RRBO is 32.7 g.) *Received 23 Aug. 1997, accepted 2 June 1998.*

There are numerous accounts of small birds being entangled in burdock (*Arctium minus*). They include four Ruby-throated Hummingbirds (*Archilochus colubris*), three Black-capped Chickadees (*Poecile atricapillus*), one Red-breasted Nuthatch (*Sitta canadensis*), well over a dozen Golden-crowned Kinglets (*Regulus satrapa*), two Ruby-crowned Kinglets (*Regulus calendula*), one each Blue-gray Gnatcatcher (*Polioptila caerulea*), Solitary Vireo (*Vireo solitarus*), Magnolia Warbler (*Dendroica magnolia*), Yellow-rumped Warbler (*Dendroica coronata*), Common Yellowthroat (*Geothlypis trichas*) and Pine Siskin (*Cardulis pinus*), two unidentified warblers, and several American Goldfinch (*Carduelis tristis*) (McNicholl 1988, 1994; Wright 1984). Hampson (1970) provides the only report of birds trapped in a plant other than burdock: a House Wren (*Troglodytes aedon*) and a Ruby-crowned Kinglet entangled in beggar's lice (*Hacklelia virginiana*).

The seed heads of burdock are fairly large (1.5–3 cm), and the plant itself is robust. The fruits of beggar's lice are also bur-like, approximately 8 mm wide. With the exception of the Solitary Vireo, all of the victims are small birds; for example, the mean weight of Golden-crowned Kinglets (the most frequent victims) is just over 6 g (Dunning 1993). In contrast, enchanter's nightshade is a relatively weak plant, with very small (<3 mm) nut-like seeds covered with minute barbed hairs, giving a Velco®-like effect. This is the first reported instance of a bird being caught in enchanter's nightshade, and the Swainson's Thrush is the largest bird reported entangled in seed heads.

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Comparisons of Wintering Bird Communities in Mature Pine Stands Managed by Prescribed Burning

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ABSTRACT.—We compared the effects of growing season and dormant season prescribed fire on the winter bird communities in mature pine stands on Fort Benning Military Reservation, Georgia. We surveyed the avian community using fixed-radius point counts from 1 December 1995 to 28 February 1996, one year after burning. We detected no differences in mean bird abundance or species richness between burn treatments. No species was observed more or less frequently in either burn treatment. Season of burn had little apparent effect on the composition of wintering bird communities in managed mature pine forests. *Received 31 March 1998, accepted 30 July 1998.*

Winter mortality may be a limiting factor for many resident birds in North America (Arcese et al. 1992), and the alteration or loss of winter habitats could contribute to avian population declines (Terborgh 1989, Morton 1992). Consequently, conditions on the wintering ground can influence breeding populations in following years (Baillie and Peach 1992) through competition for winter habitats

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TABLE 1. Vegetation characteristics, expressed as $\bar{x}$ (± SE), for growing and dormant season prescription burned mature pine stands on Fort Benning Military Reservation, Georgia (July–August 1995).

Habitat characteristic	Growing (n = 9)	Dormant (n = 9)	F-Value	P-Value
Stand age (years)	51.6 (4.3)	57.7 (4.0)	0.22	>0.05
Basal area (m^2/ha)	11.8 (1.4)	13.9 (1.8)	0.54	>0.05
Canopy closure (%)	31.7 (0.9)	31.0 (0.8)	0.12	>0.05
Shrub density (no./0.04 ha)	10.2 (0.8)	8.2 (0.8)	0.62	>0.05

(Holmes et al.1989, Rappole et al. 1989) and effects on winter site fidelity (Kricher and Davis 1986, Sherry and Holmes 1992). Therefore, it is important to understand how land management activities may affect avian use of winter habitats.

