IMPACTS OF POTENTIAL OAK FOREST CHANGE ON BREEDING BIRDS IN NORTHWESTERN ARKANSAS

Douglas A. James[1]

Abstract—Birds found on existing census routes in the Ozark region of northwestern Arkansas were used to predict avifaunal changes that could occur in the area due to oak-hickory forest degradation caused by red oak borer beetle infestations. The two census routes used passed through high elevation forests where red oaks thrive the best. Analysis showed that 21 bird species would decrease, 38 would increase, and 6 would remain unchanged in abundance in the event of forest thinning.

INTRODUCTION

Widespread death of oaks (*Quercus*) due to attacks by red oak borer beetles, *Enaphalodes rufulus* (Haldeman), is well documented (Spencer 2001). Resulting thinning and opening of the upland oak-hickory forests has been described for the Ozark Plateaus region of Arkansas (Spencer 2001). The change in forest structure before recovery would produce intervening rather open canopy stands with dense understory compared to pre-infestation conditions. Particularly in areas of dense oak stands, such as at high elevations in the Ozark National Forest, areas of forest are being completely removed.

This phenomenon will affect avifaunal composition in impacted areas. As a resource for predicting the nature of these changes there are 44 years (1967 to 2000) of data available from two roadside bird censuses in the region of concern. These censuses, two routes from the Breeding Bird Survey (Robbins 1986), are situated at high elevations where northern red oak (*Quercus rubra L.*), of northern affinity, thrives the best. This oak is the primary host of the red oak borer. These two Breeding Bird Surveys are also the only ones in Arkansas that have high numbers of two bird species of northern affinity, Scarlet Tanager and Ovenbird. (Scientific names of birds are in the tables, and authorities for these names are found in the A.O.U. Check-list of North American birds, 7th ed.)

Both the census routes pass through mature forest with a few pasture openings at high elevation around 2000 ft, and dip down to extensive areas of pasture lands and farm residences around 1000 ft elevation. Therefore, both forest birds and open country birds have been found over the years on the routes. The objective of this study is to identify the avian species already present that will increase or decrease with the opening of the forest due to oak borer infestation.

STUDY AREAS

The Compton and Lurton routes were the Arkansas routes of the Breeding Bird Survey (Robbins 1986) used to analyze the effects of forest change on the avifauna in the Ozarks. Both routes are in Newton County. The Compton route begins near the town of Compton on the ridge top, follows highway 43 into the Buffalo River Valley joining highway 21 for a ways and then up to the ridge top again on a rural road. The Lurton route follows rural roads starting near Lurton on road 123 continuing north to Mt. Judea, then swinging south again on a road toward Cowell. Both routes are 24.5 miles long and at around 2000 ft elevation at each end dominated by forest, with river valleys in the middle at around 1000 ft or below dominated by pastures and farm yards.

METHODS

The Breeding Bird Survey (Robbins 1986) is a roadside bird census comprising 50 stops along 24.5 miles of road, the starting point randomly selected. Precisely the same stops on the same routes are visited annually every June. The census starts one-half hour before local sunrise at the route starting point. The observer records at each stop all the birds seen and heard there in a three-minute period. Then the observer drives one-half mile to the next three-minute stop, repeating until all 50 stops are covered. This has been repeated annually since 1967 at the Compton and Lurton routes. The data presented here are for 44 years from 1967 to year 2000. Results are expressed in number of individuals per bird species for each route averaged over the 44 years.

RESULTS

In order to evaluate which species will increase and which will decrease with the opening of the forest, studies of birds and their habitats must be consulted. Useful compilations of this information exist. One publication covers Arkansas (James and Neal 1986) another includes Arkansas and the rest of the southeastern United States (Hamel and others 1992), three cover nearby Missouri Ozarks (Clawson 1982, Evans and Kirkman 1981, Jacobs 1997), and one pertains to the forest lands of the southeastern Atlantic coast states (Hamel and others 1982). These sources were used collectively in making avian habitat determinations, supplemented by the author's own familiarity with Arkansas birds from field studies over the past 50 years.

Among all the birds found on the routes only species associated with upland forest and open uplands were evaluated. This eliminated water birds, one introduced species (pigeon), nocturnal birds (routes are covered in daytime when owls

[1] Professor of Biological Sciences, Department of Biological Sciences, University of Arkansas, Fayetteville, AR 72701.

