

Winter Birds in a Developing Pine Plantation

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Abstract: Winter resources may limit bird populations. In this study we document the winter bird community and assess habitat relationships in a single large loblolly pine (*Pinus taeda*) plantation (~500 ha) from shortly after establishment into the middle-age closed canopy stage at 16 years. The winter bird community changed as the plantation grass/forb/shrub community gave way to low shrubs, and again as low shrubs were dominated and mostly supplanted by the rapidly growing pine trees. The highest bird abundance (436/km²) and the most species (22) occurred the second year after planting (the first year of the study). After the second year post establishment, the number of species declined and bird abundance declined consistently until about year 10 when pine canopies dominated. From age 10 to 16 years of the plantation, number of bird species was variable and bird abundances were low and variable. Bird species diversity was variable throughout the study.

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Silvicultural operations in southern forests are often a drastic habitat alteration affecting faunal communities, including birds. Bird communities and habitat relationships of breeding birds in southern pine and pine-hardwood stands in different stages of development have been documented (e.g., Johnston and Odum 1956, Shugart and James 1973, Dickson and Segelquist 1979a). There are more birds in structurally diverse pine-hardwood stands than in pine stands (Dickson and Segelquist 1979a). Normally, breeding bird density and diversity in pine stands are relatively high in young rapidly-growing stands with forbs and shrubs, decrease in middle-aged pine stands as pine canopies close and

shade out other plants, and increase to the highest level in structurally diverse older stands with several layers of foliage (Johnston and Odum 1956, Shugart and James 1973, Conner and Adkisson 1975, Dickson and Segelquist 1979a). In these past studies, different stands were selected to represent different stand developmental stages.

In another phase of this study, we documented the breeding bird community changes in a young, developing pine plantation. The breeding bird community was at its lowest abundance at the earliest grass/forb stage of the stand (Dickson et al. 1993). The plantation grew rapidly into the shrub stage and the bird community also increased in abundance and complexity. Bird abundance increased consistently until plantation age 7 to 9 years, then declined as the pine canopy closed and shaded out lower vegetation. Bird diversity declined somewhat later, at about age 11.

But habitat suitability for birds varies seasonally (Fretwell 1972). Habitat used during migration may be important, and winter can be a critical period for birds (Sherry and Holmes 1992). Resident birds may suffer direct winter mortality (Arcese et al. 1992). Also, recent ecological studies suggest that resources may not be limiting during the breeding season, thus winter may limit populations (Wiens 1989). There is recent demographic and experimental evidence of competition for and implied limitation of winter habitat. An even dispersion of wintering individuals (Sliwa and Sherry 1992), rapid replacement of removed individuals from winter habitat (Rappole and Warner 1980), intraspecific aggression (Holmes et al. 1989), and widespread sex and age segregation of birds among winter habitats (Sherry and Holmes 1993) all support the concept of competition for limited winter resources by birds.

Only a few studies have detailed winter bird communities in pine stands of different ages. Conner et al. (1979) documented winter bird communities in pine-oak (*Quercus* spp.) stands of various ages in southwestern Virginia. Noble and Hamilton (1976) censused winter birds in 3 different-aged loblolly pine stands in Livingston Parish, Louisiana. Dickson and Segelquist (1979b) analyzed winter bird communities in paired pine and pine-hardwood small sapling, sapling, pole, and sawtimber stands in eastern Texas.

To understand ecosystem components and relationships better, long-term data are needed. In this study we measured the vegetational development of a large loblolly pine plantation, monitored the wintering bird community, and evaluated the long term bird habitat/bird community relationships for 15 years from plantation establishment to pole stage.

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Methods

The study area was a pine plantation of about 500 ha located in the southern portion of Nacogdoches County, Texas, near the western edge of the South-

ern Coastal Plain. Representative vegetation of the area includes loblolly and shortleaf (*P. echinata*) pines and associated oaks, hickories (*Carya* spp.), sweetgum (*Liquidambar styraciflua*), and other hardwood species. Soils are classified as Tenaha loamy fine sand and Cuthbert fine sandy loam. The area is generally rolling upland with a few intermittent streams. Merchantable trees on the area had been clearcut and the remaining woody vegetation cleared, pushed into windrows, and burned in 1975. The site was planted in winter 1975–76 with loblolly pine seedlings.

