SHORT-TERM EFFECTS OF SILVICULTURE ON BREEDING BIRDS IN WILLIAM B. BANKHEAD NATIONAL FOREST

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Abstract—We evaluated the changes in the bird community in relation to six disturbance treatments in the William B. Bankhead National Forest, AL. The study design is randomized complete block with a factorial arrangement of three thinning levels [no thin, 11 m^2/ha residual basal area (BA), and 17 m^2/ha residual BA] and two burn treatments (burn and no burn), with three replications. We collected data from pre- and post-treatment avian line-transect surveys. We found that the silvicultural treatments appear to create habitat for early successional bird species.

INTRODUCTION

The decline of neotropical migratory songbirds in Eastern North America has been a subject of much discussion among ornithologists over the past two decades (Askins and others 1990, Finch 1991, James and others 1996, Rappole and McDonald 1994, Robbins and others 1989). Although some evidence of declines is conflicting, it is generally accepted that due to general trends of habitat loss and degradation, and their importance to the ecosystems, giving priority conservation status to neotropical songbirds is justified. In recent studies, the decline of birds associated with early successional breeding habitat has been noted (Askins and others 1990, Hunter and others 2001, Litvaitis and others 1999). Trani and others (2001) reported that, according to Forest Inventory and Analysis data, young forest habitats are declining due to forest maturation and the absence of timber removal on much public land. Tree removal creates early successional habitat by removing trees to create an environment favorable for tree growth or regeneration (Smith and others 1997). As forest management evolves to employ multiple silvicultural tools to meet a myriad of objectives, it is important to understand how such management affects the bird community and if quality early successional wildlife habitat is produced.

Prescribed burning has garnered heightened awareness on public lands as a silvicultural technique since fire suppression in eastern forests has been questioned (Brose and others 2001, Van Lear and Waldrop 1989). Although the effect of silviculture and fire on birds has been studied individually in eastern forests, there is little research assessing the effect of thinning and prescribed burning (Greenberg and others 1995, 2007) and only one study reports the effects when tree reduction and burning are combined (Wilson and others 1995). It is important to understand how these treatments will affect the bird community when compared to other silvicultural techniques.

The objective of this portion of the study was to quantify the bird community on six silvicultural treatments in the William B. Bankhead National Forest.

METHODS

Study Sites

The study was located in the northern one-third of William B. Bankhead National Forest (BNF), located in Lawrence and Winston Counties, northwestern Alabama. The forests in this region have a diverse species composition due to a variety of past disturbances—agriculture in the 1800s, heavy cutting and wildfire in the early 1900s, fire suppression in the last decade, and the recent infestation of the southern pine beetle (*Dendroctonus frontalis* Zimmerman) (Gaines and Creed 2003). In the 1930s, abandoned farmland and other open lands were reestablished with loblolly pine (*Pinus taeda* L.) (Gaines and Creed 2003). This has resulted in 31 600 ha of loblolly pine throughout BNF. Once established, intensive pine plantation management was not implemented, and subsequently, a variety of hardwood species voluntarily invaded these sites. Over the past decade, southern pine beetle infestations have killed a major portion of loblolly pine, increasing fuel loads and the risk of wildfires (Gaines and Creed 2003). BNF has initiated a Forest Health and Restoration Project to promote healthy forest growth via thinning and fire disturbance. The thinning and fire prescriptions were administered to return the forest to a more healthy state and to promote regeneration of native species. Our research was conducted in conjunction with BNF's restoration project.

The study design consisted of a randomized complete block design with two factors: three thinning levels [no thin, 11 m^2/ha residual basal area (BA), and 17 m^2/ha residual BA] and two burn treatments (no burn and burn). Each treatment was replicated three times and blocked by year. Treatments were assigned randomly to delineated stands. After the treatments were completed, we collapsed the thinned treatments together because there was no difference in BA between the two thinning levels ($F = 0.07$, $df = 1$, $P = 0.8$). This created three replicates each of the control and burn, and six replicates each of the thin and the thin/burn. The research stands were located on upland sites composed of 20- to 35-year-old loblolly pine. Stands were comprised of a minimum of 60 percent pine [loblolly pine or Virginia pine

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(*P. virginiana* Mill.)], with the remainder mainly oak species (*Quercus* spp.). Average stand size was 12 ha and plots had similar age and stand density. Thinning favored the retention of hardwood species and was done before fire prescriptions. Prescribed burning was completed in the dormant season (January through March) with low-burning surface fires. Treatments on block one were completed between August 2005 and February 1, 2006; blocks two and three were treated between April 2006 and March 2007. Pre-treatment data was collected from all stands between April and June 2005. Post-treatment data was collected from block one between April and June 2006, and from blocks two and three between April and June 2007.