Citation for proceedings: Spetich, Martin A., ed. 2004. Upland oak ecology symposium: history, current conditions, and sustainability. Gen. Tech. Rep. SRS–73. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 311 p.

and goatsuckers are roosting), rare birds, species at the edge of their range, and species such as vultures that fly over several habitats. The birds that are expected to decrease with the opening of the forest due to oak borer damage are included in table 1, the ones that would increase are in table 2, and shown in table 3 those that should remain unchanged in abundance.

Three hawks occur along the routes: Red-shouldered Hawk, Broad-winged Hawk, and Red-tailed Hawk. The open county Red-tailed Hawk will increase in areas where extensive tracts of forest are destroyed, the other two are forest birds and will decrease except where forest damage is slight.

The two upland game birds are Wild Turkey and Northern Bobwhite. The Turkey thrives where there are small forest openings but does not tolerate extensive forest loss. Also, acorns are a major winter food. Therefore, turkeys would decrease following extensive oak forest thinning from red oak borer damage. The bobwhite is an open country and shrubby thicket bird. It will increase with the loss of forest canopy.

Table 1—Summer birds found on the Compton and Lurton Breeding Bird Surveys in the Arkansas Ozarks: species that would decrease if forest stands become more open

Species	Birds per route	
	Compton	Lurton
Red-shouldered Hawk (*Buteo lineatus*)	0.56	0.44
Broad-winged Hawk (*B. platypterus*)	0.11	0.44
Wild Turkey (*Meleagris gallopavo*)	0.22	0.22
Red-bellied Woodpecker (*Melanerpes carolinus*)	6.56	2.89
Downy Woodpecker (*Picoides pubescens*)	3.56	3.56
Hairy Woodpecker (*P. villosus*)	1.44	0.67
Pileated Woodpecker (*Dryocopus pileatus*)	6.78	7.11
Eastern Wood-Pewee (*Contopus virens*)	11.00	12.33
Acadian Flycatcher (*Empidonax virescens*)	2.22	4.56
Yellow-throated Vireo (*Vireo flavifrons*)	2.44	0.67
Red-eyed Vireo (*V. olivaceous*)	37.89	54.89
White-breasted Nuthatch (*Sitta carolinensis*)	3.78	9.44
Wood Thrush (*Hylocichla mustelina*)	5.78	6.00
Cerulean Warbler (*Dendroica cerulea*)	0.67	0.56
Black and White Warbler (*Mniotilta varia*)	5.89	7.44
Worm-eating Warbler (*Helmitheros vermivorus*)	1.44	2.89
Ovenbird (*Seiurus aurocapillus*)	9.89	33.67
Louisiana Waterthrush (*S. motacilla*)	1.33	0.56
Kentucky Warbler (*Oporornis formosus*)	9.00	5.78
Hooded Warbler (*Wilsonia citrina*)	2.89	5.22
Scarlet Tanager (*Piranga olivacea*)	6.89	9.00

Table 2—Summer birds found on the Compton and Lurton Breeding Bird Surveys in the Arkansas Ozarks: species that would increase if forest stands become more open

