BIRD POPULATIONS ASSOCIATED WITH AN ELECTRIC TRANSMISSION RIGHT-OF-WAY

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Abstract: A 2-year study of bird populations was conducted along a 230-kV transmission line right-of-way (ROW) in spring (June) and summer (August) 2000 and 2001. Forty-four species were observed on the ROW during 2000 and 2001. In 1987 and 1988 combined, 39 species were noted on the ROW; thus, bird populations have changed relatively little over the past 13 to 14 years. In both 2000 and 2001, slightly more species occurred on the ROW in summer (n = 26–32) than in spring (n = 25–26), and considerably fewer species were noted in the adjacent forest in both spring (n = 8–13) and summer (n = 7). Common bird species (≥50 individuals/100 ha/day) on the ROW were those adapted to brushy or early successional habitat. Most species were found in the low-volume basal spray and foliage spray units (n = 29 and 28 species, respectively), and fewest species were noted in the handcutting unit (n = 19 species). Considerably more bird species were observed in border zones than in wire zones of the ROW in 2000 and 2001 combined (n = 39 versus 17 species, respectively). Moreover, abundance of all bird species combined was nearly fourfold higher in border zones (1,530 individual birds/100 ha/day) than in wire zones (393 birds/100 ha/day). Thus, the border zone is a very important habitat for birds along a ROW, with its combination of shrub–forb–grass cover type.

Key Words. Birds; herbicides; populations; rights-of-way; tree control.

The State Game Lands 33 Research and Demonstration Project has been ongoing since 1953, making it the longest continuous study documenting the effects of mechanical and herbicidal maintenance on flora and fauna along an electric transmission right-of-way (ROW) (e.g., Yahner et al. 2001a). This long-term project is invaluable from management and ecological perspectives because it provides an understanding of the response of plant and animal communities to ROW management practices.

The State Game Lands 33 Project is located along a 230-kV transmission line right-of-way of GPU Energy (First Energy) in the Allegheny Mountain Province, Centre County, Pennsylvania, U.S. Beginning in 1987, a new maintenance technique, termed the wire zone–border zone method (Bramble et al. 1992, Yahner et al. 2001b) was used for all treatment units on the ROW (Figure 1). This technique is designed to produce a tree-resistant forb–low shrub–grass cover type in wire zones while maintaining a shrub cover type in border zones, thereby producing a diverse wildlife habitat on the ROW.

Long-term research studies, such as that on the ROW of the State Game Lands 33 Project, are extremely valuable for understanding of the effects of land uses on biota (e.g., bird populations) (Saunders et al. 1991). Long-term studies of bird populations, in particular, are important because many species have experienced declines over recent decades, in part, as a result of forest fragmentation of eastern deciduous forests (e.g., Robbins et al. 1989; James et al. 1996; Yahner 2000a, 2000b). Transmission line rights-of-way are linear corridors that may disturb otherwise contiguous forested tracts; hence, studies of bird populations are relevant because birds can be indicators of the effects of vegetative management on the local ecosystem (e.g., Bramble et al. 1992).

The objectives of this study were to 1) determine the diversity and relative abundance of breeding bird populations in spring versus summer on the ROW and adjacent forest, 2) compare bird use among six representative treatment units of the ROW, and 3) compare use of wire zones versus border zones on the ROW. In addition, bird populations in this study were compared to those observed on the ROW in 1987–1988 (Bramble et al. 1992).

METHODS

Vegetation on the ROW

Oak (*Quercus* spp.) and red maple *(Acer rubrum)* were common trees in border zones of the ROW and in the adjacent forest (e.g., Bramble et al. 1992; Yahner et al. 2001a). Common shrubs on the ROW were blackberry *(Rubus allegheniensis)*, dewberry (*Rubus* spp.), blueberry (*Vaccinium* spp.), witchhazel *(Hamamelis virginiana)*, and sweet fern *(Comptonia peregrina)*. Abundant forbs in-

Figure 1. A basal low-volume unit on the State Game Lands 33 Research and Demonstration Area. The border zone is shown on the right, and the wire zone is to the center and left. The border zone in this unit is primarily witchhazel, and the wire zone is fern and forbs; a small patch of blackberry is found in the wire zone to the left (photo taken by Richard Yahner in July 2000).

cluded goldenrod (*Solidago* spp.), hayscented fern *(Dennstaedtia punctilobula)*, and bracken fern *(Pteridium aquilinum)*. Major grasses were poverty grass *(Danthonia spicata)*, meadow fescue *(Fescue elatior)*, and a mix of other grasses.

