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Breeding Bird Communities in Pine Plantations On the Coastal Plain of North Carolina

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Introduction

Prior to European settlement of North America, the landscape of the Southeastern United States was dominated by an estimated 55 million hectares of old growth forest (Ware *et al.* 1993). Since that time, three centuries of land clearing for agriculture and other uses has reduced the extent of forest cover to 60% of its former range. Conversion rates of some forest types in this region have been extremely high. For instance, longleaf pine (*Pinus palustris*) forests have been reduced by nearly 24 million hectares and currently exist in only 1% of their historic range.

The character of much of the remaining forested land also has been altered. Over the past two to three decades, large timber corporations began to implement intensive management operations to produce sustained yields of plantation pines. By 1990, approximately 15% of the remaining forest area in the Southeastern US had been converted to pine plantations. Silvicultural techniques associated with plantations greatly affect landscape composition and the intrinsic forest structure (Thompson *et al.* 1995). Although specific silvicultural techniques vary with factors such as forest yield (*e.g.* pulpwood, wood fiber, or saw-timber) and tree species, clearcutting stands on relatively short rotation schedules (usually 20-25 years for pulpwood/fiber production) is the dominant practice (USDA Forest Service 1990). Clearcutting creates a specific age-class distribution of habitats that differs in scale and frequency from disturbances in natural landscapes. As a result, landscapes under intensive management often contain more early to mid-successional stands in comparison to natural areas. Additionally, managing timber plantations on short rotations truncates succession and prevents development of some characteristics associated with old-growth forests.

The purpose of this study is to describe breeding bird communities within managed pine plantations on the Coastal Plain of North Carolina. In addition, we provide an elementary description of habitat changes that occur during the management cycle.

Methods

This study was conducted in managed loblolly pine (*Pinus taeda*) plantations in eastern North Carolina (approximately 35° 0'N, 76° 60'W). These plantations are situated in three large management tracts located in Beaufort, Martin, and Washington counties. The tracts are embedded within a matrix of agricultural fields, residential areas, and forested areas. Historically, much of this land was once naturally forested as pocosin wetlands, non-alluvial swamp forest, and upland mixed pine-deciduous forest. Over a period of time, many of the natural pocosin and swamp forest areas were ditched, drained, and cleared for conversion to agriculture.

The plantations studied are managed for pulpwood and sawtimber production on a 30-35 year rotation. The staggered regime of harvesting and intermediate silvicultural treatments creates a mosaic of different stand ages. Pine stands go through several stages of vegetative succession following planting. Regeneration begins with a grass/seedling phase during the first two growing seasons. Subsequently, for the next 3-7 years, stands are dominated by shrub-layer vegetation and planted trees. Approximately 7-10 years after planting, young pine trees form a dense, low canopy that reduces light penetration to the understory. As a result, ground-level shrub vegetation during this period is significantly reduced. After canopy closure, the plantations are commercially thinned twice before final harvest. Thinnings reduce the number of trees, open the forest canopy, and allow growth of understory vegetation. The vertical stratification of vegetation within stands after first thin is relatively simple with an overstory of planted pines, 15 -20 m in height, and a shrub layer restricted to the first two meters. As stands mature, the growth of hardwood trees in the understory and midstory add additional vegetation layers.

We selected stands that represent ten different stand ages and relation to thinning: (1) 1 year old stands, (2) 3 year old stands, (3) 5 year old stands, (4) 9-11 year old stands, (5) 13-16 year old stands that were 1 year after the first thin, (6) 16-18 year old stands that were 3 years after first thin, (7) 19-22 year old stands that were 5 years after first thin, (8) 22-26 year old stands that were 1 year after second thin, (9) 28-29 year old stands that were 3 years after second thin, and (10) 30-35 year old stands that were 5 years after second thin. Six replicate stands (each > 24 ha) were selected for each stand type. Stands within each type were chosen to minimize variation in planted stocking level and basal area of pine and were separated by at least 500 m. Both the vegetation and the bird community were surveyed during the breeding bird seasons of 1997 and 1998.