Species	Birds per route	
	Compton	Lurton
Red-tailed Hawk (*Buteo jamaicensis*)	0.22	0.33
Northern Bobwhite (*Colinus virginianus*)	6.00	1.22
Yellow-billed Cuckoo (*Coccyzus americanus*)	8.56	12.67
Ruby-throated Hummingbird (*Archilocus colubris*)	2.00	2.22
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	0.00	0.00
Northern Flicker (*Colaptes auratus*)	0.22	0.00
Eastern Phoebe (*Sayornis phoebe*)	4.22	3.00
Great-crested Flycatcher (*Myiarchus crinitis*)	3.44	2.67
Eastern Kingbird (*Tyrannus tyrannus*)	1.89	1.33
Scissor-tailed Flycatcher (*T. forficatus*)	0.44	0.11
White-eyed Vireo (*Vireo griseus*)	6.56	4.22
American Crow (*Corvus brachyrhynchos*)	32.11	30.00
Purple Martin (*Progne subis*)	6.89	6.22
Barn Swallow (*Hirundo rustica*)	6.78	1.56
Carolina Wren (*Thryothorus ludovicianus*)	15.56	7.78
Blue-gray Gnatcatcher (*Polioptila caerulea*)	13.44	13.11
Eastern Bluebird (*Sialia sialis*)	12.44	4.78
American Robin (*Turdus migratorius*)	7.78	3.33
Gray Catbird (*Dumetella carolinensis*)	0.22	1.22
Northern Mockingbird (*Mimus polyglottos*)	0.44	0.56
Brown Thrasher (*Toxostoma rufum*)	2.67	0.33
European Starling (*Sturnus vulgaris*)	1.00	2.78
Blue-winged Warbler (*Vermivora pinus*)	0.56	0.33
Yellow Warbler (*Dendroica petechia*)	1.00	0.00
Prairie Warbler (*Dendroica discolor*)	0.00	0.11
Common Yellowthroat (*Geothylpis trichas*)	2.56	0.78
Yellow-breasted Chat (*Icteria virens*)	6.22	7.56
Summer Tanager (*Piranga rubra*)	7.33	6.33
Eastern Towhee (*Pipilo erythrophthalmus*)	12.11	7.89
Chipping Sparrow (*Spizella passerina*)	13.56	12.56
Field Sparrow (*S. pusilla*)	15.33	6.89
Northern Cardinal (*Cardinalis cardinalis*)	17.67	15.00
Blue Grosbeak (*Guiraca caerulea*)	15.11	3.33
Indigo Bunting (Passerina cyanea)	39.89	51.22
Common Grackle (*Quiscalus quiscula*)	1.56	3.33
Brown-headed Cowbird (*Molothrus ater*)	11.89	6.33
Orchard Oriole (*Icterus spurius*)	6.00	2.56
American Goldfinch (*Carduelis tristis*)	5.56	1.89

Table 3—Summer birds found on the Compton and Lurton Breeding Bird Surveys in the Arkansas Ozarks: species that would not change in abundance if forest stands become more open

Species	Birds per route	
	Compton	Lurton
Blue Jay (*Cyanocitta christata*)	8.89	8.67
Carolina Chickadee (*Poecile carolinensis*)	9.89	13.67
Tufted Titmouse (*Baeolophus bicolor*)	16.78	9.67
Dickcissel (*Spiza americana*)	2.00	1.11
Eastern Meadowlark (*Sturnella magna*)	10.89	2.89
House Sparrow (*Passer domesticus*)	1.44	2.44

Yellow-billed Cuckoo, which is very abundant on both routes (table 2), seeks more open than dense forest and will only increase with forest thinning. Ruby-throated Hummingbird is an open country bird. It too will increase when forest openings are created.

Obviously most of the woodpeckers will decrease when the forest is degraded. For a brief period dead trees and wood boring insects will be an attraction followed by overall woodpecker decrease. The decreasing ones are Red-bellied Woodpecker, Downy Woodpecker, Hairy Woodpecker, and Pileated Woodpecker. The Red-headed Woodpecker is very responsive to standing dead trees and is expected to show a spectacular influx, even though none have been present on either route. It is a nomadic species that quickly finds new suitable areas. However, it also stores acorns for winter food. The loss of oaks will have a negative effect. Northern Flicker inhabits open lands where it feeds on the ground on ants. It will increase.

There were six species in the flycatcher family on the two census routes. Four will increase with forest degradation: Eastern Phoebe, Great-crested Flycatcher, Eastern Kingbird, Scissor-tailed Flycatcher. The Great-crested Flycatcher will increase if forest thinning is not too severe. The change in Phoebe abundance depends too on availability of its unique nesting site. The kingbird and Scissor-tailed Flycatcher, uncommon on the routes (table 2), occur in extensive open country. Two other flycatchers are both forest dependent and will decrease with disappearance of forest. Acadian Flycather seeks thickets in dense mature woods. Eastern Wood-Pewee, very abundant on the routes (table 1), will increase some with initial forest canopy opening but will decrease with further degradation.

Of the vireos on the routes, White-eyed Vireo is a denizen of dense thickets in forest edge habitat and will increase with forest opening. The other two, Yellow-throated Vireo and Red-eyed Vireo, are forest birds and will decrease. Notice that the Red-eyed Vireo along with the Indigo Bunting (tables 1 and 2) are the most common birds on both routes. These two top abundances are typical of bird populations in Arkansas (James and Neal 1986, p. 48) and the eastern United States.