Treatments on the ROW

Six treatment units were selected for study: handcutting, low-volume basal spray, mowing plus herbicide, stem–foliage spray, foliage spray, and mowing. These units were the same study plots used in a previous study of bird populations on the ROW in 1987 and 1988 (Bramble et al. 1992). Units varied in size from 0.81 to 1.34 ha (2 to 3.3 ac). The total area surveyed on the ROW and the adjacent forest was each 6.87 ha (17 ac).

Maintenance treatments were applied in July 2000 (details of previous treatments can be found in Yahner et al. 2001a). Briefly, the 2000 treatments consisted of handcutting undesirable trees in wire and border zones, and the application of a low volume basal spray to undesirable tree and shrub species using Garlon 4 (25%) in basal oil (75%) in wire and border zones of other units. The handcutting unit was characterized by shrub–tree–forb cover type in the wire zone and shrub–tree cover type in the border zone (e.g., Yahner et al. 2001a, 2001b). The low volume basal unit was shrub–forb cover type in wire and border zones. The mowing plus herbicide unit was forb–shrub cover type in the wire zone and shrub–forb cover type in the border zone. The stem–foliage spray unit was forb–shrub cover type in the wire zone and shrub–grass–forb cover type in the border zone. The foliage spray mowing plus herbicide unit was forb–grass–shrub cover type in the wire zone and shrub–forb cover type in the border zone. Finally, the mowing unit was shrub–forb–grass cover type in both wire and border zones.

Bird Surveys on the ROW

Bird populations were surveyed during two time periods in 2000 (a pre-treatment survey in June and a post-treatment survey in August) and two periods in 2001 (June and August). During each time period, birds were counted on 6 consecutive days along the ROW. Counts were made between sunrise and 1000 hours. All birds seen or heard were noted; the location of each bird was recorded in relation the type of treatment unit and whether it was in the wire or border zone.

RESULTS AND DISCUSSION

Differences Between Seasons and Between ROW and Adjacent Forest

Forty-four species were observed on the State Game Lands 33 Research and Demonstration Project during the 2 years on the ROW and adjacent forest combined (Table 1). In 1987 and 1988 combined, 39 species were noted on the ROW (Bramble et al. 1992); thus, in terms of numbers of species, the bird community on the ROW has changed relatively little over the past 13 to14 years.

In both 2000 and 2001, slightly more species occurred on the ROW in summer (n = 25–33) than in spring (n = 25–26) (Table 1). In contrast, considerably fewer species were noted in the adjacent forest in both spring

Table 1. Number of birds per species/100 ha/day, number of individuals of all species combined/100 ha/day, and number of species on the State Game Lands 33 Research and Demonstration ROW and in the adjacent forest during four time periods (June 2000, August 2000, June 2001, and August 2001) and for all periods combined. Only those species present on the ROW during at least three periods are included in this table (a complete list is available from Richard Yahner). Surveys were conducted for 6 days; the total area of the ROW and forest surveyed was 6.87 ha (17 ac). Species are listed in phylogenetic order. Common species (≥50 individuals/100 ha/day) are given in bold.