Seven minute, fixed radius (50 m) point counts were used to measure bird species richness and bird density. Four point counts were established in each stand and distributed evenly between edge and interior locations. Edge points were positioned 50 m from the stand edge such that the plot perimeter was tangential to the edge. Interior points were positioned at least 150 m from the stand edge. All points were surveyed three times between 1 June and 4 July 1997 and three times between 21 May and 30 June 1998. Surveys were initiated 0.5 hr after sunrise and concluded within four hours.

Species richness was calculated for each stand based on the accumulated number of species detected (within or beyond 50 m radius) over the three survey visits. Bird density was calculated for each survey point as a composite of the survey visit with the highest recorded annual density (within the 50 m radius) for each species detected. A community similarity index was calculated for pairwise comparisons of stand ages, based on the density values of shared species.

The vegetation was sampled within all point count plots to determine vegetation changes across the growing cycle and vegetation responses to thinning. Linear transects were used for vegetation sampling to parallel the long, regularly distributed canopy openings created by row thinning. The transect length was standardized to 25 m for all surveys. Transect width varied between 4 and 7 m to accommodate variation in thinned and non-thinned rows within stands. Four vegetation transects were established within each point count and equally distributed between thinned and non-thinned rows.

Habitat data were collected at two levels within transects. Counts of all large woody plants (> 8 cm dbh) by species were made over the entire 25 m transect. Counts of all stems, shrubs, and saplings (> 0.5 m in height and < 8 cm dbh) were collected within 2 x 2 m quadrats established at opposite ends of each 25 m transect and summed to represent total groundcover density. Habitat data summarized and presented for this account include groundcover density, pine tree density, and hardwood tree density.

There was no significant variation in habitat or bird community-level variables between survey years so all data were pooled for further analysis. The effects of stand age on bird species richness and bird density were examined by one-way Analysis of Variance (ANOVA). Tukey's Honestly Significant Difference (HSD) test was used for post-hoc comparisons to differentiate which stand ages were responsible for statistically significant results. Community similarity was examined by single linkage cluster analysis. Cluster analysis identifies the most similar stand ages by repeated grouping of a matrix of stand age community similarities. Euclidean distances (*i.e.* the output of cluster analysis) between stand ages reflect the degree of similarity among bird communities in each category. Frequency statistics were used to compare habitat patterns of commonly detected species. Stand age comparisons were made based on the frequency of occupied points (*i.e.* includes detections within 50 m) relative to an expected even distribution among age categories. For each species examined, associations with a particular age or group of ages is based on significant, positive deviations from expected distributions. Finally, vegetation data were examined using a non-parametric test (Kruskal-Wallis ANOVA) due to non-normal distributions and unequal variances of variables between stand ages.

Results

Vegetation Surveys. Across all stand ages, dominant shrub-level vegetation included: cane (*Arundinaria gigantea*), blackberry (*Rubus* sp.), sweet pepperbush (*Clethra anifolia*), fetterbush (*Lyonia lucida*), high bush blueberry (*Vaccinium corymbosum*), and gallberry (*Ilex glabra*). In addition to planted pine trees, dominant canopy and midstory trees included; red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), red bay (*Persea borboinia*), sweet bay (*Magnolia virginiana*), and tulip poplar (*Liriodendron tulipifera*).

Across the entire growing period, stand age had a significant influence on groundcover density (K-W ANOVA, $H = 40.2$, $df = 9$, $p < 0.001$) (Fig. 1). Groundcover density increased from the first growing season to the sixth and then significantly decreased in the tenth growing season. Subsequently, stem density increased significantly only after the first and second thin and declined with time since thin. Hardwood tree density showed an opposite pattern. Overall, the density of hardwood trees significantly increased with stand age

(Spearman $r = .43$, $p < 0.001$, K-W ANOVA, $H = 44.5$, $p < 0.001$), but was significantly reduced by thinning. Finally, as expected, pine tree density was reduced significantly with each thin (K-W ANOVA, $H = 116.1$, $p < 0.001$).

Bird surveys. Over 24,000 bird observations were made during the two-year study period. Although a total of 68 species was detected, 11 species accounted for nearly 70 % of all observations (see Appendix). Species such as the Common Yellowthroat, Eastern Towhee, and Gray Catbird that are associated with early successional habitats or dense understory vegetation, were the most commonly observed.