American Crows, Purple Martins and Barn Swallows all will increase with forest degradation. The Blue Jay is an interesting case. The large wintering migratory population (James and Neal 1986) will dwindle because jays feed on acorns in winter. The birds counted on the survey routes are nesting birds not dependent on acorns in summer. However, they are also year around residents, so their winter survival will suffer from acorn deficits causing population decline. The thinning of the forest would have the opposite effect producing more jay habitat because jays occupy broken forest, not dense closed canopy stands. Counterbalancing these two opposite effects, numbers of jays will probably be unchanged.

Carolina Chickadee and Tufted Titmouse occur equally in forest and forest edge. No change is expected in their numbers. Forest disappearance will cause declined in White-breasted Nuthatches. Carolina Wren, a forest edge bird, already rather common, will increase. Blue-gray Gnatcatcher is a forest bird but seeks more open forest and forest edge. It will increase with forest canopy breakup.

The survey routes have seven species in the thrush and mimic thrush families, plus the closely related starling. Only one in this group, the Wood Thrush, now fairly abundant (table 1) will decrease with forest change. The others thrive in open country and forest edge and will increase: Eastern Bluebird, American Robin, Gray Catbird, Northern Mockingbird, Brown Thrasher and European Starling.

Seventeen species of nesting warblers were found on the two survey routes of which twelve are associated with upland oak-hickory forest or upland open habitats. Opening the forest will produce increases in five of these: Blue-winged Warbler, Yellow Warbler, Prairie Warbler, Common Yellowthroat and Yellow-breasted Chat. Seven will decrease: Cerulean Warbler, Black and White Warbler, Worm-eating Warbler, Ovenbird, Louisiana Waterthrush, Kentucky and Hooded Warblers. The Cerulean Warbler seeks forest canopies with small breaks (James and others 2001), so at first there will be an increase, later rapid decline as the forest becomes more open.

With regard to the two tanagers, the Summer Tanager has a southern affinity and the Scarlet Tanager is part of a northern avifauna. They seek different habitats. Summer Tanager will increase with forest thinning because it occupies broken forest and tall forest edge. Scarlet Tanager will decrease since it occurs in closed canopy forests.

There were nine species in the sparrow, bunting, finch group on the two Breeding Bird Survey routes. Two of these will show no change, the House Sparrow because it occupies barnyard and pasture sites, and the Dickcissel that depends on extensive hay fields. The rest are all open country thicket, forest edge, and old field birds. They will increase with opening of the upland forest: Eastern Towhee, Chipping Sparrow, Field Sparrow, Northern Cardinal, Blue Grosbeak, Indigo Bunting (already extremely common, table 2), and American Goldfinch.

Eastern Meadowlark will be unaffected by forest change since it occupies pastures and hayfields. All the rest of the

blackbird family will increase with forest degradation because they thrive in a landscape mosaic of forest and open country patches: Common Grackle, Brown-headed Cowbird, Orchard Oriole.

DISCUSSION

Two Breeding Bird Survey routes in northwestern Arkansas contain 44 years of information for predicting changes in bird populations if upland forests are thinned and opened by red-oak borer infestations. These two routes traverse high elevation forests where northern red oak is most abundant, and where forest birds predominate. Both routes also dip into a valley where open farmland exists inhabited by open country and forest edge birds. These latter birds will increase when the forest is opened; the forest birds will decrease. Among the species found on the two census routes there are 21 that will decrease in abundance, 38 that will increase, and 6 that will exhibit no change.

This investigation refers only to what will happen to breeding birds in the event of forest change in the study area. Decrease in forest cover will also affect winter resident bird populations and migrant species in passage. Predictions regarding these species will require further study. Some of the breeding birds mentioned herein are permanent residents and thus are present in winter too.

ACKNOWLEDGMENTS

The author of this paper for many years covered both the Compton and Lurton routes of the Breeding Bird Survey. Others who have been in charge of either or both routes over the years include Frances James, Helen Parker, Max Parker Lance Peacock, Charles Preston, Joseph Neal and Kimberly Smith. Their efforts are greatly appreciated.

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