	June 2000		August 2000		June 2001		August 2001		All periods	
Bird species	R[z]	F[y]	R	F	R	F	R	F	R	F
Ruffed grouse *(Bonasa umbellus)*	2	*[x]	5	*	2	*	*	*	2	*)
Black-billed cuckoo *(Coccyzus erythropthalmus)*	5	*	*	*	2	*	2	*	2	*
Downy woodpecker *(Picoides pubescens)*	2	*	2	2	2	*	12	*	5	<1
Northern flicker *(Colaptes auratus)*	2	*	5	*	2	*	*	*	2	*
Least flycatcher *(Empidonax minimus)*	*	*	2	*	2	2	17	*	6	<1
Common raven *(Corvus corax)*	*	*	5	*	7	*	10	*	6	*
Blue jay *(Cyanositta cristata)*	*	*	30	2	*	*	19	*	12	<1
Black-capped chickadee *(Poecile atricapillus)*	10	2	*	2	19	2	**93**	10	13	4
Blue-gray gnatcatcher *(Polioptila caerulea)*	15	*	40	*	2	*	2	*	10	*
Gray catbird *(Dumetella carolinensis)*	20	*	22	*	22	*	**56**	*	30	*
Cedar waxwing *(Bombycilla cedrorum)*	25	*	**52**	*	*	*	10	*	22	*
Red-eyed vireo *(Vireo olivaceus)*	32	**77**	7	42	**51**	**98**	**85**	**50**	45	**67**
Chestnut-sided warbler *(Dendroica pensylvanica)*	**69**	*	2	*	**93**	*	**95**	*	**65**	*
Black-and-white warbler *(Mniotilta varia)*	5	*	10	*	19	*	34	*	17	*
American redstart (*Setaphaga ruticilla*)	**87**	42	17	*	**103**	**54**	**107**	7	**77**	26
Ovenbird *(Seiurus aurocapillus)*	5	30	10	20	*	34	10	5	7	22
Common yellowthroat *(Geothlypis trichas)*	**67**	*	**200**	*	**100**	*	**347**	*	**179**	*
Scarlet tanager *(Piranga olivacea)*	*	10	2	*	7	19	2	*	3	7
Eastern towhee *(Pipilo erythrophthalmus)*	**94**	2	**69**	*	**105**	*	**134**	*	**101**	<1
Chipping sparrow *(Spizella passerina)*	10	*	*	*	15	2	2	*	3	<1
Field sparrow *(Spizella pusilla)*	**77**	*	**215**	*	**129**	*	**171**	*	**148**	*
Song sparrow *(Melospiza melodia)*	22	*	27	*	25	*	24	*	26	*
Rose-breasted grosbeak *(Pheucticus ludovicianus)*	25	*	12	*	5	*	17	*	17	*
Indigo bunting *(Passerina cyanea)*	**77**	*	32	*	**95**	*	**105**	*	**77**	*
American goldfinch *(Carduelis tristis)*	*	*	5	*	7	*	10	*	6	*
Total/100 ha/day	237	73	280	26	872	245	1,507	82	725	105
Total number of species	25	8	26	7	26	13	32	7	43	20

[z]R = ROW.

[y]F = adjacent forest.

[x]An asterisk (*) indicates that the species was not present on the ROW and/or forest during that season.

(n = 8–13) and summer (n = 7). A greater number of species was also found on the ROW than in the adjacent forest during spring and summer in a previous study of bird populations on the State Game Lands 33 Research and Demonstration Project (Bramble et al. 1992).

The abundance of all species combined (number of individuals/100 ha/day) was nearly sevenfold higher on the ROW compared to the adjacent forest (Table 1). Moreover, abundance was much higher in 2001 than 2000; however, we have no biological explanation for this year-to-year difference. In other studies of bird populations in Pennsylvania, dramatic differences in bird populations have been noted between consecutive years (e.g., Yahner and Smith 1990), thereby attesting to the importance of more than one field season of data collection in ecological studies.