Stand age had a significant effect on species richness (ANOVA, $F = 23.1$, $p < 0.001$) (Fig. 2). However there were no differences between sequential stand age classes surveyed in this study (HSD tests, all p-values > 0.10). Overall, species richness was positively related to stand age (Pearson $r = 0.72$, $p < 0.001$). Thinned stands had greater species richness values compared to all stands before thinning (HSD tests, $p < 0.001$ for all pairwise comparisons). Stand age was also found to have a significant influence on overall bird density ($F = 38.6$, $p < 0.001$) (Fig. 2). Although density was also positively associated with stand age ($r = .58$, $p < 0.005$), differences between sequential stand ages were variable. Bird density significantly increased from the first growing season through the sixth growing season (HSD tests, p values < 0.05) and was punctuated by a significant decrease (HSD test, $p < 0.005$) in density during the 10th growing season. Subsequently bird density significantly increased only after first thin. There were no significant differences in bird density among stands after thinning (HSD tests, all p values > 0.90).

Cluster analysis further highlighted the influence of stand age on community organization (Fig. 3). The greatest Euclidean distance (*i.e.* the greatest difference in community indices) was between stands in their first two growing seasons and all other stands. A second grouping separated early successional stands (ages 3 through 11 years) from thinned stands. All thinned stands were grouped with greater similarity than any other group of stands.

Of the total species observed during the study, 55 (80%) species were detected in stands before thinning, and 60 (88%) species were detected in thinned stands. Seven species (10%) were detected exclusively in stands before thinning and 11 (16%) species exclusively in thinned stands. The remaining 51 (75%) species were detected in both age subgroups. Although the majority of species observed was detected in early successional and thinned stands, many were not evenly distributed. Based on the overall habitat use patterns for the various species, three functional species groups were formed: 1) early successional - those species exhibiting a significant association with a subgroup of stands 1 through 11 years old, 2) forest - those species exhibiting a significant association with a subgroup of thinned stands, and 3) habitat generalist - those species that exhibit no significant association for either of the subgroups above.

The most commonly observed species within early successional stands were species typically associated with grasslands or shrublands. Turnover rates between early successional stand ages were high for these species reflecting the rapid rates of vegetation change. For instance, some of these species exhibited a significant association with specific stand ages within this age subgroup. The

Killdeer and Eastern Meadowlark were significantly associated with stands in their first two growing seasons. The Eastern Bluebird, Eastern Kingbird, Blue Grosbeak, Indigo Bunting and Field Sparrow were all significantly associated with stands in their first four growing seasons. The American Goldfinch was associated with stands in their first six growing seasons. The Prairie Warbler showed a different pattern and was significantly associated with stands that were two through eleven years old. The Yellow-breasted Chat was significantly associated with stands that were three through six years old. Aerial insectivores (*e.g.* Barn Swallow, Chimney Swift, and Purple Martin) that use these habitats for foraging purposes only, were significantly associated with one year old stands. The Indigo Bunting and the Yellow-breasted Chat exhibited relatively unique patterns. Although these two species were most associated with a subgroup of early successional stands, they were also frequently detected in stands that were 1-2 years after first and second thin.

Habitat-generalist species were distributed evenly across all stand ages and were the most abundant and widespread of all species detected. For example, the Common Yellowthroat was ranked the most abundant species in every stand age examined. Similarly, the Brown-headed Cowbird, Gray Catbird, White-eyed Vireo, and Eastern Towhee were among the species detected with the highest densities. With the exception of the Brown-headed Cowbird, these species are typically associated with dense cover of shrub and understory vegetation, which was present in sufficient amounts for these species in almost all stand ages. These species only underutilized stands in their first and in the 9-11th growing seasons (*i.e.* stands with the lowest stem densities).