Sampling

We sampled the bird community using line-transect surveys and distance sampling methods (Buckland and others 2001). Line transects were established on each of the stands and flagged every 25 m. Each transect was 50 m from the edge of the stand and 100 m wide; the observer slowly walked down the middle of the transect and recorded all birds heard or seen within 50 m on either side. The observer recorded the following: species, sex, age, and the location of the bird in relation to the transect.

All stands were surveyed three times during the breeding season (May 15 through June 30) between 0530 and 1030 central daylight savings time. Surveys were done in random order and the transects walked in a different order and direction at each visit. All surveys were conducted by JMW to avoid observer bias.

To create a relative bird abundance index, we divided the number of detections by the transect length for each stand. Stands differed in size and shape and transect lengths differed among stands as well. We used the greatest number of individuals detected among the three surveys to estimate the relative abundance of each species. We grouped species into four guilds based on their habitat association (Blake and Karr 1987, Freemark and Collins 1992) (tables 1 and 2).

RESULTS

Before treatment, a total of 1,185 birds were detected, representing 35 species (table 1). The most abundant species were the red-eyed vireo (*Vireo olivaceus* Linnaeus), comprising 20.9 percent of total individuals, and the pine warbler (*Dendroica pinus* Wilson), comprising 11.6 percent of total individuals.

A total of 983 birds were detected 1 year after treatment, representing 40 species (table 2). The most abundant species were the red-eyed vireo, comprising 16.5 percent of total individuals, and the pine warbler, comprising 14.0 percent of total individuals. Species detected post-treatment that were not detected before treatment were the brown-headed nuthatch (*Sitta pusilla* Latham), eastern phoebe (*Sayornis phoebe* Latham), eastern towhee (*Pipilo erythrophthalmus* Linnaeus), eastern wood-pewee (*Contopus virens* Linnaeus), mourning dove (*Zenaida macroura* Linnaeus), ruby-throated hummingbird (*Archilochus coulbris* Linnaeus), and yellow-throated vireo (*V. flavifrons* Vieillot). Two species [blue grosbeak (*Guiraca caerulea* Linnaeus) and red-bellied woodpecker (*Melanerpes carolinus* Linnaeus)] detected before treatments were not detected post-treatment.

DISCUSSION

The overall structure of the bird community before treatment appears to be a midsuccessional forest. The bird community consisted of a majority of shrub-nesting species and interior/edge dwelling species. Optimal habitat for these guilds was created by the presence of wildlife openings, roads, and southern pine beetle damaged areas within many of the plots, which create small pockets of open areas and increase the amount of edge.

One year after treatment there was a treatment effect on some aspects of the bird community; it is likely a result of changes in microhabitat among treatments. Seven species were detected after silvicultural treatment that were not detected before treatment; six of these species prefer early successional forests. This suggests that silvicultural treatments that leave trees are viable options for creating habitat for early successional birds if clearcutting is not an option or if retaining mature forest birds is also a management goal. Many other studies have found that when some trees are retained, as in shelterwood and selection cuts, edge and open habitat bird species use the habitat for a short time and many mature forest birds remain (Campbell and others 2007, Greenberg and others 2007, Holmes and Pitt 2007, Lanham and others 2002, Vanderwel and others 2007, Weakland and others 2002). However, Costello and others (2000) suggest that there may be a minimum opening size requirement for some species associated with early successional habitat. Treatments that retain some trees may not create openings large enough to support all species that use early successional habitat for breeding.

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Table 1—Species detected before treatment on 18 upland pine-hardwood stands in Bankhead National Forest, AL, classified by habitat association