The most common species (≥50 individuals/100 ha/day) on the ROW in spring were chestnut-sided warbler *(Dendroica pensylvanica)*, American redstart *(Setaphaga ruticilla)*, common yellowthroat *(Geothlypis trichas)*, eastern towhee *(Pipilo erythropthalmus)*, field sparrow *(Spizella pusilla)*, and indigo bunting *(Passerina cyanea)*. Common bird species on the ROW in spring were mainly those adapted to early successional habitats in general, including those characteristic of habitat created by even-aged forest management in nearby (<20 km) forest stands (Yahner 1997, 2000b). These six species, plus red-eyed vireo *(Vireo olivaceus)* and black-capped chickadee *(Poecile atricapillus)*, were the most abundant species on the ROW in summer. In contrast, the only common species in the adjacent forest was the red-eyed vireo. In 1987 and 1988 combined, the seven most abundant species noted on the State Game Lands 33 ROW were chestnut-sided warbler, common yellowthroat, eastern towhee, field sparrow, song sparrow *(Melospiza melodia)*, gray catbird *(Dumetella carolinensis)*, and indigo bunting (Bramble et al. 1992). Perhaps the only notable change in abundance of individual bird species from 1987 to 1988 compared to 2000 to 2001 on the ROW was a decline in abundance of brown-headed cowbirds *(Molothrus ater)* in 2000–2001 (see Bramble et al. 1992). Brown-headed cowbirds are obligate brood parasites but probably have a negligible impact on nesting success of birds breeding on rights-of-way in central Pennsylvania (e.g., Yahner 1995a, 1995b).

One reason for an increase in the abundance of birds in summer versus spring on the ROW was the presence of family groups on the ROW (Table 2). Family groups of 18 species were observed, with 12 species noted in August 2000 and 17 in August 2001. The most prominent family groups (≥0.75 groups/day) were those of common yellowthroat, field sparrow, black-capped chickadee, eastern towhee, black-and-white warbler *(Mniotilta varia)*, and red-eyed vireo. Chickadees and vireos are forest-nesting birds; family groups of these two species and other species adapted to early successional habitats were presumably on the ROW because of the abundance of arthropods (insects, etc.) as food for young throughout the growing season (e.g., Bramble et al. 1994). On several occasions, adult birds were seen in summer with food in their beaks, which probably was intended for young birds in the immediate vicinity that were recently fledged from nests (R. Yahner, personal observation). Thus, the State Game Lands 33 Research and Demonstration Project, which is managed using the wire zone–border zone method, not only provided habitat and food resources for birds nesting in early successional habitat (e.g., towhee and yellowthroat), but it also provided habitat and food resources for family groups of forest species [e.g., vireo, black-throated green warbler *(Dendroica virens)*, ovenbird *(Seiurus aurocapillus)*] that shifted home ranges to include the ROW. Other recent studies also have shown that other types of early successional habitats are important to fledgling forest birds as sources of food and cover (e.g., Pagen et al. 2000).

Table 2. Average number of family groups observed per day per bird species on the ROW at the State Game Lands 33 Research and Demonstration Project in August 2000 and 2001.

Species	2000	2001	Both years
Common raven	*[z]	0.17	0.08
Blue jay	0.50	0.33	0.42
Black-capped chickadee	0.67	1.33	1.00
White-breasted nuthatch *(Sitta carolinenis)*	*	0.17	0.08
Gray catbird	0.50	0.83	0.67
Cedar waxwing	0.17	0.17	0.17
Red-eyed vireo	*	1.50	0.75
Chestnut-sided warbler	*	1.33	0.67
Black-throated green warbler (*Dendroica virens*)	*	1.33	0.67
Black-and-white warbler	0.17	0.67	0.83
American redstart	0.17	1.17	0.67
Ovenbird	*	0.17	0.08
Common yellowthroat	2.50	5.83	4.12
Eastern towhee	0.33	1.67	1.00
Field sparrow	2.83	2.33	2.58
Song sparrow	0.50	*	0.25
Rose-breasted grosbeak	*	0.17	0.08
Indigo bunting	0.17	1.00	0.58

[z]An asterisk (*) indicates that a family group(s) was not noted in this year.

Diversity and Relative Abundance per Treatment Unit

Forty-three of the 44 bird species recorded in this study were observed on the ROW in both years combined (Table 3). Eight species were found in each of the six treatment units, including black-capped chickadee, red-eyed vireo, chestnut-sided warbler, black-and-white warbler, American redstart, common yellowthroat, eastern towhee, and indigo bunting. Most species occurred in the low-volume basal spray and foliage spray units (n = 29 and 28 species, respectively), and fewest species were noted in the handcutting unit (n = 19 species). With the exception of the abundance of birds of all species combined in the handcutting unit (552 birds/100 ha/day), abundance was at least 713 birds/100 ha/day in each of the remaining units; the greatest abundance of birds of all species combined was observed in the low-volume basal spray unit (1,361 birds/100 ha/day).