In 1977, 4 80- by 250-m transects (2 ha each) were established on the pine plantation at least 100 m away from the adjoining woods and other transects. Plots were similar in topography and representative of the plantation. Birds on each of the 4 transects were censused 9 times annually (except 1 year) an equal number of times by each of 3 censusers. Censusing was conducted by the same people during January and February from plantation age 2 (1978) through plantation age 16 (1992). All birds detected by sight or sound within a 40-m lateral distance from the transect mid-line were plotted on transect maps as each censuser slowly traversed the midline of each transect (Conner and Dickson 1980). Censusing of each transect took from 12 to 20 minutes. All censusing was completed by 3 hours after sunrise. Censusing was avoided during high winds (>19 kph) or substantial rain. Bird abundance, number of species, and species diversity (Shannon 1948) were calculated for all transects each year.

Shrub and forb vegetation on each of the 4 transects was sampled each growing season from 6 4.05-m² circular plots randomly located each year. Vegetation plots were representative of the plantation. Percentage of horizontal surface area covered to the nearest 5% was estimated for each plant species ≤ 2 m high. Species were combined into broad taxonomic groups for presentation (Table 1). Woody vegetation was sampled from 6 200-m² circular plots on each transect (Table 2). Stem density and basal area were determined from measurement of individual stems and height of dominant trees measured with a vertical pole.

Results and Discussion

During the early years the pine plantation changed rapidly. Grass/forbs/shrubs gave way to low shrubs in the early phases, then shrubs were dominated and mostly eliminated by the rapidly growing pines. The highest bird abundance (436/km²) and the most species (22) occurred the second year after planting during the first year of the study (Fig. 1). At this stage of the plantation, grasses, forbs, and low shrubs dominated (Table 1), with abundant seed and fruits of the rapidly developing plantation available to foraging birds. These results are consistent with the abundant and diverse bird community documented in Louisiana (Noble and Hamilton 1976) and eastern Texas (Dickson and Segelquist 1979b). In the Louisiana investigation of winter bird communities in 3 pine stands of different ages, the highest species diversity and the most birds were

Table 1. Percentage of area covered by plant groups^a in a pine plantation in eastern Texas estimated from 24 4.05-m² circular plots.

Plant group	Plantation age in years since planting															
	2	3	4	6	7	8	9	10	11	12	13	14	15	16		
Grass and grasslikes	10.2	13.1	17.1	19.8	13.1	11.0	9.8	10.0	11.5	8.5	6.0	7.1	6.2	5.6		
Forbs	53.2	53.1	82.2	66.2	65.1	44.3	34.5	38.6	25.3	21.7	18.4	14.8	12.7	14.2		
Ferns	3.5	3.1	11.7	2.7	4.0	3.8	5.6	2.9	4.8	5.8	2.5	2.9	1.5	1.7		
Hardwoods	55.7	50.5	64.4	60.7	50.3	40.3	40.7	48.6	32.3	40.5	34.0	33.4	29.6	25.0		
Pines	2.3	3.5	5.0	10.2	6.5	2.1	0.4	0.2	0.4	0.8	0.4	0.4	0.4	0.8		
N species	102	116	115	113	112	99	98	100	96	86	87	78	65	65		

^aHeight ≤ 2 m.

Table 2. Mean vegetative characteristics of a pine plantation determined from 24 200-m² circular plots.

Characteristic	Plantation age in years															
	8	9	10	11	12	13	14	15	16							
Height (m)	7.3	8.9	10.2	11.3	12.8	13.5	14.3	14.7	16.0							
Pine	5.3	6.9	7.9	8.6	9.3	10.4	10.8	11.4	11.6							
Hardwood																
Basal area (m ² /ha)	10.4	11.8	16.0	18.0	21.2	22.5	25.0	27.9	28.5							
Pine	0.6	0.6	0.8	1.0	1.2	1.2	1.7	1.6	1.9							
Hardwood																
N stems/ha (≥ 5 cm)	1,096	1,085	1,156	1,102	1,135	1,116	1,083	1,162	1,029							
Pine	179	206	208	294	283	271	366	319	354							
Hardwood																