The species associated only with the thinned stand ages in this study are those typically found in second-growth forest and mature-forested habitats. Across all thinned stands, there was relatively little variation in the density patterns of individual species. The Downy Woodpecker, Carolina Wren, Blue-gray Gnatcatcher, Acadian Flycatcher, Ovenbird and Carolina Chickadee were among the most abundant species (aside from generalist species described above) and each was evenly distributed among all thinned stands. Additionally, the Eastern Wood-Pewee, Great Crested Flycatcher, Tufted Titmouse, Worm-eating Warbler, Pine Warbler, Summer Tanager, and Northern Cardinal were detected with relatively high densities and also were evenly distributed among the thinned stands. Only two species showed significant associations with particular thinned stand ages. The Hooded Warbler was primarily associated with older stands and had a greater density in stands after second thin compared to stands after first thin. The Brown-headed Nuthatch was detected with a greater density in stands 1-2 years after first and second thin compared to stands with increasing time since thin.

Discussion

The results of this study indicate that the structure of the avian community is influenced by stand age and structure. In general, species richness and bird density were both positively related to stand age. The shifts in community organization across this successional gradient were similar to that reported from other studies (Johnston and Odum 1956, Meyers and Johnson 1978, May 1982, Childers *et al.* 1986). Early successional stands (ages 1-6 years) and thinned stands vary greatly in vegetative structure. Early successional stands were characterized by dense shrub vegetation and varying coverage of grasses. In contrast, thinned stands were characterized by an open canopy dominated by pine, dense understory vegetation, and a variable density of midstory hardwoods. The gradient between early successional and thinned stands is punctuated by stands that have a very dense, closed canopy and an associated sparse understory (represented by 9-11 year old stands in this study). In addition to their overall gross structure, early successional and thinned stands exhibited different rates of vegetation change. Early successional stands change from patches of bare ground to patches with dense, woody vegetation in a relatively short period of time. In contrast, the change in forest vegetation takes place over much longer time periods.

The influence of differences in both the vegetation structure and rate of change between early successional and thinned stand types is clearly evident in the avian community. Species observed exclusively in early successional stands are those typically associated with grasslands and shrublands. Some of these species were observed within a relatively narrow window of stand ages reflecting rapid change of conditions across this period. Species associated with thinned stands were either habitat generalists that exploit the dense understory vegetation or species typically found in closed canopy forests. Most forest species did not generally discriminate between stand age categories, reflecting a much slower rate of vegetation change during this period. None of the bird species detected were most associated with stands (9-11 years old) that were between early successional and thinned stands. These closed-canopy stands had the lowest bird densities and appear to be inferior habitats for both early successional and forest bird species.

The large canopy openings created during thinning allowed for understory regeneration and had a positive influence on species richness and overall bird diversity. These openings appeared to have extended the habitat use of some early successional species and provided habitat elements required by some forest species. Only two forest bird species showed significant responses among thinned stands (Brown-headed Nuthatch and Hooded Warbler), although many species had lower densities in stands one and two years after first thin. The openness of the understory just after thinning may have deterred some species from using recently thinned stands. However, thinning releases the understory that was used in subsequent years. Additionally, hardwood tree densities reached their highest values in stands at least three years after second thin. The availability of midstory hardwoods appears to be an important habitat requirement for the Hooded Warbler and for other species such as the Wood Thrush and Red-eyed Vireo. The Brown-headed Nuthatch was primarily associated with stands 1-2 years after first and second thins. Occurrence of this species was negatively influenced by hardwood tree density which is lower in stands one year after thinning (Wilson and Watts 1999). The Brown-headed Nuthatch is a pine forest specialist that excavates cavities (usually in a pine snag) relatively low to the ground (unpublished data from this site; McNair 1984). Obstruction of cavity sites by a dense hardwood understory may deter this species. In addition to thinning, Brown-headed Nuthatch occurrence within stands was significantly associated with snags (Wilson and Watts 1999).

Apparently, a combination of an open understory and snag availability are both important habitat requirements for Brown-headed Nuthatches within these plantations.