Table 3. Number of birds per individual species/100 ha/day, number of individuals/100 ha/day, and number of species on the State Game Lands ROW in each of six treatment units: handcutting [HC-1, 1.19 ha (2.9 ac)], basal low volume [BLV-3, 1.12 ha (2.8 ac)], mowing plus herbicide [MH-2, 0.81 ha (2 ac)], stem–foliage spray [SF-2, 1.34 ha (3.3 ac)], foliage spray [F-2, 1.14 ha (2.8 ac)], and mowing [M-3, 1.23 ha (3 ac)] during four time periods (June 2000, August 2000, June 2001, and August 2001) combined. Only those species present in at least two units are included in this table (a complete list is available from Richard Yahner). Common species (≥50 individuals/100 ha/day) are given in bold.

	Treatment unit					
Bird species	HC	BLV	MH	SF	F	M
Ruffed grouse	*[z]	*	*	3	11	*
Black-billed cuckoo	*	4	*	6	*	3
Downy woodpecker	4	4	*	9	7	3
Northern flicker	*	4	*	*	11	*
Eastern wood-pewee *(Contopus virens)*	*	*	*	*	4	3
Least flycatcher	4	19	5	*	7	3
Common raven	*	*	5	22	4	*
Blue jay	39	26	*	*	4	3
Black-capped chickadee	14	26	**82**	25	**51**	**51**
Tufted titmouse *(Baeolophus bicolor)*	*	*	15	*	4	*
White-breasted nuthatch	*	*	*	6	18	7
Blue-gray gnatcatcher	* 4	*	16	7	*	
Veery *(Catharus fuscescens)*	*	*	*	*	22	3
Wood thrush *(Hylocichla mustelina)*	*	*	15	3	*	*
American robin *(Turdus migratorius)*	4	22	*	*	4	3
Gray catbird	21	**142**	5	*	7	7
Cedar waxwing	32	15	*	*	18	**58**
Red-eyed vireo	46	**52**	15	9	**99**	41
Chestnut-sided warbler	35	**119**	46	25	**77**	**88**
Black-throated blue warbler *(Dendroica caerulescens)*	4	8	*	*	7	3
Black-throated Green warbler	28	30	21	*	*	27
Black-and-white warbler	7	19	**61**	12	7	10
American redstart	**63**	**78**	**56**	31	**117**	**115**
Ovenbird	14	*	5	*	7	7
Common yellowthroat	**95**	**190**	**241**	**187**	**201**	**176**
Scarlet tanager	4	*	*	*	11	3
Eastern towhee	**91**	**112**	**77**	40	**128**	**149**
Chipping sparrow	*	26	15	3	*	*
Field sparrow	*	**183**	41	**208**	**198**	**217**
Song sparrow	*	**60**	5	22	**51**	14
Rose-breasted grosbeak	*	19	31	9	26	20
Indigo bunting	43	**164**	**82**	**53**	**84**	**64**
Brown-headed cowbird (*Molothrus ater*)	*	4	*	6	*	*
American goldfinch	*	15	5	12	*	3
Total/100 ha/day	552	1,361	838	713	1,170	1,078
Total number of species	19	29	22	23	28	26

[z]An asterisk (*) indicates that the species was not recorded on that treatment unit.

The common yellowthroat was ubiquitous as a common species (≥50 individual birds/100 ha/day) in each of the six treatment units (Table 3). In addition, other common species in decreasing order of abundance were eastern towhee and American redstart in the handcutting unit; field sparrow, indigo bunting, gray catbird, chestnut-sided warbler, eastern towhee, American redstart, song sparrow, and red-eyed vireo in the low-volume basal unit; black-capped chickadee, indigo bunting, eastern towhee, black-and-white warbler, and American redstart in the mowing plus herbicide unit; field sparrow and indigo bunting in the stem–foliage spray unit; field sparrow, eastern towhee, red-eyed vireo, indigo bunting, chestnut-sided warbler, black-capped chickadee, and song sparrow in the foliage spray unit; and field sparrow, eastern towhee, American redstart, chestnut-sided warbler, indigo bunting, cedar waxwing *(Bombycilla cedrorum)*, and black-capped chickadee in the mowing unit. Thus, regardless of unit, common species were typically those adapted to early successional habitats.

