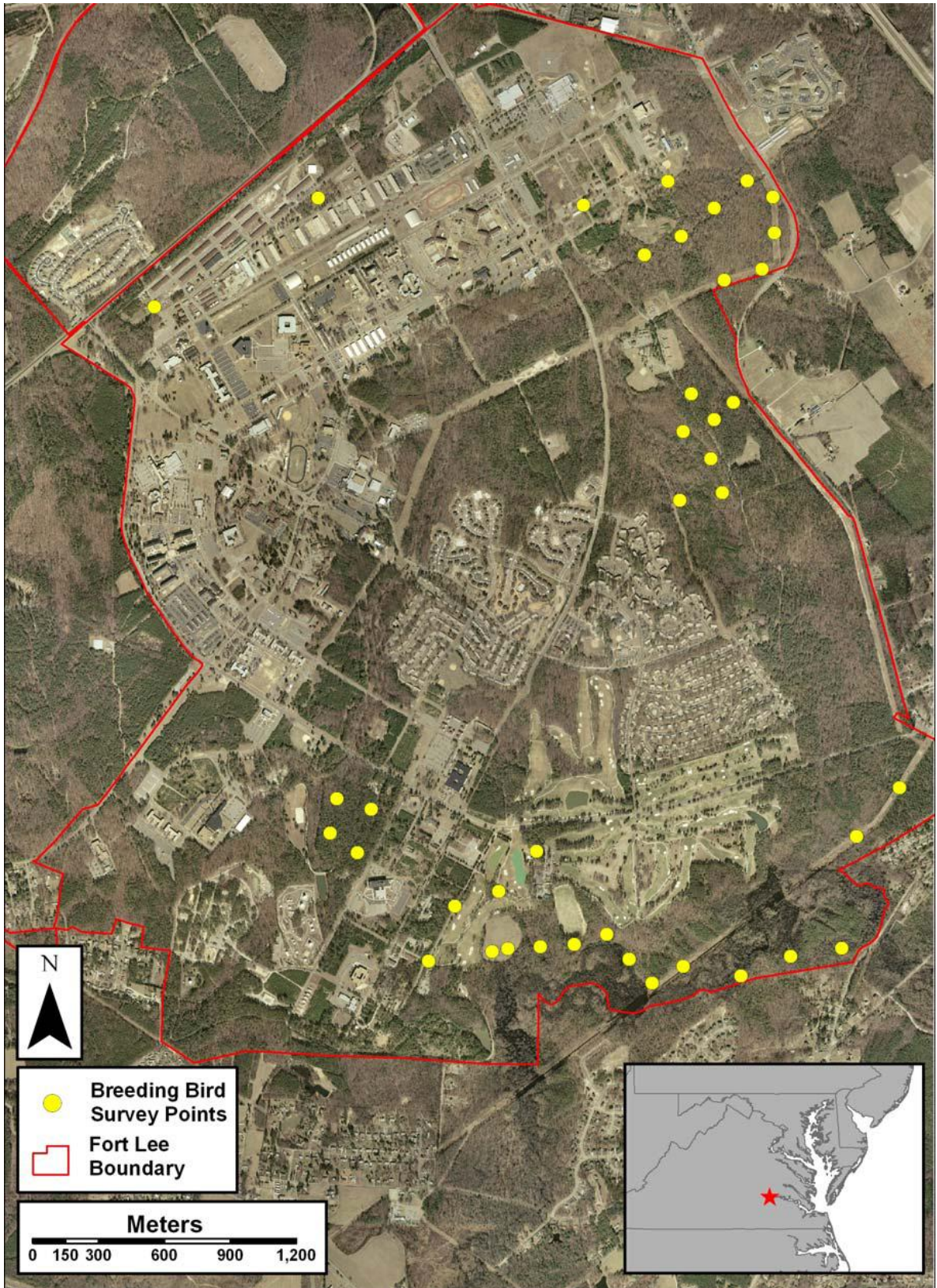


Figure 4. Map of survey transects and area searches conducted on the Fort Lee Range Training Area.