Common name	Scientific name	Habitat guild
Acadian flycatcher	*Empidonax virescens* Vieillot	I
Black-and-white warbler	*Mniotilta varia* Linnaeus	I
Blue-gray gnatcatcher	*Polioptila caerulea* Linnaeus	I/E
Brown-headed cowbird	*Molothrus ater* Boddaert	O/E
Blue-headed vireo	*Vireo solitarius* Wilson	I/E
Blue grosbeak	*Guiraca caerulea* Linnaeus	O/E
Blue jay	*Cyanocitta cristata* Linnaeus	I/E
Brown thrasher	*Toxostoma rufum* Linnaeus	O/E
Black-throated green warbler	*Dendroica virens* Gmelin	I
Carolina chickadee	*Poecile carolinensis* Audubon	I/E
Carolina wren	*Thryothorus ludovicianus* Latham	O/E
Downy woodpecker	*Picoides pubescens* Linnaeus	I/E
Tufted titmouse	*Baeolophus bicolor* Linnaeus	I/E
Great crested flycatcher	*Myiarchus crinitus* Linnaeus	I/E
Hairy woodpecker	*Picoides villosus* Linnaeus	I
Hooded warbler	*Wilsonia citrina* Boddaert	I
Indigo bunting	*Passerina cyanea* Linnaeus	O/E
Kentucky warbler	*Oporornis formosus* Wilson	I/E
Louisiana waterthrush	*Seiurus motacilla* Vieillot	I/E
Northern cardinal	*Cardinalis cardinalis* Linnaeus	I/E
Northern mockingbird	*Mimus polyglottos* Linnaeus	E
Northern parula	*Parula americana* Linnaeus	I/E
Ovenbird	*Seiurus aurocapillus* Linnaeus	I
Pine warbler	*Dendroica pinus* Wilson	I/E
Pileated woodpecker	*Dryocopus pileatus* Linnaeus	I
Prairie warbler	*Dendroica discolor* Vieillot	O/E
Red-bellied woodpecker	*Melanerpes carolinus* Linnaeus	I/E
Red-eyed vireo	*Vireo olivaceus* Linnaeus	I/E
Scarlet tanager	*Piranga olivacea* Gmelin	I
Summer tanager	*Piranga rubra* Linnaeus	I/E
White-breasted nuthatch	*Sitta carolinensis* Latham	I
White-eyed vireo	*Vireo griseus* Boddaert	O/E
Worm-eating warbler	*Helmitheros vermivorus* Gmelin	I
Wood thrush	*Hylocichla mustelina* Gmelin	I/E
Yellow-breasted chat	*Icteria virens* Linnaeus	O/E
Yellow-billed cuckoo	*Coccyzus americanus* Linnaeus	I/E

E = edge; I = interior; I/E = interior-edge; O/E = open/edge.

Source: Blake and Karr (1987), Freemark and Collins (1992).

Table 2—Species detected after silvicultural treatment on 18 upland pine-hardwood stands in Bankhead National Forest, AL, classified by habitat association

Common name	Scientific name	Habitat guild
Acadian flycatcher	*Empidonax virescens* Vieillot	I
Black-and-white warbler	*Mniotilta varia* Linnaeus	I
Blue-gray gnatcatcher	*Polioptila caerulea* Linnaeus	I/E
Brown-headed cowbird	*Molothrus ater* Boddaert	O/E
Brown-headed nuthatch	*Sitta pusilla* Latham	I
Blue-headed vireo	*Vireo solitarius* Wilson	I/E
Blue jay	*Cyanocitta cristata* Linnaeus	I/E
Brown thrasher	*Toxostoma rufum* Linnaeus	O/E
Black-throated green warbler	*Dendroica virens* Gmelin	I
Carolina chickadee	*Poecile carolinensis* Audubon	I/E
Carolina wren	*Thryothorus ludovicianus* Latham	O/E
Downy woodpecker	*Picoides pubescens* Linnaeus	I/E
Eastern phoebe	*Sayornis phoebe* Latham	I/E
Eastern towhee	*Pipilo erythrophthalmus* Linnaeus	I/E
Eastern wood-pewee	*Contopus virens* Linnaeus	I/E
Tufted titmouse	*Baeolophus bicolor* Linnaeus	I/E
Great crested flycatcher	*Myiarchus crinitus* Linnaeus	I/E
Hairy woodpecker	*Picoides villosus* Linnaeus	I
Hooded warbler	*Wilsonia citrina* Boddaert	I
Indigo bunting	*Passerina cyanea* Linnaeus	O/E
Kentucky warbler	*Oporornis formosus* Wilson	I/E
Louisiana waterthrush	*Seiurus motacilla* Vieillot	I/E
Mourning dove	*Zenaida macroura* Linnaeus	O/E
Northern cardinal	*Cardinalis cardinalis* Linnaeus	I/E
Northern parula	*Parula Americana* Linnaeus	I/E
Ovenbird	*Seiurus aurocapillus* Linnaeus	I
Pine warbler	*Dendroica pinus* Wilson	I/E
Pileated woodpecker	*Dryocopus pileatus* Linnaeus	I
Prairie warbler	*Dendroica discolor* Vieillot	O/E
Red-eyed vireo	*Vireo olivaceus* Linnaeus	I/E
Ruby-throated hummingbird	*Archilochus coulbris* Linnaeus	O/E
Scarlet tanager	*Piranga olivacea* Gmelin	I
Summer tanager	*Piranga rubra* Linnaeus	I/E
White-breasted nuthatch	*Sitta carolinensis* Latham	I
White-eyed vireo	*Vireo griseus* Boddaert	O/E
Worm-eating warbler	*Helmitheros vermivorus* Gmelin	I
Wood thrush	*Hylocichla mustelina* Gmelin	I/E
Yellow-breasted chat	*Icteria virens* Linnaeus	O/E
Yellow-billed cuckoo	*Coccyzus americanus* Linnaeus	I/E
Yellow-throated vireo	*Vireo flavifrons* Vieillot	I/E

I = interior; I/E = interior-edge; O/E = open/edge.

Source: Blake and Karr (1987), Freemark and Collins (1992).

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