The commercially-thinned plantations studied here share several habitat characteristics with natural, tall pocosins (Christensen *et al.* 1981). The most conspicuous of these characteristics is a dense thicket of understory vegetation. Moreover, the two habitat types share relatively similar breeding bird communities (Lynch 1982, Karriker 1993). This includes some species that show unique patterns within the coastal plain. The density of Worm-eating Warblers recorded within these pine plantations is greater than at many other locations within the species range (Hanners and Patton 1998). Locally, the density of this species is most similar to that recorded in tall pocosin communities (Lynch 1982, Karriker 1993). In this study, Worm-eating Warblers begin to occupy plantations in their 10th growing season but attain the greatest density in thinned stands that have a dense understory. It appears as if the conversion of some natural habitats, such as pocosins, to open-canopy pine plantations may have had little impact on this population. Similarly, the density of the Black-and-White Warbler in these plantations is similar to accounts reported from pocosin habitats (Lynch 1982, Karricker 1993). The Prothonotary Warbler and the Swainson's Warbler are typically associated with pocosins as well as mature swamp forests. The Prothonotary Warbler was detected only in plantations that were directly adjacent to swamp forest; however, the Swainson's Warbler, was detected with a very low density in plantations (>27 years old) that had a dense understory and that were isolated from any nearby hardwood stands.

Perhaps surprising was the complete absence of the Henslow's Sparrow from the surveyed plantations. Several of the early plantations (1-2 years after planting) surveyed in this study are located only a few miles to the west from a relatively large population of Henslow's Sparrows (*i.e.*, Voice of America grassland). Similarly, Lynch and LeGrand (1985) recorded the species at several sites, including within early stages of pine plantations, in the same geographic area in 1983 and 1984.

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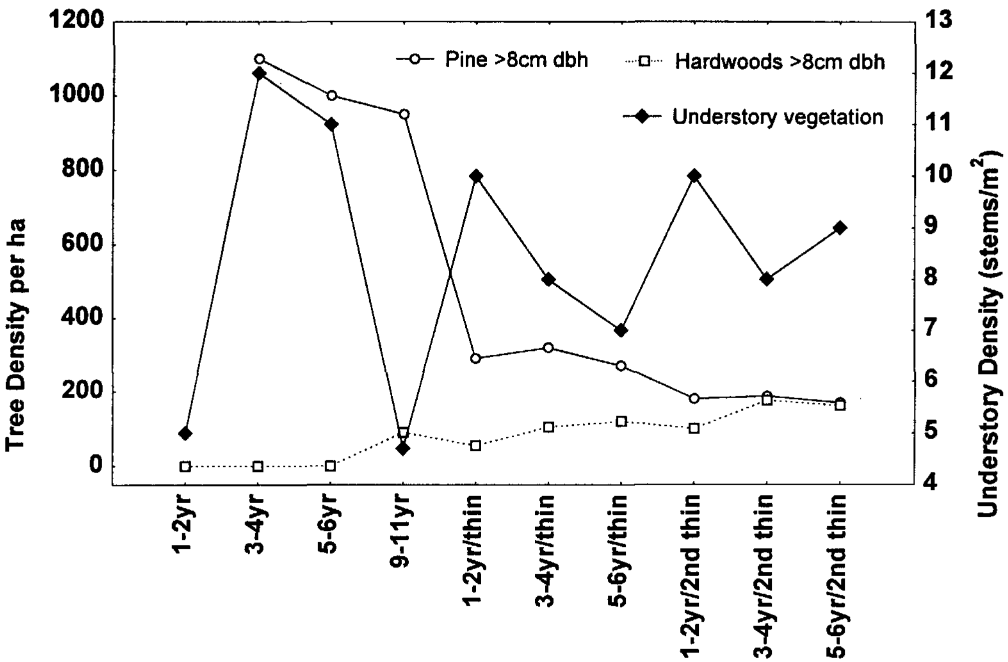

Figure 1. Median values for habitat variables among pine plantation age classes.