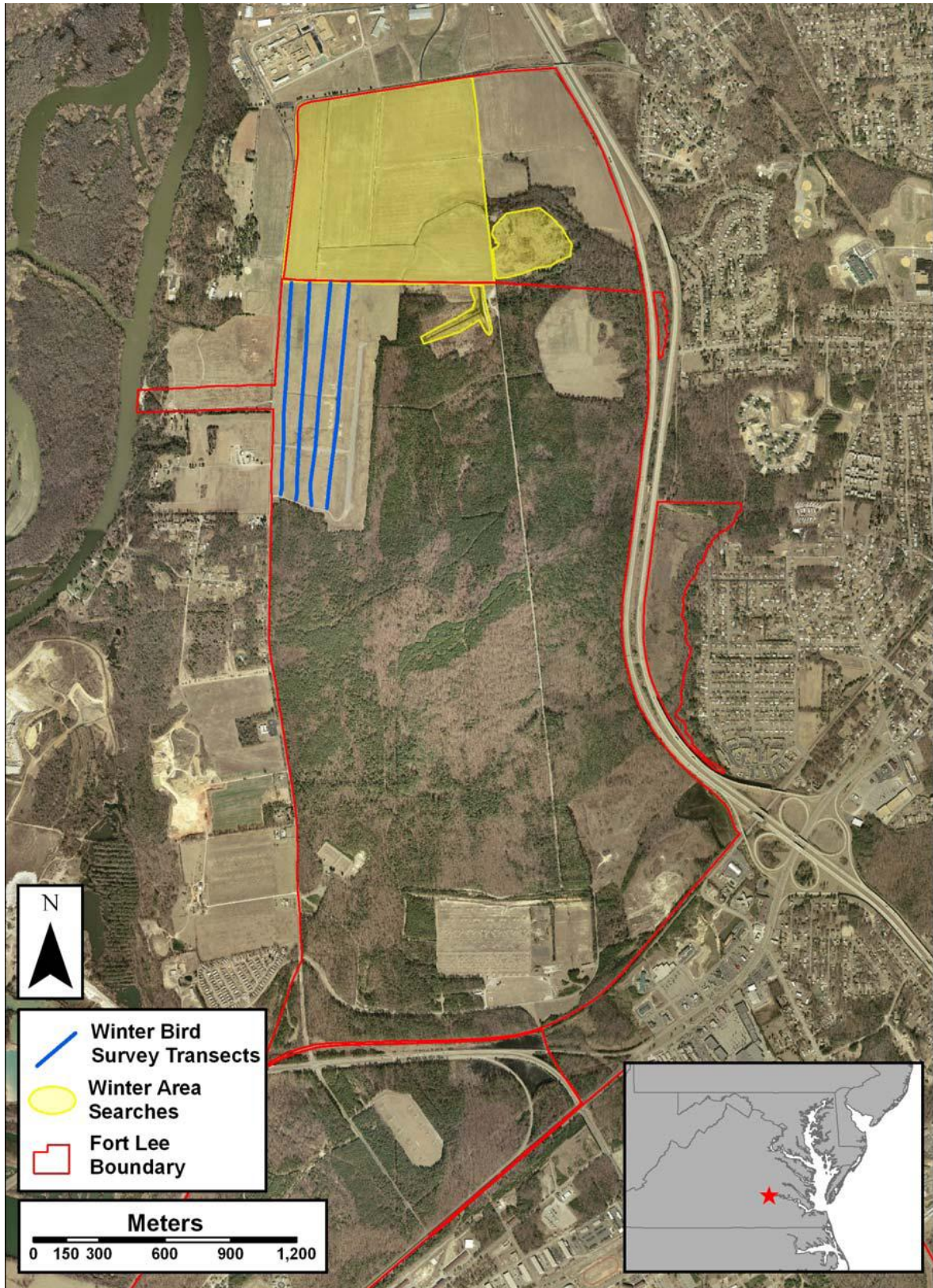
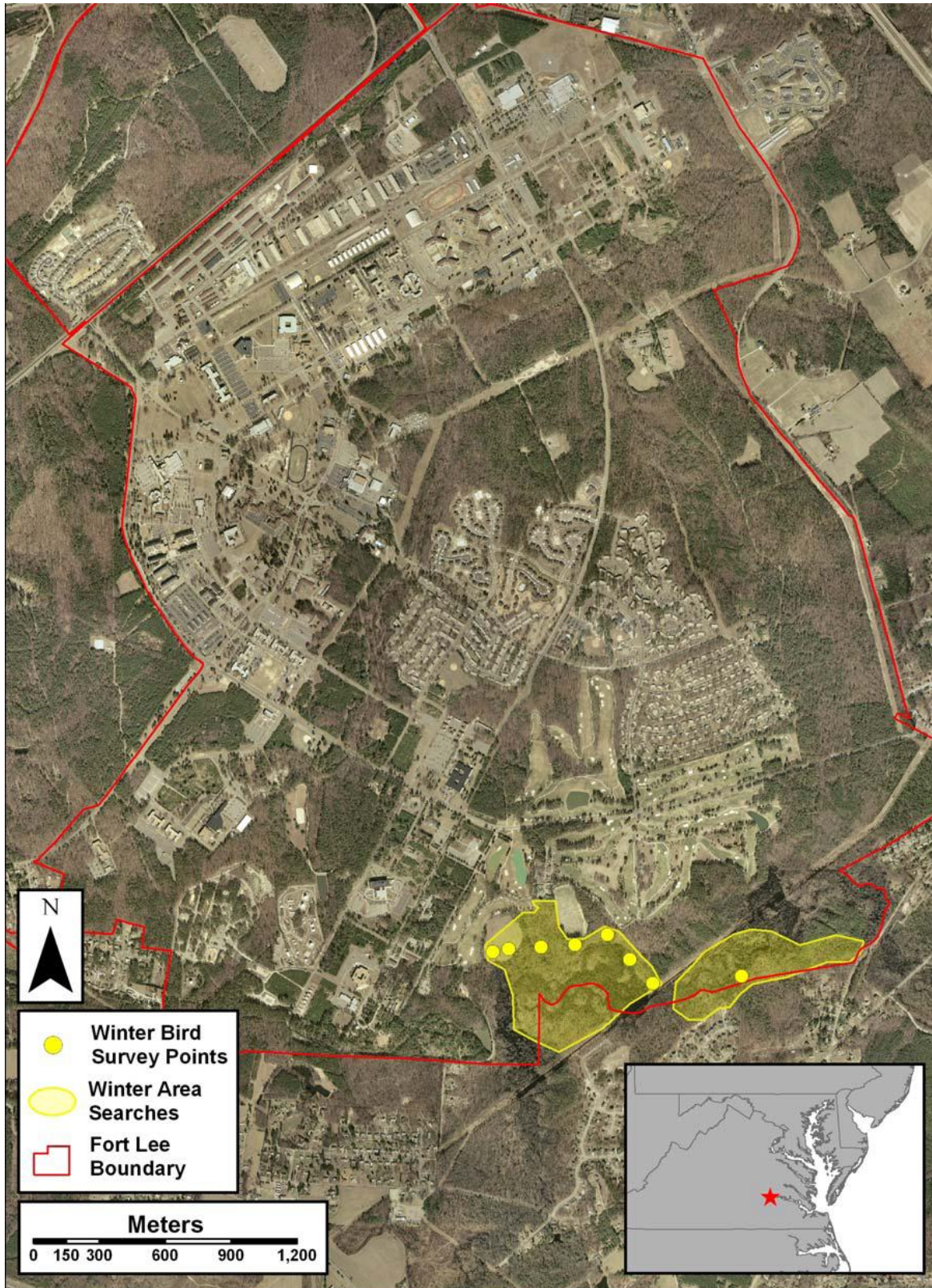


Figure 5. Point count locations and area searches of winter surveys on the Fort Lee Cantonment Area.



# Results

## Breeding Season

A total of 2,609 observations of 48 species were made during breeding season surveys. The most commonly encountered species were the Northern Cardinal, Eastern Tufted Titmouse, Carolina Chickadee, and Blue-gray Gnatcatcher. Together, these species accounted for nearly 37 % of all detections. This result is mostly due to all of these species being habitat generalists so are frequently found across all forested and mid-successional habitats.

Accumulated species richness and average species richness per survey point followed the same general pattern among habitat types (Figure 6 and 7). Mixed Forest and pine-dominated forest supported the greatest diversity of species whereas grassland and transmission line corridors supporting the fewest species. Forests support distinctly different communities of birds than those found in grasslands and other early successional habitats. The greater number of species in forested habitats is expected because forests are more structurally diverse and can support a wider range of species than simple-low vegetated grasslands. Urban habitats appeared to support a wide range of species as well but may include species not found in either forests or grasslands.