Diversity and Relative Abundance in Wire Versus Border Zones

Considerably more bird species were observed in border zones than in wire zones of the ROW in 2000 and 2001 combined (n = 39 versus 17 species, respectively) (Table 4). Moreover, abundance of all bird species combined was nearly fourfold higher in border zones (1,530 individual birds/100 ha/day) than in wire zones (393 birds/100 ha/day).

Seven relatively common bird species (i.e., ≥50 birds/100 ha/day) were noted in border zones: common yellowthroat, field sparrow, eastern towhee, American redstart, indigo bunting, chestnut-sided warbler, red-eyed vireo, and black-capped chickadee (Table 4). These species represent a combination of those adapted to early successional habitats and forested habitats (latter two species). Thus, the border zone is a very important habitat for birds along a ROW, with its combination of shrub cover types mixed in with forb, grass, or tree cover type, depending on the treatment unit. In contrast, only field sparrow and common yellowthroat were abundant in wire zones of the ROW.

Cooper's hawk *(Accipiter cooperii)*, American crow *(Corvus brachyrhynchos)*, common raven *(Corvus corax)*, and mourning dove *(Zenaida macroura)* were found exclusively in the wire zone (Table 4). These four species, plus an additional three species, were observed on towers or lines of the ROW (Table 5). Ravens, in particular, were typically observed only on towers on the ROW.

In summary, based on this 2-year study, the bird community on the State Game Lands 33 Research

Table 4. Number of individual birds per species/100 ha/day, number of total individual birds of all species combined/100 ha/day, and number of species on the ROW of the State Game Lands 33 Research and Demonstration Project in wire zones [3.23 ha (8 ac)] versus border zones [3.59 ha (8.9 ac)] in each of six treatment units combined. Only species in which at least five individual birds/100 ha/day were observed in either wire or border zones are included in the table (a complete list is available from Richard Yahner). Common species (≥50 individuals/100 ha/day) are given in bold.

	Zone	
Bird species	Wire	Border
Ruffed grouse	*	5
Black-billed cuckoo	*[z]	5
Downy woodpecker	*	9
Northern flicker	*	5
Eastern wood-pewee	*	5
Least flycatcher	6	26
Common raven	29	*
Blue jay	*	**57**
Black-capped chickadee	*	**77**
Tufted titmouse	*	5
White-breasted nuthatch	*	9
Blue-gray hnatcatcher	*	9
Veery	*	9
American robin	1	9
Gray catbird	19	43
Cedar waxwing	*	37
Red-eyed vireo	1	**85**
Chestnut-sided warbler	8	**115**
Black-throated blue warbler	*	5
Black-throated green warbler	*	35
Black-and-white warbler	*	35
American redstart	2	**150**
Ovenbird	*	10
Common yellowthroat	**121**	**227**
Scarlet tanager	*	6
Eastern towhee	30	**160**
Chipping sparrow	*	13
Field sparrow	**133**	**163**
Song sparrow	14	36
Rose-breasted grosbeak	*	28
Indigo bunting	21	**128**
American boldfinch	1	9
Total/100 ha/day	393	1,530
Total number of species	17	39

[z]An asterisk (*) indicates that the species was not present.

Table 5. Number of birds per individual species and number of species observed perching on wires and towers on the ROW of the State Game Lands 33 Research and Demonstration Project in 2000 and 2001 combined.

Bird species	Wire	Tower
Cooper's hawk *(Accipiter cooperii)*	0	1
Mourning dove *(Zenaida macroura)*	1	0
American crow *(Corvus brachyrhynchos)*	0	1
Common raven	0	10
American robin	1	0
Indigo bunting	0	2
Brown-headed cowbird	1	1
Number of observations	3	15
Number of species	3	5

and Demonstration ROW is quite diverse on all treatment units. Bird species in spring are especially adapted to early successional habitat created by the wire-zone–border-zone method; species in the summer also include early successional species as well as those that breed in more mature forests but use the ROW as foraging sites. The presence of many family groups of birds supports the fact that food resources are common on the ROW.