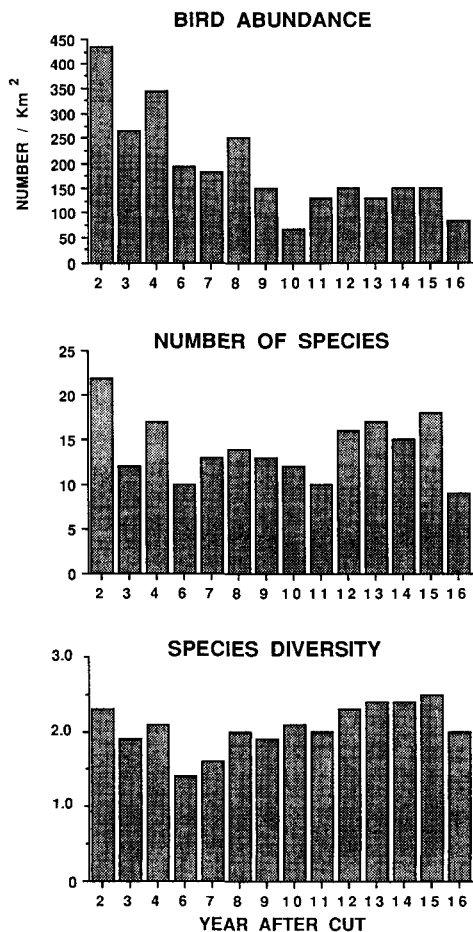


Figure 1. Winter bird abundance, number of species, and species diversity in a developing pine plantation.

detected in the youngest pine stand (6 years old). In the Texas investigation of 4 pine and 4 pine-hardwood stands of different stages of development, the highest bird abundance was detected in the 4-year-old pine sapling stand (509/km²). High bird abundance also was noted in the youngest (6-year-old) pine-hardwood stand (252/km²).

After the second year the number of bird species declined and bird abundance declined consistently from year 2 until about the 10th year post establishment. During this rapidly developing phase of the plantation, species detected annually during the winter censuses varied from 9 to 18. Bird abundance declined erratically, but consistently to a low of only 65 birds/km² at year 10. From year 10 to 16, bird abundance varied annually from a low of 65 to a high of 151 birds/km². The decline in abundance and diversity of the bird community in this pine plantation as pines dominated the stand contrasts with the increased

complexity of bird communities in older, more complex oak-pine stands in Virginia (Conner et al. 1979).

Bird species diversity averaged about 2.0 throughout the study (Fig. 1), but was variable, probably as a result of uneven distribution of birds in winter flocks. This bird species diversity value was similar to that in the previous study of winter birds in eastern Texas (Dickson and Segelquist 1979b), but lower than that in Louisiana (Noble and Hamilton 1976).

Several species of seed-eating birds normally associated with grass/forb vegetation were abundant in the youngest stages of the pine plantation. Savannah sparrows (*Passerculus sandwichensis*) and red-winged blackbirds (*Agelaius phoeniceus*) were present only in the youngest stage of the pine plantation, the first year of the study (Fig. 2). Hamel (1992) describes savannah sparrow winter habitat as grass/forb vegetation < 0.2 m high and red-winged blackbird habitat as open.

Eastern meadowlarks (*Sturnella magna*), an early successional species, were present in small numbers in the plantation at age 2, increased in abundance to 31 birds/km² at age 3, and decreased to a few birds at age 4 after which they disappeared from the stand. This species also was fairly abundant in the pine small sapling stand in eastern Texas (Dickson and Segelquist 1979b).

The song sparrow (*Melospiza melodia*) was the most abundant bird at plantation age 2 (126/km²), but decreased consistently in the plantation until it disappeared by age 7 as grass/forb vegetation was replaced by hardwood shrubs. Hamel (1992) described their winter habitat as thick herbaceous cover or shrubby thickets. This species also was found in the youngest pine stand in Louisiana (Noble and Hamilton 1976) and eastern Texas (Dickson and Segelquist 1979b). Vesper sparrows (*Poocetes gramineus*) were relatively abundant (about 30 birds/km²) for years 2 and 3 post treatment, but declined to <10 birds/km² for years 4 to 6, after which they disappeared from the stand. This species also is characteristic of early successional stands with grass/forbs and bare ground (Hamel 1992). Winter coveys of northern bobwhites (*Colinus virginianus*) were detected occasionally during the early years of the plantation. Dark-eyed juncos (*Junco hyemalis*) were relatively abundant with highest densities around 50/km² in the shrubby plantation through year 8. According to Hamel (1992), their winter habitat is short grass or bare ground. Juncos were occasional visitors in the studies in Louisiana and eastern Texas.