Figure 6. Accumulated number of species detected by habitat type on Fort Lee, VA.

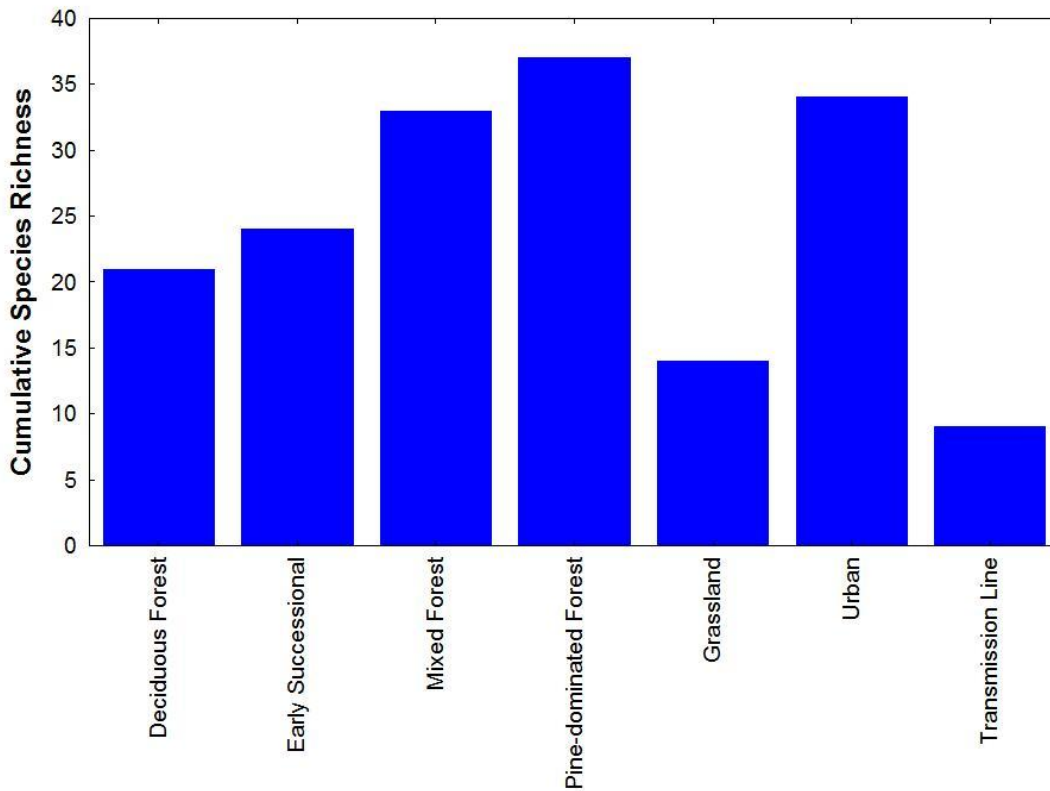
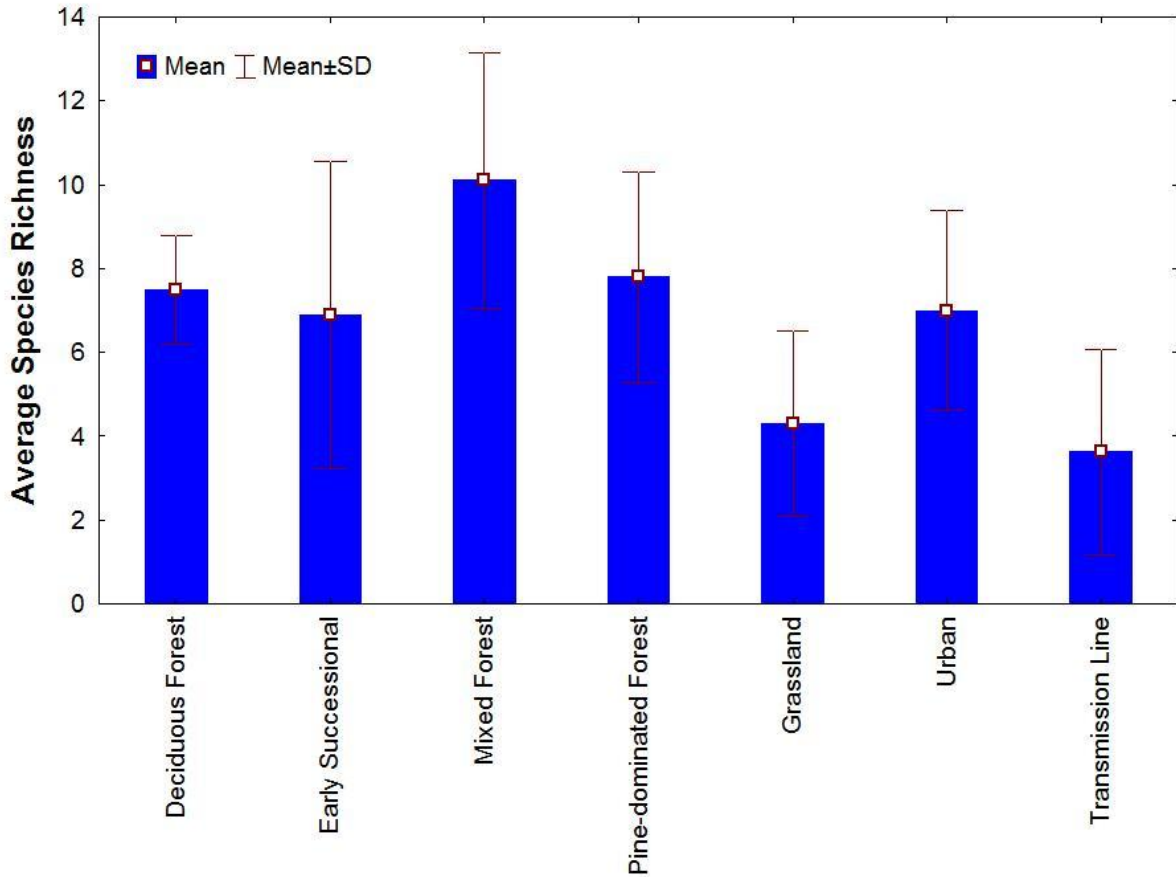
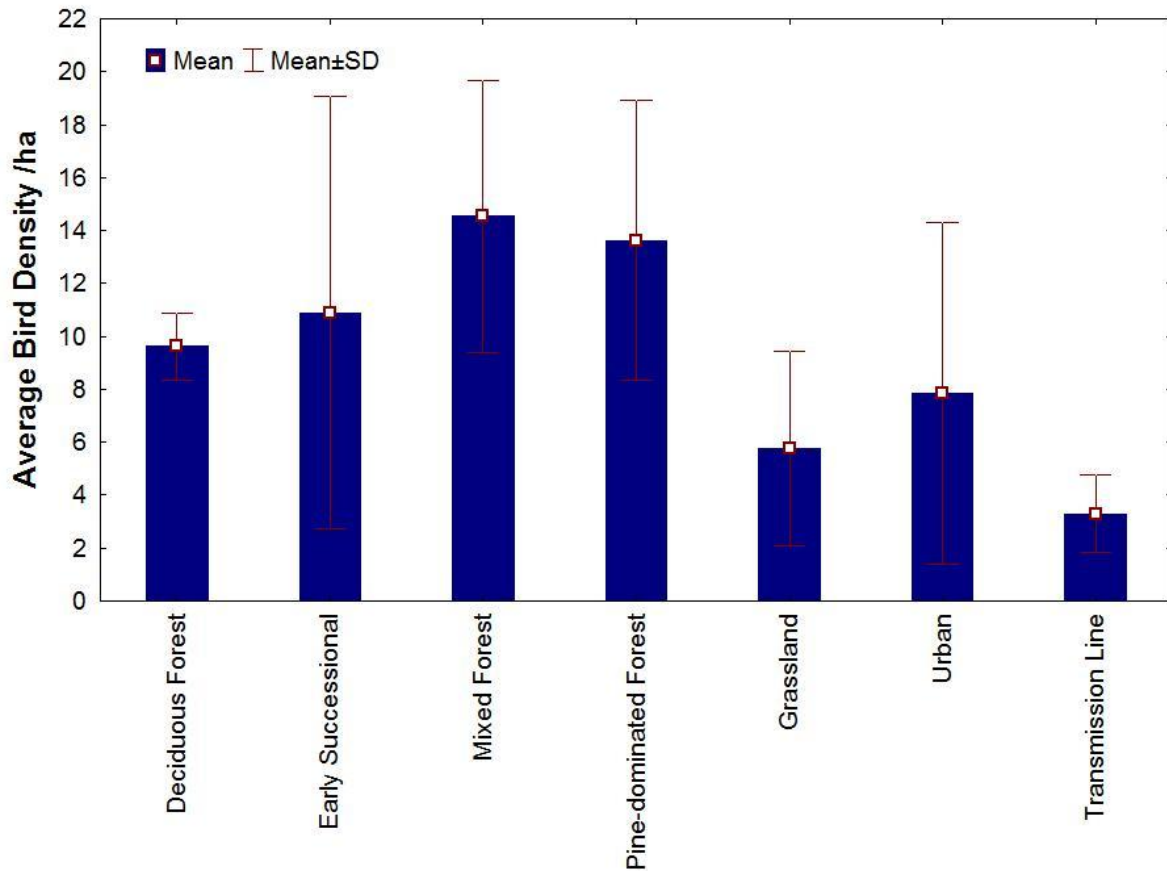