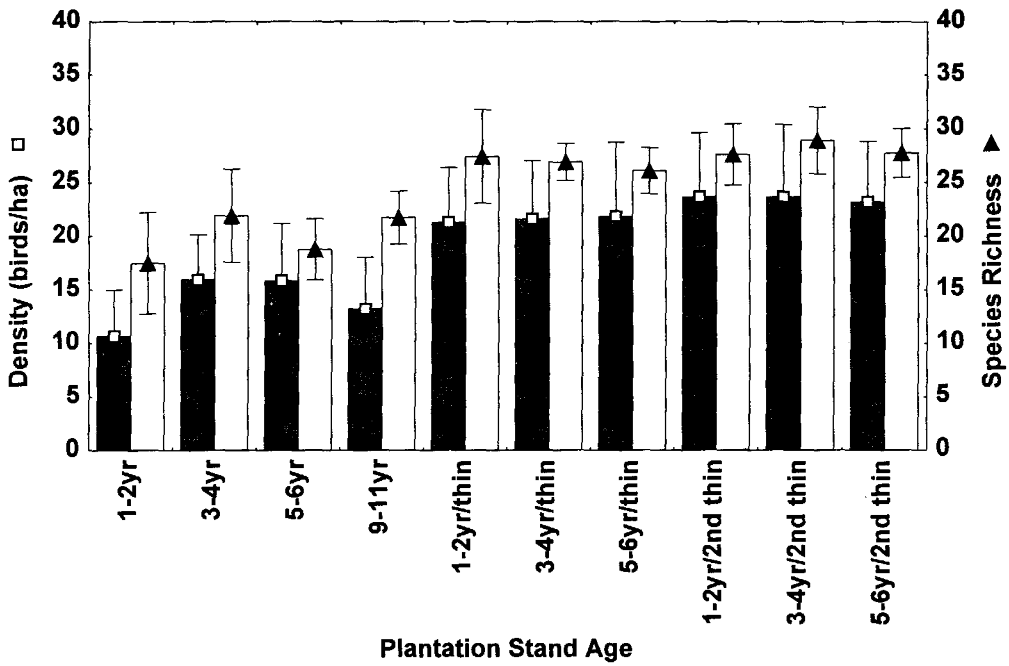

Figure 2. Average species richness and average bird density (± SD) among pine plantation age classes.

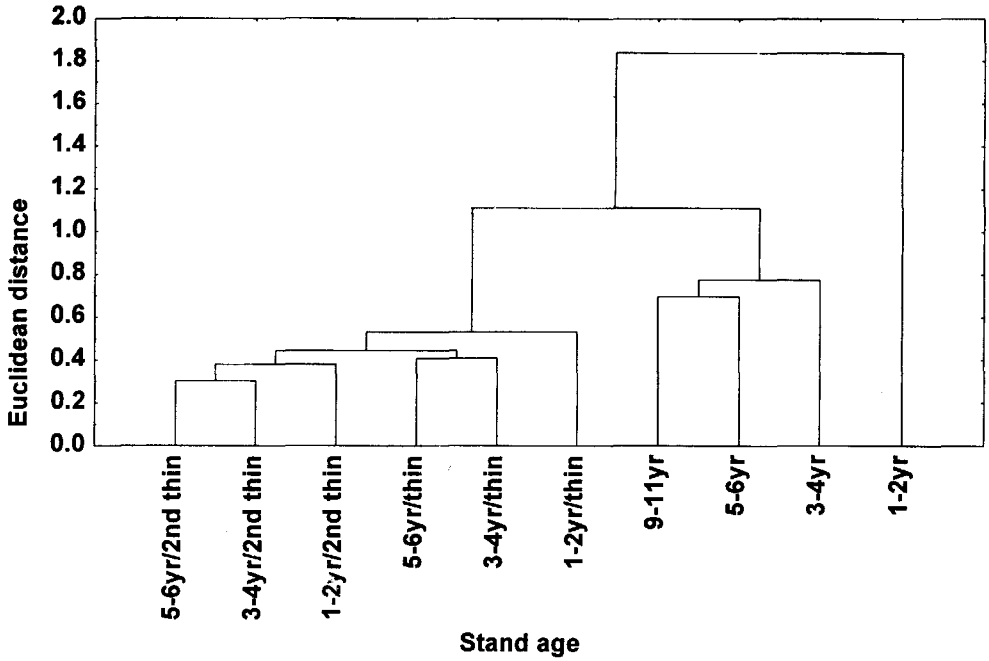

Figure 3. Cluster analysis dendrogram of avian community similarity among pine plantation age classes. Data are based on Euclidean distances between pairwise age comparisons. Greater Euclidean distances represent greater differences in community similarity.