As the plantation developed and shrubs became dominant, bird community changes were apparent. The grass-forb associated birds dwindled and shrub associated species became dominant. Two ubiquitous species, the northern cardinal (*Cardinalis cardinalis*) and Carolina wren (*Thryothorus ludovicianus*), were found consistently in the plantation. Cardinals were detected regularly at fairly low densities (7–36/km²) each winter. This species was associated with the low hardwood shrubs which were eventually overtopped by pines. The Carolina wren, also a shrub-level inhabitant (Dickson and Noble 1978), was first detected at plantation age 4 and annually thereafter, but was never more abundant than

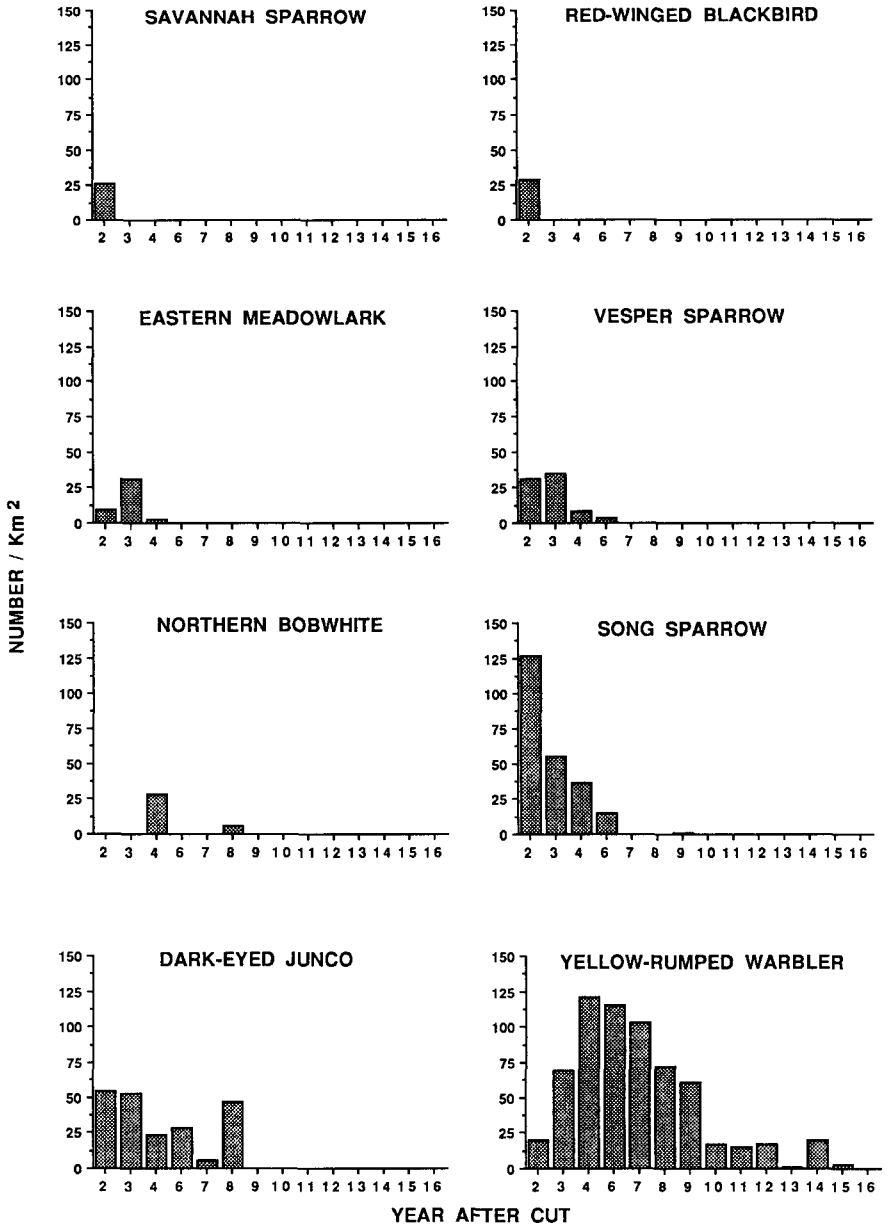
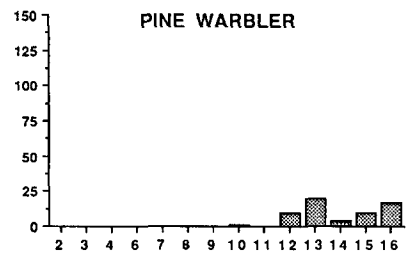
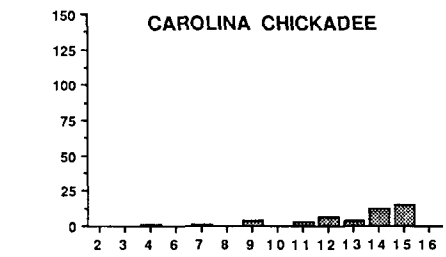
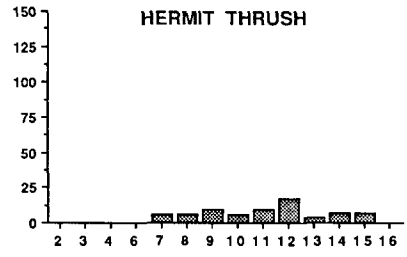
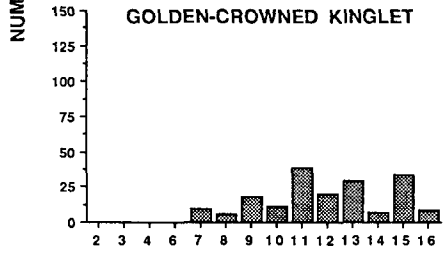
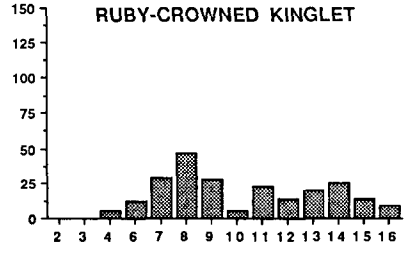
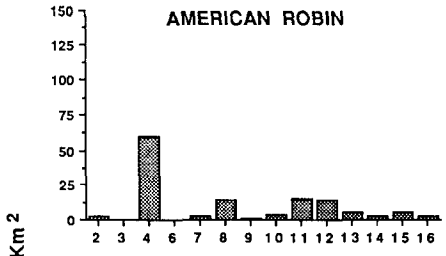
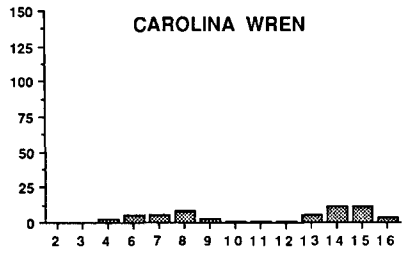
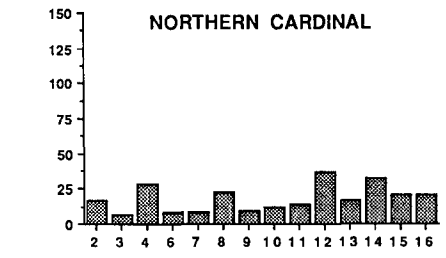