Figure 7. Average number of species detected per point count for each habitat surveyed on Fort Lee, VA.



Mixed pine and pine-dominated forests supported the highest number of birds per hectare among all habitat types (Figure 8). This result is not surprising given that these habitat types also support the greatest number of species. By contrast, even though urban habitats support a wide range of species, this habitat supports a relatively low number of birds per hectare. This result is likely due to detecting only one to a few individuals per species at any one time.

Figure 8. Average bird density per point count for all habitat types surveyed on Fort Lee, VA.



## Habitat Breakdown

### Forested Habitats

Species such as the Eastern Tufted Titmouse, Carolina Chickadee, Carolina Wren, Blue-gray Gnatcatcher, Red-eyed Vireo, and Northern Cardinal had the highest densities among all species for all 3 forested habitats (Table 1). Moreover, the density of each of these common species was relatively similar between the different forested habitats. The fact that density values could be calculated for more species detected in mixed and pine-dominated forests compared to deciduous forest was likely due to having more survey points in the former two categories.

The Belted Kingfisher is not a forested species per se, but rather was detected along the forested edge that was adjacent to open water. Kingfishers require open water for foraging and therefore are not typically found within forest interiors. The Prothonotary Warbler was only detected at points within

Table 1. Detection and Average density ( $\pm$  SD) per ha of selected species detected within 50m radius point counts for forested habitats of Fort Lee, VA. A value of D indicates the species was only detected beyond 50m so a density value could not be calculated. Value of N under habitat types indicate number of count stations.