Appendix. Average densities (birds/10 ha) of species detected within Loblolly Pine plantations in eastern North Carolina. Density values for each stand age are based on the average of peak counts for each stand (N = 6 per age category) over two survey years. Densities are calculated only for detections within 50m radius point counts ("P" indicates a given species was present but only detected beyond 50m, and dashes indicate stand ages where a species was not recorded).

	1-2yr	3-4yr	5-6yr	9-11yr	1-2yr/thin	3-4yr/thin	5-6yr/thin	1-2yr/2nd thin	3-4yr/2nd thin	5-6yr/2nd thin
Green-backed Heron	-	-	P	-	-	-	-	-	-	-
Common Bobwhite	3.2	3.7	2.6	0.5	2.1	2.1	1.6	1.6	0.0	0.0
Turkey Vulture	P	-	-	-	-	-	-	-	-	-
Red-shouldered Hawk	-	-	-	-	P	-	P	-	-	-
Killdeer	1.0	-	-	-	-	-	-	-	-	-
Mourning Dove	2.1	4.7	2.1	3.7	2.1	0.5	2.1	3.7	1.6	2.1
Yellow-billed Cuckoo	0.0	1.0	2.6	3.2	1.6	4.2	5.3	3.1	2.1	1.6
Chuck-will's Widow	-	-	-	-	-	-	-	P	-	-
Whip-poor-will	-	-	-	P	-	-	-	-	-	P
Common Nighthawk	P	-	-	-	P	-	-	-	-	-
Ruby-thr. Hummingbird		0.5	0.5	1.0	1.0	P	0.5	0.5	P	P
Red-headed Woodpecker	-	-	-	-	-	-	P	-	-	-
Red-bellied Woodpecker	-	-	-	-	1.1	2.7	2.1	1.0	1.0	1.6
Downy Woodpecker	-	-	2.1	3.1	4.2	6.4	5.8	4.7	4.7	6.3
Hairy Woodpecker	-	-	-	1.1	2.1	0.5	3.2	0.5	1.6	2.1
Pileated Woodpecker	-	-	-	-	-	1.1	1.1	0.5	3.7	0.5
Northern Flicker	-	1.1	2.1	1.1	1.1	1.6	1.1	1.6	1.6	2.1
Eastern Wood-Peewee	0.5	1.1	0.5	-	3.2	3.7	1.6	2.7	3.7	2.7

	1-2yr	3-4yr	5-6yr	9-11yr	1-2yr/ thin	3-4yr/ thin	5-6yr/ thin	1-2yr/ 2nd thin	3-4yr/ 2nd thin	5-6yr/2nd thin
Acadian Flycatcher	-	2.1	3.2	3.2	12.2	15.9	12.7	15.4	14.7	15.4
Great Crested Flycatcher	-	-	0.5	3.2	5.3	4.2	5.3	6.9	6.9	7.4
Eastern Kingbird	1.6	2.7	-	-	-	-	-	-	-	-
Purple Martin	2.1	0.5	-	-	-	-	-	-	-	-
Barn Swallow	15.2	-	-	-	-	-	-	-	-	-
Chimney Swift	23.2	1.0	-	-	-	-	-	-	-	-
Blue Jay	-	1.1	1.1	3.2	1.6	1.6	2.1	1.1	0.5	0.5
American Crow	-	2.1	-	0.5	2.7	2.1	-	-	-	-
Fish Crow	-	-	-	-	-	-	-	1.1	-	0.5
Carolina Chickadee	2.1	6.4	12.7	6.9	17.5	24.4	15.9	16.5	25.4	12.2
Tufted Titmouse	-	1.6	1.6	4.2	8.5	7.4	10.6	5.8	7.4	8.5
White-breasted Nuthatch	-	-	-	-	-	0.5	-	-	-	-
Brown-headed Nuthatch	-	-	-	-	5.8	2.1	1.1	6.4	3.2	2.1
Carolina Wren	3.7	6.9	10.1	9.0	11.1	18.0	12.7	12.7	11.7	11.1
Blue-gray Gnatcatcher	-	12.7	7.4	5.8	17.5	15.4	14.9	20.7	16.5	20.7
Eastern Bluebird	2.7	0.5	0.5	-	0.5	-	1.5	1.5	0.5	-
Wood Thrush	-	-	-	5.3	0.5	3.2	4.2	4.2	5.9	6.4
American Robin	-	-	-	P	-	-	-	-	-	-
Gray Catbird	8.5	17.5	16.4	9.0	16.4	14.9	15.4	16.4	12.7	14.9
Northern Mockingbird	P	-	-	-	-	-	-	-	-	-
Brown Thrasher	2.7	2.1	P	P	1.1	1.1	-	-	-	-
European Starling	0.5	-	-	-	-	-	-	-	-	-
White-eyed Vireo	5.8	14.7	14.7	9.6	11.7	8.6	11.7	11.1	14.3	11.7
Yellow-throated Vireo	-	-	-	-	-	0.5	-	P	0.5	0.5
Red-eyed Vireo	-	-	-	-	1.1	1.6	3.2	4.2	5.8	3.7
Black-and-white Warbler	-	-	-	1.6	1.1	3.2	4.8	2.7	4.2	4.8