Figure 2. Abundance of common winter birds in a developing pine plantation.



YEAR AFTER CUT

11 individuals per square kilometer. Both of these species were regular inhabitants of young stands in Louisiana and eastern Texas.

Flocks of American robins (*Turdus migratorius*) were encountered erratically almost every winter of the study (Fig. 2). In comparison, they inhabited the youngest pine stands in the Louisiana (Noble and Hamilton 1976) and eastern Texas (Dickson and Segelquist 1979b) studies.

Yellow-rumped warblers (*Dendroica coronata*) were at low densities (19/km²) at year 2, increased to more than 100 birds per square kilometer by the fourth year, then decreased consistently through the ninth year, after which they remained at low densities (<20/km²). Yellow-rumped warblers were the most abundant species in the youngest stand in Louisiana (Noble and Hamilton 1976) and were the most dominant species by far in the youngest stand in Texas (Dickson and Segelquist 1979b), with density exceeding 200/km² in the pine small sapling stand. During winter this ubiquitous species inhabits a variety of habitats (Hamel 1992).

The ruby-crowned kinglet (*Regulus calendula*) first appeared at stand age 4 and was detected annually in widely fluctuating numbers throughout the duration of the study. This species is typically ubiquitous and inhabits a wide variety of forest stands of different composition during winter in the South. The ruby-crowned kinglet was one of the most common winter residents of Louisiana pine stands (Noble and Hamilton 1976), the only species detected in all pine and pine-hardwood stands in Texas (Dickson and Segelquist 1979b), and a common winter resident of southern bottomland hardwoods (Dickson 1978).