LITERATURE CITED

Bramble, W.C., R.H. Yahner, and W.R. Byrnes. 1992. Breeding-bird population changes following right-of-way maintenance treatments. J. Arboric. 18:23–32.

Bramble, W.C., R.H. Yahner, and W.R. Byrnes. 1994. Nesting of breeding birds on an electric utility right-of-way. J. Arboric. 20:124–129.

Bramble, W.C., W.R. Byrnes, R.J. Hutnik, S.A. Liscinsky, and R.H. Yahner. 1999. Gamelands 33 Research Project. Annual Report to Cooperators. 29 pp.

Coulter, M.W., and J.C. Baird. 1982. Changing forest land uses and opportunities for management in New England and the Maritime Provinces, pp 75–85. In Dryer, T.J., and G. L. Storm (Tech. Coords.). Woodcock Ecology and Management. USDA Forest Service Wildlife Research Report. Washington, D.C.

James, F.C., C.E. McCullough, and D.A. Wiedenfeld. 1996. New approaches to the analysis of population trends in land birds. Ecology 77:13–27.

Pagen, R.W., F.R. Thompson III, and D.E. Burhans. 2000. Breeding and post-breeding habitat use by forest migrant songbirds. Condor 102:738–747.

Robbins, C.S., D.K. Dawson, and B.A. Dowell. 1989. Habitat area requirements of breeding forest birds of the Middle Atlantic states. Wildl. Monogr. 103:1–34.

Saunders, D.A., R.J. Hobbs, and C.R. Margules. 1991. Biological consequences of ecosystem fragmentation: A review. Conserv. Biol. 5:18–32.

Yahner, R.H. 1995a. Forest-dividing corridors and Neotropical migrant birds. Conserv. Biol. 9:476–477.

Yahner, R.H. 1995b. Forest fragmentation and avian populations in the Northeast: Some regional landscape considerations. Northeast Wildl. 52:93–102.

Yahner, R.H. 1997. Long-term dynamics of bird communities in a managed forested landscape. Wilson Bull. 109:595–613.

Yahner, R.H. 2000a. Eastern Deciduous Forest: Ecology and Wildlife Conservation (2nd ed.). University of Minnesota Press, Minneapolis, MN. 256 pp.

Yahner, R.H. 2000b. Long-term effects of even-aged management on bird communities in central Pennsylvania. Wildl. Soc. Bull. 28:1102–1110.

Yahner, R.H., R.J. Hutnik, S.A. Liscinsky, W.C. Bramble, and W.R. Byrnes. 2001a. State Game Lands 33 Research and Demonstration Project. Annual Report to Cooperators. 44 pp.

Yahner, R.H., W.C. Bramble, and W.R. Byrnes. 2001b. Effect of vegetation maintenance of an electric transmission line right-of-way on reptile and amphibian populations. J. Arboric. 27:24–29.

Yahner, R.H., and H.R. Smith. 1990. Avian community structure and habitat relationships in central Pennsylvania forests. J. Pa. Acad. Sci. 64:3–7.

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Résumé. Une étude de deux ans a été menée, au printemps (juin) et en été (août) 2000–2001, sur les populations d'oiseaux le long d'une emprise de ligne électrique de 230 kV. Quarante-quatre espèces ont été observées dans l'emprise en 2000–2001. Dans les années 1987 et 1988 combinées, 39 espèces avaient été identifiées dans l'emprise; les populations d'oiseaux ont donc peu changé au cours des 13 ou 14 dernières années. À la fois en 2000 et 2001, il y avait légèrement plus d'espèces à l'intérieur de l'emprise en été (n = 26 et 32) qu'au printemps (n = 25 et 26), alors qu'elles étaient considérablement moins nombreuses dans la forêt adjacente à la fois au printemps (n = 8 et 13) et en été (n = 7). Les espèces communes d'oiseaux (≥50 individus/100 ha/jour) dans l'emprise étaient celles adaptées aux habitats arbustifs ou de friches. La plupart des espèces étaient observées dans les unités d'emprises traitées par vaporisation basale à faible volume et celles traitées par vaporisation foliaire (n = 28 et 29 espèces respectivement), alors que le plus petit nombre d'espèces se trouvait dans les unités traitées par coupe manuelle (n = 19 espèces). Considérablement plus d'espèces ont été observées dans les zones latérales de l'emprise que dans la zone centrale sous les fils électriques, et ce pour les années 2000 et 2001 combinées (n = 39 espèces versus 17 respectivement). De plus, l'abondance toutes espèces confondues était près de quatre fois supérieure dans les zones latérales (1530 oiseaux/100 ha/jour) que dans la zone centrale de l'emprise (393 oiseaux/100 ha/jour). Donc, la zone latérale est un habitat très important pour les oiseaux à l'intérieur d'une emprise de ligne électrique avec sa combinaison de couverts herbacées et arbustifs.