Species	Forested Habitat Category		
	Deciduous (N=4)	Mixed (N= 10)	Pine-dominated (N = 18)
Red-shouldered Hawk		D	
Mourning Dove		D	0.1 $\pm$ 0.26
Yellow-billed Cuckoo		0.1 $\pm$ 0.30	D
Belted Kingfisher	0.3 $\pm$ 0.64		
Pileated Woodpecker	D	D	D
Red-bellied Woodpecker	0.3 $\pm$ 0.64	0.4 $\pm$ 0.59	0.3 $\pm$ 0.53
Hairy Woodpecker	D	0.1 $\pm$ 0.30	0.1 $\pm$ 0.26
Downy Woodpecker	D	0.4 $\pm$ 0.59	0.2 $\pm$ 0.36
Northern Flicker	D		0.1 $\pm$ 0.26
Great-crested Flycatcher	D	0.5 $\pm$ 0.89	D
Eastern Wood-Pee-wee	D	0.1 $\pm$ 0.30	0.1 $\pm$ 0.36
Acadian Flycatcher	D	0.6 $\pm$ 0.79	0.3 $\pm$ 0.57
White-eyed Vireo		D	0.1 $\pm$ 0.26
Red-eyed Vireo	0.6 $\pm$ 0.74	1.4 $\pm$ 1.07	0.9 $\pm$ 1.05
Yellow-throated Vireo	D	D	D
Blue Jay	D	0.1 $\pm$ 0.60	
American Crow	D		0.2 $\pm$ 0.52
Eastern Tufted Titmouse	2.2 $\pm$ 1.61	1.8 $\pm$ 1.53	1.8 $\pm$ 1.30
Carolina Chickadee	1.3 $\pm$ 1.05	1.5 $\pm$ 1.18	1.4 $\pm$ 1.33
White-breasted Nuthatch		0.1 $\pm$ 0.61	
Carolina Wren	1.6 $\pm$ 1.23	1.5 $\pm$ 1.18	0.7 $\pm$ 1.13
Blue-gray Gnatcatcher	1.6 $\pm$ 1.23	1.6 $\pm$ 0.94	1.3 $\pm$ 0.85
American Robin		0.6 $\pm$ 1.10	0.5 $\pm$ 0.91
Northern Parula			0.1 $\pm$ 0.26
Pine Warbler		0.2 $\pm$ 0.59	0.9 $\pm$ 0.9
Prothonotary Warbler		0.1 $\pm$ 0.60	
Ovenbird	D	0.7 $\pm$ 0.9	0.4 $\pm$ 0.82
Common Yellowthroat		D	0.1 $\pm$ 0.36
Yellow-breasted Chat		0.1 $\pm$ 0.30	0.1 $\pm$ 0.36
Wood Thrush		0.1 $\pm$ 0.41	
Northern Mockingbird			0.1 $\pm$ 0.26
Northern Cardinal	1.6 $\pm$ 1.23	1.6 $\pm$ 1.13	1.7 $\pm$ 1.44
Brown-headed Cowbird		0.1 $\pm$ .049	0.6 $\pm$ 1.36
Common Grackle		D	D
Scarlet Tanager	D	D	
Summer Tanager	D	0.4 $\pm$ 0.59	0.4 $\pm$ 0.82
Eastern Towhee		0.5 $\pm$ 0.78	1.1 $\pm$ 0.90
Indigo Bunting	D		0.1 $\pm$ 0.65
Blue Grosbeak			0.1 $\pm$ 0.36
American Goldfinch		D	0.2 $\pm$ 0.57

forested wetlands. This species generally nests in swamp and bottomland forests such as found in the southern portion of the Cantonment area. Other notable species detected include the Wood Thrush, Scarlet Tanager, and Yellow-billed Cuckoo. All three of these species are Neotropical migrants of conservation concern. Scarlet Tanagers require deciduous forests which explain why they were not found in pine-dominated forests. By comparison, Summer Tanagers can use a wider variety of forest habitats and were found in greatest densities in mixed pine and pine-dominated forests. Species such as the Yellow-breasted Chat, Indigo Bunting, and Blue Grosbeak are typically associated with early successional scrub forests or forest edge. They were only found along the edge of pine-dominated forests that were adjacent to open habitats.

## Grasslands

Fort Lee grasslands were dominated by detections of the Grasshopper Sparrow and Eastern Meadowlark (Table 2). Grasshopper Sparrows are an area-sensitive species so typically are only found in grasslands larger than 5-10ha. This species has undergone declines in recent decades due to a decline in available large patches. The large open grass available in the drop zone (patches > 100ha) of Fort Lee and adjacent grassland areas are collectively the most significant patches of available habitat with the region and the reason Grasshopper Sparrows are found here with relatively high abundance. Smaller grassland patches in the Cantonment area (< 1ha) did not support Grasshopper Sparrows. Field Sparrows also require open habitats and generally use patches that have more woody vegetation than Grasshopper Sparrows. Corresponding with that notion, Field Sparrows were typically found on the edge of grasslands that had a few scattered shrubs. The drop zone also supports a pair of breeding American Kestrels. This species requires large-open grasslands for foraging and has undergone significant declines in the Piedmont and Coastal Plain of Virginia. The pair successfully nested in a nest box that has been placed on a nearby telephone pole for this purpose. Cliff Swallows, Barn Swallows, and Purple Martins were observed foraging over the grasslands found just north of the drop zone. These species are aerial insectivores that fly low over open habitats to capture insects but nest in other locations so do not use the underlying grass substrate for nesting. Cliff Swallows are another species that has undergone significant declines in Virginia and throughout its range. Within this region, this species has adapted to nesting in large colonies under concrete bridges. It is likely that a nesting colony is located nearby given the presence of multiple birds on Fort Lee.

## Urban and Transmission Line Habitats

Urban habitats surveyed were often adjacent to natural forests or in areas that contained a few scattered trees within a larger matrix of buildings, roads, and other man-made infrastructures. Species detected in urban areas therefore contained a few species that emanate from surrounding natural habitats and those that are often dependent on man-made alterations of the environment such as open-park like grass (e.g. golf course) or buildings (Table 3). The most notable detection for urban placed survey points were Brown-headed Nuthatches that were found in a pine-stand adjacent to the Fort Lee golf course. This was the only location Brown-headed Nuthatches were detected on Fort Lee during the breeding season although they were found to be more widespread and more abundant in previous surveys in 2008 (Smith and Paxton, 2008). Chipping Sparrows were also found in this location and other urban areas adjacent to pine habitats. Species such as the House Finch and European Starling are dependent on urban or semi-urban environments and were only found in urban survey locations and not native habitats on Fort Lee.

Table 2. Detections and average density for species observed in grassland habitat on Fort Lee, VA. A value of D indicates a species was detected outside of 50m radius point counts so a density estimate was not calculated.

Species	Avg. Density ( $\pm$ SD) per ha
Killdeer	D
American Kestrel	D
Northern Bobwhite	0.1 $\pm$ 0.32
Purple Martin	D
Cliff Swallow	0.1 $\pm$ 1.40
Barn Swallow	0.2 $\pm$ 0.64
Grasshopper Sparrow	2.0 $\pm$ 1.24
Field Sparrow	0.6 $\pm$ 0.93
Indigo Bunting	0.5 $\pm$ 0.93
Blue Grosbeak	0.1 $\pm$ 0.32
American Goldfinch	D
Eastern Meadowlark	1.7 $\pm$ 1.46
Red-winged Blackbird	0.1 $\pm$ 0.32

Birds detected in transmission line corridors were mostly species such as Mourning Doves and Eastern Bluebird that will use the overhead wires to perch and the mowed habitat for foraging (Table xx). Other species such as the Field Sparrow and Common Yellowthroat also take advantage of the open nature of the mowed corridor. The Yellow-breasted Chat and Indigo Bunting utilize forest edges and supplement their habitat use by moving into the adjacent corridor. Most other species detected require forested habitats so were detected using the ecotone between forest and the open transmission line but these species are not dependent on this open habitat.