In the southeastern United States, prescribed burning is a widely used silvicultural tool in the management of pine forests. Historically, lightning caused fires have been a major ecological force in southeastern ecosystems (Komarek 1962, Landers 1987). Such fires usually occurred during the growing season (Komarek 1968, Taylor 1969), but during this century forest managers have relied predominately upon prescribed fires during the dormant season to manage forest understories. Burns conducted during the winter months provide conditions such as high moisture content of the vegetation, low ambient temperatures, and consistent winds, that reduce the chances of wildfire. Recently, growing season burns are being used more frequently by forest managers because they more closely mimic natural fire regimes and provide greater control of hardwoods. Although some researchers report favorable responses of breeding bird communities to burned versus unburned habitats (Emlen 1970, Wilson et al. 1995), research on the effects of prescribed fire on wintering bird communities is limited (Blake 1982). Because the season of burn can influence the vegetational structure of a habitat (Waldrop et al. 1992), we deemed it important to compare wintering avian communities in growing season and dormant season prescription-burned mature pine stands.

STUDY AREA AND METHODS

Our study was conducted at the Fort Benning Military Reservation near Columbus, Georgia. Fort Benning is located in the Upper Coastal Plain of west-central Georgia. The vegetation on Fort Benning is dominated by pure and mixed stands of longleaf (*Pinus palustris*), loblolly (*P. taeda*), and shortleaf pine (*P. echinata*) with open understories consisting mainly of sweetgum (*Liquidambar styraciflua*), flowering dogwood (*Cornus florida*), andropogon (*Andropogon* spp.), blackberry (*Rubus* spp.), gallberry (*Ilex* spp.), and wax myrtle (*Myrica cerifera*). Pine stands on the reservation are managed with both growing season and dormant season prescribed fires on 3-year rotations. Many of the stands are managed to provide required habitat conditions for the Red-cockaded Woodpecker (*Picoides borealis*), an endangered species endemic to mature pine forests in the southeastern United States (U.S. Fish and Wildlife Service 1985). These stands are burned by prescription every 2–4 years.

We selected for study 9 plots that were burned in the growing season (April–August) and 9 plots that were burned in the dormant season (January–March) of 1994. All plots were located in mature pine stands within managed Red-cockaded Woodpecker habitat and were similar in basal area, canopy closure, and shrub density (Table 1). Because our interest was in comparing the avifauna of growing season burned areas to dormant season burned areas, we did not sample unburned plots. When comparing conditions in fire-maintained habitats, fire exclusion usually is considered a treatment rather than a control (Platt et al. 1988).

We censused birds in each plot along a line transect consisting of 9 census points located at least 122 m apart within managed, mature pine stands. Transect points were placed in 3 × 3 grids and were located at least 100 m from roads and other open areas (White et al. 1996). We conducted biweekly counts from mid-December 1995 through mid-February 1996, using the fixed-radius point count method (Hutto et al. 1986). Census methods were derived from Ralph and coworkers (1995). To reduce bias, plots were censused at alternate times between sunrise and 10:30 EST (Robbins 1981, Blake et al. 1991) and were alternated between observers (Erwin 1982). During each count, observers sampled each survey point for 5 minutes and all birds detected aurally or visually within a 61 m radius were counted. Flagging tape streamers were placed 15 m, 30 m, 45 m, and 61 m in the four cardinal directions from each point to assist observers in estimating bird distances. Birds flushed when observers were approaching or leaving a survey point were recorded, but birds flying over the plot were not included in the data analysis. Because all plots were relatively

TABLE 2. Mean (SE) nonbreeding bird abundance (mean no./per plot) on growing and dormant season prescription burned mature pine stands at Fort Benning Military Reservation, Georgia, December 1995 through February 1996.