As the plantation developed from about age 6 to 10, pines became more dominant (Table 2), some hardwood shrubs such as sumac (*Rhus* spp.) diminished, and a few hardwood sprouts, such as sweetgum, grew underneath and into the stand canopy. The bird community was changing also. The golden-crowned kinglet (*Regulus satrapa*) invaded the pine stand at age 7 and was present in widely varying numbers thereafter. This species, which normally winters in conifer stands (Hamel 1992), was found regularly in the middle-aged and older pine and pine-hardwood stands in Texas and in the middle-aged pine stand in Louisiana.

The hermit thrush (*Catharus guttatus*), a wintering species found on the forest floor (Dickson and Noble 1978), was present in small numbers from age 7 through 15, similar to previous data from Louisiana (Noble and Hamilton 1976) and eastern Texas (Dickson and Segelquist 1979b), where it was found consistently in low densities in the middle-aged and older stands. The Carolina chickadee (*Parus carolinensis*), normally a species of the forest canopy (Dickson and Noble 1978), was detected occasionally in the shrub stage of the plantation and usually more frequently after age 11. Pine warblers (*Dendroica pinus*), a permanent resident of a variety of middle-aged and older pine stands (Noble and Hamilton 1976; Dickson and Segelquist 1979a,b; Hamel 1992), was detected in varying numbers at plantation age 12 and older as pine canopies dominated the stand. Uncommon birds in the stand with insufficient detections to determine distribution and abundance patterns are presented in Table 3.

Table 3. Uncommon winter birds in a developing pine plantation in eastern Texas, 1978–92.

Turkey vulture (<i>Cathartes aura</i>)	Northern harrier (<i>Circus cyaneus</i>)
Cooper's hawk (<i>Accipiter cooperii</i>)	Red-shouldered hawk (<i>Buteo lineatus</i>)
Red-tailed hawk (<i>Buteo jamaicensis</i>)	American kestrel (<i>Falco sparverius</i>)
American woodcock (<i>Scelopax minor</i>)	Mourning dove (<i>Zenaidra macroura</i>)
Yellow-bellied sapsucker (<i>Sphyrapicus varius</i>)	Northern flicker (<i>Colaptes auratus</i>)
Downy woodpecker (<i>Picoides pubescens</i>)	Eastern phoebe (<i>Sayornis phoebe</i>)
Pileated woodpecker (<i>Dryocopus pileatus</i>)	American crow (<i>Corvus brachyrhynchos</i>)
Blue jay (<i>Cyanocitta cristata</i>)	Bewick's wren (<i>Thryomanes bewickii</i>)
Tufted titmouse (<i>Parus bicolor</i>)	Brown thrasher (<i>Toxostoma rufum</i>)
Winter wren (<i>Troglodytes troglodytes</i>)	Solitary vireo (<i>Vireo solitarius</i>)
Loggerhead shrike (<i>Lanius ludovicianus</i>)	Rufous-sided towhee (<i>Pipilo erythrophthalmus</i>)
Orange-crowned warbler (<i>Vermivora celata</i>)	Chipping sparrow (<i>Spizella passerina</i>)
Bachman's sparrow (<i>Aimophila aestivalis</i>)	Fox sparrow (<i>Passerella iliaca</i>)
Field sparrow (<i>Spizella pusilla</i>)	White-throated sparrow (<i>Zonotrichia albicollis</i>)
Lincoln's sparrow (<i>Melospiza lincolni</i>)	

Management Implications

Some different silvicultural alternatives in pine stands could be employed to benefit wintering bird communities. Firstly, other than for a few species such as the red-cockaded woodpecker (*Picoides borealis*), bird communities mostly are dependent on non-pine vegetation in pine stands. Even winter birds in plantations are often at their lowest abundance when pine trees dominate stands. Practices which promote grass-forb and hardwood vegetation, such as wider spacing and thinning, generally would benefit birds. Burning would disfavor species associated with hardwood understory foliage and favor species associated with grass-forb and low shrub vegetation. Also, streamside zones of mature hardwoods would accommodate species not found in young or pine dominated stands. Snag retention in plantations would accommodate cavity using species. Stands smaller than this ~500 ha stand would probably have a similar bird community, except along the stand edge which would be influenced by stand juxtaposition, and probably would be more complex.

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