Table 3. Detection and Average density ( $\pm$  SD) per ha of selected species detected within 50m radius point counts for urban and transmission line habitats of Fort Lee, VA. A value of D indicates the species was only detected beyond 50m so a density value could not be calculated. Value of N under habitat types indicate number of survey stations.

Species	Urban Habitats (N = 8)	Transmission Line (N = 7)
Canada Goose	D	
Killdeer	D	
Mourning Dove	0.2 $\pm$ 0.45	0.9 $\pm$ 1.61
Chimney Swift	D	
Red-bellied Woodpecker	0.2 $\pm$ 0.45	
Downy Woodpecker	D	D
Northern Flicker		D
Great-crested Flycatcher	0.2 $\pm$ 0.45	0.2 $\pm$ 0.48
Eastern Wood-Pewee	D	
American Crow	0.2 $\pm$ 0.45	D
Blue Jay	D	D
Red-eyed Vireo	D	0.2 $\pm$ 0.48
White-eyed Vireo		0.2 $\pm$ 0.48
Eastern Tufted Titmouse	0.3 $\pm$ 0.59	D
Carolina Chickadee	1.0 $\pm$ 1.33	D
Carolina Wren	D	D
Blue-gray Gnatcatcher	D	0.2 $\pm$ 0.48
White-breasted Nuthatch	0.2 $\pm$ 0.45	
Brown-headed Nuthatch	0.5 $\pm$ 1.36	
Eastern Bluebird	0.6 $\pm$ 1.91	D
Eastern Kingbird	D	
American Robin	1.1 $\pm$ 2.11	
Pine Warbler	0.2 $\pm$ 0.45	D
Common Yellowthroat		0.2 $\pm$ 0.48
Northern Mockingbird	0.6 $\pm$ 0.97	
Gray Catbird	0.2 $\pm$ 0.45	
Northern Cardinal	D	0.4 $\pm$ 0.97
Yellow-breasted Chat		D
Brown-headed Cowbird	1.0 $\pm$ 1.33	D
Common Grackle	0.3 $\pm$ 0.91	D
Red-winged Blackbird	D	
Summer Tanager	D	
Field Sparrow		D
Eastern Towhee	D	D
Indigo Bunting	D	0.5 $\pm$ 0.69
American Goldfinch		
House Sparrow	D	
House Finch	0.5 $\pm$ 1.36	
European Starling	D	

## Early Successional

This habitat category is actually divided between patches of open canopy shrub-scrub, one patch of emergent wetland, and a host of other areas that have undergone succession from an early successional vegetation state to a mid-successional state since the last survey in 2008. These mid-successional stands are characterized by dense stocking levels of pine, a closed canopy, and very little understory plant growth. The structures of these habitats are markedly different to the open canopy stands that have dense shrub growth.

Table 4. Detections and average density for species observed in early successional habitat on Fort Lee, VA. A value of D indicates a species was detected outside of 50m radius point counts so a density estimate was not calculated.

Species	Avg. Density $\pm$ SD per ha
Wild Turkey	0.1 $\pm$ 0.41
Belted Kingfisher	D
Northern Bobwhite	D
Mourning Dove	D
Yellow-billed Cuckoo	0.1 $\pm$ 0.41
Acadian Flycatcher	D
White-eyed Vireo	D
Red-eyed Vireo	0.4 $\pm$ 0.62
Blue Jay	D
Eastern Tufted Titmouse	0.6 $\pm$ 1.38
Carolina Chickadee	0.8 $\pm$ 1.24
Carolina Wren	1.0 $\pm$ 1.18
Blue-gray Gnatcatcher	0.1 $\pm$ 0.41
Eastern Kingbird	D
American Robin	0.4 $\pm$ 0.87
Pine Warbler	0.1 $\pm$ 0.41
Common Yellowthroat	1.0 $\pm$ 1.32
Yellow-breasted Chat	0.5 $\pm$ 0.90
Northern Cardinal	1.5 $\pm$ 1.18
Brown-headed Cowbird	0.5 $\pm$ 1.08
Common Grackle	D
Field Sparrow	0.5 $\pm$ 0.66
Eastern Towhee	0.9 $\pm$ 1.06
Indigo Bunting	0.8 $\pm$ 1.10
Blue Grosbeak	0.4 $\pm$ 0.87
American Goldfinch	0.6 $\pm$ 1.38
Orchard Oriole	D
Red-winged Blackbird	0.4 $\pm$ 0.87

Birds of the open shrub patches include those such as the Field Sparrow, Common Yellowthroat, Northern Cardinal, Eastern Towhee, Indigo Bunting, and Blue Grosbeak (Table 4). The abundance of these species decline as the canopy begins to close in mid-successional habitats. Yellow-billed Cuckoos and Orchard Orioles were detected in the early successional shrub on the northeastern edge of the Range. The presence of these species is made possible by the appearance of small trees that are beginning to extend above the shrub layer. The one emergent wetland surveyed on the southeastern edge of the Range harbored Belted Kingfishers, Eastern Kingbirds, and Red-winged Blackbirds.

The closed canopy, mid-successional patches appeared to support lower bird diversity and bird abundance. These habitat patches were dominated by generalist forest users such as the Carolina Wren, Eastern Titmouse, and Carolina Chickadee. Species such as Field Sparrows, Indigo Buntings, and Blue Grosbeaks are unable to utilize these stands. Species richness and abundance will likely remain low in these stands unless they are opened mechanically or undergo succession into more mature forest.

## Winter Season

A total of 238 observations of 50 species were made during the winter season. Species included permanent residents and temperate migrants that are only present in Virginia during the winter or migratory periods.

### Grassland Transects – Landing Area

A total of 42 detections of 10 species were made during the landing area transect surveys (Table 5). The American Pipit, Savannah Sparrow, and Eastern Meadowlark were the most frequently detected species. American Pipits and Savannah Sparrows are both temperate migrants that are not found on Fort Lee during the breeding season but are dominant grassland species within this region in winter. The Killdeer is found on the landing area in both summer and winter. The additional species detected use grasslands facultatively and are not dependent on the landing area.