Avian species	Growing	Dormant	*t*	*P*-Value
American Crow (*Corvus brachyrhynchos*)	0.14 (0.08)	0.29 (0.16)	0.68	0.42
American Goldfinch (*Carduelis tristis*)	0.13 (0.09)		2.23	0.16
American Kestrel (*Falco sparverius*)		0.02 (0.02)	1.00	0.33
American Robin (*Turdus migratorius*)	4.85 (2.27)	8.10 (3.63)	0.57	0.46
Bachman's Sparrow (*Aimophila aestivalis*)		0.14 (0.10)	2.14	0.16
Black Vulture (*Coragyps atratus*)		0.02 (0.02)	1.00	0.33
Blue Jay (*Cyanocitta cristata*)	0.13 (0.07)	0.09 (0.05)	0.21	0.65
Brown-headed Nuthatch (*Sitta pusilla*)	1.36 (0.36)	0.90 (0.22)	1.18	0.29
Carolina Chickadee (*Poecile carolinensis*)	1.44 (0.29)	1.75 (0.35)	0.48	0.50
Carolina Wren (*Thryothorus ludovicianus*)	2.10 (0.36)	1.80 (0.35)	0.39	0.54
Cedar Waxwing (*Bombycilla cedrorum*)	1.40 (0.87)	1.24 (0.68)	0.02	0.89
Chipping Sparrow (*Spizella passerina*)	0.59 (0.23)	0.20 (0.09)	2.55	0.13
Common Grackle (*Quiscalus quiscula*)	0.09 (0.09)		1.00	0.33
Common Snipe (*Gallinago gallinago*)		0.02 (0.02)	1.00	0.33
Common Yellowthroat (*Geothlypis trichas*)	0.06 (0.05)	0.07 (0.06)	0.02	0.88
Dark-eyed Junco (*Junco hyemalis*)	2.15 (1.50)	0.72 (0.19)	0.90	0.36
Downy Woodpecker (*Picoides pubescens*)	0.53 (0.15)	0.80 (0.13)	1.81	0.20
Eastern Bluebird (*Sialia sialis*)	1.48 (0.66)	0.68 (0.25)	1.31	0.27
Eastern Phoebe (*Sayornis phoebe*)	0.56 (0.18)	0.44 (0.19)	0.22	0.64
Eastern Towhee (*Pipilo erythrophthalmus*)	1.54 (0.33)	2.31 (0.68)	1.04	0.32
Eastern Wood-Pewee (*Contopus virens*)		0.02 (0.02)	1.00	0.33
Fox Sparrow (*Passerella iliaca*)	0.04 (0.04)		1.00	0.33
Gray Catbird (*Dumetella carolinensis*)	0.04 (0.04)		2.29	0.15
Golden-crowned Kinglet (*Regulus satrapa*)	0.07 (0.07)	0.47 (0.33)	1.37	0.26
Hairy Woodpecker (*Picoides villosus*)		0.10 (0.05)	3.61	0.08
Hermit Thrush (*Catharus guttatus*)	0.36 (0.16)	0.54 (0.18)	0.57	0.46
Mourning Dove (*Zenaida macroura*)	0.06 (0.04)	0.07 (0.05)	0.01	0.91
Northern Cardinal (*Cardinalis cardinalis*)	1.13 (0.21)	0.91 (0.19)	0.55	0.47
Northern Flicker (*Colaptes auratus*)	0.27 (0.08)	0.24 (0.09)	0.08	0.78
Palm Warbler (*Dendroica palmarum*)	0.02 (0.02)		1.00	0.33
Pileated Woodpecker (*Dryocopus pileatus*)	0.30 (0.16)	0.10 (0.05)	1.32	0.27
Pine Warbler (*Dendroica pinus*)	3.32 (1.26)	4.55 (2.31)	0.22	0.65
Prairie Warbler (*Dendroica discolor*)	0.34 (0.20)	0.07 (0.07)	1.48	0.24
Red-bellied Woodpecker (*Melanerpes carolinus*)	1.18 (0.19)	0.87 (0.27)	0.90	0.36
Red-breasted Nuthatch (*Sitta canadensis*)	0.04 (0.04)	0.02 (0.02)	0.12	0.74
Red-cockaded Woodpecker (*Picoides borealis*)	1.57 (0.53)	0.90 (0.48)	0.89	0.36
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	0.07 (0.07)	0.16 (0.10)	0.41	0.53
Red-shouldered Hawk (*Buteo lineatus*)	0.02 (0.02)	0.02 (0.02)	0.02	0.90
Ruby-crowned Kinglet (*Regulus calendula*)	0.62 (0.23)	1.12 (0.40)	1.20	0.29
Song Sparrow (*Melospiza melodia*)	0.06 (0.04)		2.00	0.18
Solitary Vireo (*Vireo solitarius*)	0.08 (0.08)	0.04 (0.04)	0.15	0.71
Tufted Titmouse (*Baeolophus bicolor*)	0.65 (0.22)	0.99 (0.42)	0.50	0.49
Turkey Vulture (*Cathartes aura*)		0.04 (0.04)	1.00	0.33
White-breasted Nuthatch (*Sitta carolinensis*)	0.59 (0.20)	0.17 (0.09)	3.54	0.08
White-throated Sparrow (*Zonotrichia albicollis*)	0.78 (0.28)	1.81 (0.77)	1.61	0.22
Wild Turkey (*Meleagris gallopavo*)	0.19 (0.19)		1.00	0.33
Yellow-bellied Sapsucker (*Sphyrapicus varius*)	0.45 (0.15)	0.21 (0.07)	2.07	0.17
Yellow-rumped Warbler (*Dendroica coronata*)	0.46 (0.18)	0.33 (0.10)	0.36	0.56