Zusammenfassung. Entlang einer 230 kV-Hochspannungsleitung wurde im Juni und im August 2000-2001 in einer zweijährigen Studie die Vogelpopulationen untersucht. Im Leitungsverlauf wurden in den Jahren 2000-01 44 Arten beobachtet. 1987 und 1988 zusammen wurden 39 Arten im Verlauf registriert, obwohl die Vogelpopulationen über die Jahre etwas abgenommen haben. 2000 und 2001 erschienen etwas mehr Vögel in der Zone in den Sommermonaten (n = 26–32) als im Frühling (n = 25–26) und bemerkenswert weniger Arten wurden in den benachbarten Forsten in Frühling (n = 8–13) und Sommer (n = 7) festgestellt. Gewöhnliche Vogelarten (weniger als 50 Individuen/100 ha/Tag) in dem Streifen waren diejenigen, die an buschiges oder offenes Habitat gewöhnt waren. Die meisten Arten wurden in den Bereichen mit geringem Spritzmitteleinsatz (n = 29 und 28 Arten) gefunden und die wenigsten Arten wurden in den handgeschnittenen Bereichen registriert. Dementsprechend gab es 2000 und 2001 mehr Vogelarten in den Randzonen als unter der Kabeln (n = 39 versus 17 Arten). Die Vielfalt aller Arten zusammen war 4mal höher in Randzonen (1.530 Individuen/100 ha/Tag als unter den Kabeln (393 Vögel/100 ha/Tag). Daher ist die Randzone ein wichtiges Vogelhabitat entlang einer Hochleitung mit seinen kombinierten buschigen und vegetationsoffenen Bereichen.

Resumen. Se llevó a cabo un estudio de dos años con poblaciones de pájaros a lo largo del derecho de vía (ROW) de las líneas de transmisión de 230 kVA en primavera (Junio) y verano (Agosto) de 2000–2001. Durante 2000–2001 se observaron 44 especies. En 1987 y 1988 se observaron 39 especies; por lo que las poblaciones de aves han cambiado relativamente poco en 13–14 años. Tanto en 2000 como 2001, ocurrieron levemente más especies en verano (n = 26–32) que en primavera (n = 25–26), y considerablemente menos especies fueron observadas en los bosques adyacentes tanto en primavera (n = 8–13) y verano (n = 7) Las especies comunes de aves (≥50 individuos/100 ha/día) en el ROW fueron aquellas adaptadas al matorral o hábitat sucesional temprano. La mayoría de las especies fueron encontradas en lugares con bajo volumen basal (n = 29 y 28 especies, respectivamente), y muy pocas especies se observaron en unidades de corta manual (n = 19 especies) Considerablemente más especies fueron observadas en las zonas de borde que en las zonas de los cables de las ROW en 2000 y 2001 combinados (n = 39 versus 17 especies, respectivamente) Sin embargo, la abundancia de todas las especies de pájaros combinada fue cercanamente 4 veces más alta en las zonas de borde (1530 aves individuales/100 ha/día) que en zonas de cables (393 pájaros/100 ha/día) Por consiguiente, la zona de borde es muy importante hábitat para los pájaros a lo largo de una ROW, con su combinación de cobertura de arbustos y pastos.