Table 5. Density of birds per hectare of grassland as determined by line-transect surveys on the landing area of Fort Lee, VA

Species	Average Density ( $\pm$ SD) per ha
Ring-billed Gull	0.1 $\pm$ 0.25
Killdeer	0.4 $\pm$ 0.25
Red-tailed Hawk	0.1 $\pm$ 0.25
Common Flicker	0.1 $\pm$ 0.25
American Crow	0.1 $\pm$ 0.25
American Pipit	0.5 $\pm$ 0.70
Savannah Sparrow	0.8 $\pm$ 0.28
Eastern Meadowlark	2.4 $\pm$ 3.47
Common Grackle	0.1 $\pm$ 0.25
Red-winged Blackbird	0.1 $\pm$ 0.25

## Mixed Pine-Hardwood Forest

A total of 128 detections of 31 species were observed during point count surveys of the mixed pine-hardwood forest located at the south end of the Cantonment area (Table 6). The majority of the species detected are indicative of winter forest bird communities within the regions. Species such as the Eastern Phoebe, Brown Creeper, Golden-crowned Kinglet, Ruby-crowned Kinglet, Hermit Thrush, Yellow-rumped Warbler, and Dark-eyed Junco are only found in Virginia in winter or migration.

Table 6. Total number of detections for all species detected by point count surveys in the mixed pine-hardwood forest of the Cantonment area on Fort Lee, VA.

Species	# of Detections	Species	# of Detections
Turkey Vulture	1	Golden-crowned Kinglet	8
Red-tailed Hawk	1	Ruby-crowned Kinglet	1
Belted Kingfisher	1	American Robin	14
Pileated Woodpecker	5	Eastern Bluebird	10
Red-headed Woodpecker	3	Hermit Thrush	3
Red-bellied Woodpecker	2	Northern Mockingbird	4
Northern Flicker	1	European Starling	2
Eastern Phoebe	2	Cedar Waxwing	3
American Crow	1	Yellow-rumped Warbler	2
Blue Jay	5	White-throated Sparrow	5
Carolina Chickadee	8	Song Sparrow	2
Tufted Titmouse	3	Dark-eyed Junco	6
Brown Creeper	1	American Goldfinch	8
Brown-headed Nuthatch	4	Northern Cardinal	4
White-breasted Nuthatch	1	Red-winged Blackbird	7
Carolina Wren	4		

## Area Search Surveys

The generalized area search of this parcel resulted in detection of 42 species (Table 7). Additional species detected during the area search but not during point counts in the forested habitat nor transect survey in grassland habitat include the Wild Turkey, Red-shouldered Hawk, Downy Woodpecker, Yellow-bellied Sapsucker, Red-headed Nuthatch, Winter Wren, Pine Warbler, Field Sparrow, Chipping Sparrow, White-crowned Sparrow, and Fox Sparrow.

Table 7. Total number of birds detected by species from area searches on Fort Lee, VA.

Species	Area of Survey			
	Blackberry	Blackwater (Bull Hill Gate)	Farm Field	17 Alpha Range
Turkey Vulture	7			
Red-tailed Hawk				
Red-shouldered Hawk		1		
Wild Turkey				4
Belted Kingfisher				
Pileated Woodpecker				
Red-headed Woodpecker	4	2		
Red-bellied Woodpecker		2		
Downy Woodpecker	1	1		
Yellow-bellied Sapsucker		1		
Northern Flicker	1			1
Eastern Phoebe				
American Crow	3	1		
Blue Jay	1	4		
Carolina Chickadee	11	2		
Tufted Titmouse	7	5		
Brown Creeper	1			
Red-headed Nuthatch		1		
Brown-headed Nuthatch	8			
White-breasted Nuthatch				
Carolina Wren	4	7	1	
Winter Wren	1			
Golden-crowned Kinglet	7	3		
Ruby-crowned Kinglet	4	3		
American Robin	13	6	1	
Eastern Bluebird	5			
Hermit Thrush	4	7		
Northern Mockingbird		1		
Brown Thrasher	1			
European Starling			1	6
Cedar Waxwing				
Pine Warbler		1		
Yellow-rumped Warbler	7			
Savannah Sparrow			2	5
Chipping Sparrow			1	1
White-crowned Sparrow		1		
White-throated Sparrow	1	8	1	
Fox Sparrow		1		
Song Sparrow		2	1	
Dark-eyed Junco				
American Goldfinch	6	1		
Northern Cardinal	4	5		
Eastern Towhee	1			
Eastern Meadowlark			1	7
Red-winged Blackbird	4		1	

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**Appendix I:** Coordinates and habitat types of point count stations used during the breeding season on Fort Lee, VA

Point	Habitat Type	Lat	Long
BC-01	Deciduous Forest	37.2496879	-77.31705121
BC-02	Deciduous Forest	37.24859624	-77.3187643
BC-03	Deciduous Forest	37.24744239	-77.32046935
BC-04	Deciduous Forest	37.24670059	-77.3223831
EM-01	Early Successional	37.29208231	-77.3370713
EM-02	Early Successional	37.29242337	-77.33551478
EM-03	Early Successional	37.29141628	-77.33456796
EM-04	Early Successional	37.29064917	-77.3361477
EM-05	Early Successional	37.26885094	-77.32800066
EM-06	Early Successional	37.26754387	-77.32674371
FL-01	Mixed Forest	37.217046	-77.31787297
FL-02	Mixed Forest	37.217649	-77.315281
FL-03	Mixed Forest	37.218128	-77.312702
FW-01	Mixed Forest	37.26972484	-77.33769919
FW-02	Mixed Forest	37.27105966	-77.33652279
FW-03	Mixed Forest	37.27243504	-77.33223653
FW-04	Mixed Forest	37.27243504	-77.33223653
FW-05	Pine-dominated Forest	37.2778806	-77.3486343
FW-06	Pine-dominated Forest	37.27806626	-77.34745597
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
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
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	37.2907117	-77.34312722
GR-07	Grassland	37.29044155	-77.33942058
GR-08	Grassland	37.2922854	-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	-77.3506561
GR-15	Grassland	37.21817991	-77.33065562
GR-16	Grassland	37.21817991	-77.33065562
MH-01	Mixed Forest	37.2734112	-77.33614485
MH-02	Mixed Forest	37.27317458	-77.3379628
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
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
OP-01	Urban	37.2178096	-77.33390084
OP-02	Urban	37.22005368	-77.33251641
OP-03	Urban	37.22227179	-77.32830534
OP-04	Urban	37.22227179	-77.32830534
PB-01	Pine-dominated Forest	37.28592144	-77.34152863
PB-02	Pine-dominated Forest	37.28620542	-77.33947967
PI-01	Pine-dominated Forest	37.2799651	-77.33779642
PI-02	Pine-dominated Forest	37.27884435	-77.33906301
PI-03	Pine-dominated Forest	37.27711651	-77.33718127
SG-01	Early Successional	37.23829706	-77.31908642
SG-02	Early Successional	37.23829706	-77.31908642
SG-03	Early Successional	37.23689024	-77.31853003
SG-04	Early Successional	37.23660618	-77.3207063
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	-77.3303144
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	37.246053	-77.31635517
TL-08	Pine-dominated Forest	37.246053	-77.31635517
UR-01	Urban	37.24481056	-77.3475843
UR-02	Urban	37.2492067	-77.33910391
UR-03	Urban	37.24877134	-77.3254943
UR-04	Urban	37.24970894	-77.32112741