open, the probability of detecting birds was assumed to be equal (Dawson 1981, Verner and Ritter 1986). Counts were not conducted on days with moderate rain or wind.

Avian species were grouped by habitat preference into four categories: forest interior species, interior-edge species, edge-field species, and field species (Whitcomb et al. 1981, Freemark and Collins 1992). Since the census points in each plot were not independant, we considered the sum of birds observed during

TABLE 3. Mean (SE) avian abundance and richness in growing and dormant season prescription-burned mature pine stands at Fort Benning Military Reservation, Georgia, December 1995–February 1996.

Habitat preference	Abundance (no./plot)			Richness (S)		
	Growing	Dormant	*F*-value	Growing	Dormant	*F*-Value
Forest interior species	5.9 (1.4)	4.0 (0.7)	1.55	5.1 (0.5)	4.3 (0.3)	1.62
Interior-edge species	12.9 (1.1)	12.6 (1.1)	0.04	4.0 (0.3)	4.4 (0.2)	1.39
Edge-field species	6.2 (2.0)	5.1 (1.4)	0.20	4.6 (0.3)	3.9 (0.4)	2.12
Field species	7.6 (2.0)	5.4 (1.3)	0.85	13.2 (0.5)	12.8 (0.7)	0.24
Total	30.2 (3.9)	23.2 (2.5)	2.29	26.9 (0.9)	25.4 (0.7)	1.65

the censuses of the 9 points as one count. Annual means for bird abundance, richness, and diversity were derived from census totals ($n = 6$) for each plot. Differences between treatments were tested (SAS Institute, Inc. 1990) using a one-way analysis of variance (ANOVA). Bird species diversity was determined for each plot in each burn treatment using the Shannon-Weiner Index (Shannon and Weaver 1949). Data for individual species were transformed by adding 0.5 and calculating the square-root of all values (Steel and Torrie 1960). Differences in individual bird species abundance between burn treatments were analyzed (SAS Institute, Inc. 1990) using a *t*-test. Null hypotheses for all tests were rejected at $P \leq 0.05$.

RESULTS AND DISCUSSION

To our knowledge, no researchers have reported on the effects of season of burn on nonbreeding bird communities in mature upland pine stands. We detected a total of 48 avian species, but we found only 41 species in the plots for each burn season. Fourteen species were observed only in growing season plots and 14 species were observed only in dormant season plots. The number and composition of avian species that we observed (Table 2) is consistent with those found wintering in mature pines of the Piedmont physiographic region of Georgia (White et al. 1996). No species was observed ($P > 0.05$) more in either burn treatment. Avian communities did not differ ($P > 0.05$) in mean abundance or richness between growing and dormant-season burned habitats (Table 3).

Season of burning in mature upland pines apparently has no significant effect on the wintering bird communities. The detection of flocking birds often is reduced during winter (Yahner 1985), and this could have resulted in fewer observations and undetected species using the different burn regimes.

Avian community parameters were higher ($P < 0.05$) in mature pine stands managed with prescribed fire than in 20–30 year-old unburned pine plantations in the central Georgia Piedmont (White et al. 1996). Mature pines provided habitat conditions favorable to the Red-cockaded Woodpecker and also created habitat conditions suitable for many wintering avian species.

Although characteristics of the wintering bird communities did not differ between burn treatments, our study was limited to the nonbreeding season and did not compare the effects season of burn may have on breeding bird communities. Long-term studies comparing the effects season of burn in pine stands have on wintering and breeding bird communities are needed. With the limited research describing the effects season of prescribed burning has on avian communities, we suggest that land managers use both growing and dormant season prescribed fires to create a mosaic of habitat types.

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