	1-2yr	3-4yr	5-6yr	9-11yr	1-2yr/ thin	3-4yr/ thin	5-6yr/ thin	1-2yr/ 2nd thin	3-4yr/ 2nd thin	5-6yr/2nd thin
Yellow-throated Warbler	-	-	-	-	2.7	1.1	0.5	1.6	2.1	1.1
Prairie Warbler	6.4	17.5	16.5	8.5	4.2	2.1	3.7	1.1	0.5	1.1
Pine Warbler	-	1.6	1.1	5.8	9.6	9.6	11.1	10.6	10.6	11.1
Hooded Warbler	-	-	-	1.6	1.6	3.2	4.2	5.3	7.9	6.9
Worm-eating Warbler	-	-	P	5.8	5.8	8.5	7.9	10.1	9.5	11.1
Swainson's Warbler	-	-	-	-	-	-	1.1	-	2.6	-
Ovenbird	-	-	2.7	6.9	4.7	13.8	9.5	14.3	11.7	11.1
Common Yellowthroat	20.2	26.5	26.5	19.6	24.9	19.1	19.6	22.8	16.5	18.3
Yellow-breasted Chat	6.9	16.5	13.3	4.2	7.4	5.3	3.2	8.5	4.2	5.8
American Redstart	-	-	-	-	2.7	0.5	P	1.1	1.6	0.5
Prothonotary Warbler	-	-	-	-	P	-	1.1	-	2.6	-
Blue Grosbeak	3.7	4.2	P	-	0.5	0.5	-	-	-	-
Northern Cardinal	1.1	3.2	7.9	5.3	4.8	7.9	5.3	7.4	7.9	6.9
Indigo Bunting	12.2	8.5	0.5	2.7	3.7	2.7	0.5	1.1	-	-
Eastern Towhee	8.5	21.7	21.2	15.4	19.6	18.0	23.3	15.4	14.9	13.8
Field Sparrow	3.2	3.7	4.7	-	-	-	-	-	-	-
Chipping Sparrow	1.1	-	-	-	-	-	-	-	-	-
Eastern Meadowlark	1.1	0.5	-	-	-	-	-	-	-	
Common Grackle	1.1	0.5	P	0.5	2.6	-	-	-	-	-
Brown-headed Cowbird	4.2	9.6	9.6	6.9	13.8	10.1	10.6	11.1	13.3	9.0
Orchard Oriole	0.5	-	-	-	P	-	-	-	-	-
Scarlet Tanager	-	-	-	-	-	-	-	-	1.1	P
Summer Tanager	-	-	P	1.1	3.7	2.1	2.6	2.6	3.2	3.7
American Goldfinch	2.6	14.3	3.2	1.1	1.1	0.5	1.1	P	1.1	-