**Appendix II:** List of species detected during breeding and winter surveys on Fort Lee, VA

<b>Common name</b>	<b>Genus</b>	<b>Species</b>	<b>Migratory Category</b>
Canada Goose	Branta	canadensis	Resident
Wild Turkey	Meleagris	gallopavo	Resident
Northern Bobwhite	Colinus	virginianus	Resident
Red-shouldered Hawk	Buteo	lineatus	Resident
Red-tailed Hawk	Buteo	jamaicensis	Resident
American Kestrel	Falco	sparverius	Temperate Migrant
Killdeer	Charadrius	vociferus	Temperate Migrant
Ring-billed Gull	Larus	delawarensis	Temperate Migrant
Mourning Dove	Zenaida	macroura	Resident
Red-headed Woodpecker	Melanerpes	erythrocephalus	Temperate Migrant
Red-bellied Woodpecker	Melanerpes	carolinus	Resident
Yellow-bellied Sapsucker	Sphyrapicus	varius	Temperate Migrant
Downy Woodpecker	Picoides	pubescens	Resident
Hairy Woodpecker	Picoides	villosus	Resident
Northern Flicker	Colaptes	auratus	Temperate Migrant
Eastern Wood-Pewee	Contopus	virens	Neotropical Migrant
Acadian Flycatcher	Empidonax	virescens	Neotropical Migrant
Eastern Phoebe	Sayornis	phoebe	Temperate Migrant
Great-crested Flycatcher	Myiarchus	crinitus	Neotropical Migrant
Eastern Kingbird	Tyrannus	tyrannus	Neotropical Migrant
White-eyed Vireo	Vireo	griseus	Neotropical Migrant
Yellow-throated Vireo	Vireo	flavifrons	Neotropical Migrant
Red-eyed Vireo	Vireo	olivaceus	Neotropical Migrant
Blue Jay	Cyanocitta	cristata	Temperate Migrant
American Crow	Corvus	brachyrhynchos	Resident
Purple Martin	Progne	subis	Neotropical Migrant
Cliff Swallow	Petrochelidon	pyrrhonota	Neotropical Migrant
Barn Swallow	Hirundo	rustica	Neotropical Migrant
Carolina Chickadee	Poecile	carolinensis	Resident
Eastern Tufted Titmouse	Baeolophus	bicolor	Resident
Red-breasted Nuthatch	Sitta	canadensis	Temperate Migrant
White-breasted Nuthatch	Sitta	carolinensis	Temperate Migrant
Brown-headed Nuthatch	Sitta	pusilla	Resident
Brown Creeper	Certhia	americana	Temperate Migrant
Carolina Wren	Thryothorus	ludovicianus	Resident
Winter Wren	Troglodytes	troglodytes	Temperate Migrant
Golden-crowned Kinglet	Regulus	satrapa	Temperate Migrant
Ruby-crowned Kinglet	Regulus	calendula	Temperate Migrant
Blue-gray Gnatcatcher	Polioptila	caerulea	Neotropical Migrant
Eastern Bluebird	Sialia	sialis	Temperate Migrant
Hermit Thrush	Catharus	guttatus	Temperate Migrant
Wood Thrush	Hylocichla	mustelina	Neotropical Migrant
American Robin	Turdus	migratorius	Temperate Migrant
Gray Catbird	Dumetella	carolinensis	Neotropical Migrant

<b>Common name</b>	<b>Genus</b>	<b>Species</b>	<b>Migratory Category</b>
Northern Mockingbird	Mimus	polyglottos	Resident
Brown Thrasher	Toxostoma	rufum	Temperate Migrant
European Starling	Sturnus	vulgaris	Resident
American Pipit	Anthus	rubescens	Temperate Migrant
Cedar Waxwing	Bombycilla	cedrorum	Temperate Migrant
Northern Parula	Parula	americana	Neotropical Migrant
Yellow-rumped Warbler	Dendroica	coronata	Temperate Migrant
Prothonotary Warbler	Protonotaria	citrea	Neotropical Migrant
Ovenbird	Seiurus	aurocapilla	Neotropical Migrant
Common Yellowthroat	Geothlypis	trichas	Neotropical Migrant
Hooded Warbler	Wilsonia	citrina	Neotropical Migrant
Yellow-breasted Chat	Icteria	virens	Neotropical Migrant
Summer Tanager	Piranga	rubra	Neotropical Migrant
Scarlet Tanager	Piranga	olivacea	Neotropical Migrant
Eastern Towhee	Pipilo	erythrophthalmus	Temperate Migrant
Chipping Sparrow	Spizella	passerina	Temperate Migrant
Field Sparrow	Spizella	pusilla	Temperate Migrant
Savannah Sparrow	Passerculus	sandwichensis	Temperate Migrant
Grasshopper Sparrow	Ammodramus	savannarum	Temperate Migrant
Fox Sparrow	Passerella	iliaca	Temperate Migrant
Song Sparrow	Melospiza	melodia	Temperate Migrant
White-throated Sparrow	Zonotrichia	albicollis	Temperate Migrant
Dark-eyed Junco	Junco	hyemalis	Temperate Migrant
White-crowned Sparrow	Zonotrichia	leucophrys	Temperate Migrant
Northern Cardinal	Cardinalis	cardinalis	Resident
Blue Grosbeak	Passerina	caerulea	Neotropical Migrant
Indigo Bunting	Passerina	cyanea	Neotropical Migrant
Red-winged Blackbird	Agelaius	phoeniceus	Temperate Migrant
Eastern Meadowlark	Sturnella	magna	Temperate Migrant
Common Grackle	Quiscalus	quiscula	Resident
House Finch	Carpodacus	mexicanus	Resident
American Goldfinch	Carduelis	tristis	Temperate Migrant
House Sparrow	Passer	domesticus	Resident