

EFFECTS OF SPECIAL RIGHT-OF-WAY MAINTENANCE ON AN AVIAN POPULATION¹

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Abstract. The effects of five right-of-way (ROW) maintenance techniques on birds was studied on an electric transmission line right-of-way in central Pennsylvania. The techniques included handcutting and four different herbicide applications. An important feature of these techniques was a differential treatment of wire and border zones of the ROW. Bird censuses made before and after treatment indicated that the total number of birds of the six most common species were not significantly affected by any of the treatments. Although a decrease occurred in the average number of species counted, species diversity after treatment was not significantly different between treatments. Important changes occurred in the relative number of individuals per species and, as a result, in species dominance, after both handcutting and herbicide treatments.

Key words: Right-of-way, Birds, Herbicides, Handcutting, ROW maintenance.

Five ROW maintenance techniques were studied to evaluate potential changes in the bird population due to treatment. The study area was located on a 59 m-wide ROW which traversed an oak-hickory forest on the Allegheny Plateau in central Pennsylvania. The entire study segment lay in a forested area.

The special feature of all treatments involved a division of the ROW into a wire zone and two border zones (Figure 1). The wire zone, 23 m-wide, included all of the ROW lying under the wires; the two border zones, each 18 m-wide, covered the remainder of the ROW. These zones were given different treatments as described in detail under each application method. In general, the treatments involved removal of all trees and tall shrubs over 1 m height from the wire zone, in contrast to the border zones where only tall-growing tree species were selectively removed. As a result, a tall shrub-herb-grass cover was produced on the borders with a low shrub-herb-grass or herb-grass cover under the wires.

Literature Review

Effects of initial clearance. Effects of clearance of electric transmission ROWs traversing the oak-hickory forest type on birds were described by LeGrand (1971), Anderson et al. (1977), Anderson (1979), and Meyers and Provost (1979). Initial clearance eliminated some migrant bird species from the ROW area while producing a habitat favorable to birds of brushlands and edges. A selectively cleared ROW provided more nesting and foraging habitat than occurred on a ROW that was completely cleared and planted with fescue.

Effects of mechanical maintenance. Mowing a ROW in an oak-hickory forest did not promote use by grassland birds as expected; mixed habitat birds that were present used patches of shrubs that appeared after mowing (Lawson and Gates, 1979; Chasko and Gates, 1979). A powerline maintained by mowing on a 4-year cycle increased total bird species numbers, diversity, and density as compared to a forested area without a powerline, with no loss of any forest bird species (Kroodsma, 1982).

Effects of herbicide maintenance. Although

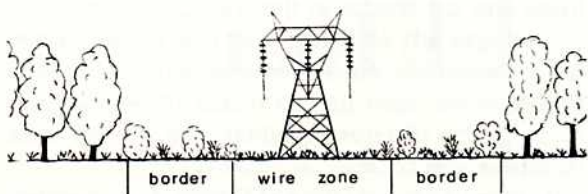


Figure 1. Diagram of an electric transmission ROW divided into a wire zone and 2 border zones. Low-growing tree species and tall shrubs were retained only in border zones.

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breeding bird species on a ROW maintained by selective basal sprays fluctuated somewhat over a period of 4 years, the differences could not be attributed to vegetation changes (Longcore, 1976). In an extensive study of the effects of selective and broadcast sprays on birds carried out in both oak-hickory and northern hardwood forest types, Carvell and Johnston (1978) found that the number of species recorded were very similar on all ROW, and the number of breeding males gave little evidence of a consistent difference between treatments. A bird census on a ROW in an oak-hickory forest that had been maintained with herbicide applications for 30 years indicated that a large and diverse bird population, dominated by shrubland and edge species, had developed (Bramble et al., 1984).

A recent New York study concluded that selective ROW maintenance with basal sprays and with a cut and stump spray were more favorable to songbird diversity and density than maintenance with aerial spray or mowing (Malefyt, 1982).

Despite the considerable research on ROW bird populations, there still exists a need for controlled ROW maintenance studies where bird populations are compared before and after ROW treatments on replicated plots.

Methods

ROW treatments. Five special ROW treatments were applied in 1982 in 5 replications randomly located along the ROW. Treatment units averaged 1.1 ha in area.

1. *Handcutting* (control/standard) removed all trees and tall shrubs in the wire zone with slash lopped and left as it fell. The two border zones were selectively cut to remove only tall-growing tree species such as red maple (*Acer rubrum*), black cherry (*Prunus serotina*), and several oaks (*Quercus* spp.).

2. *Summer basal spray* of Garlon 4 in oil-water, consisting of Garlon 4 (7.6 L), Cidekick (1.9 L), fuel oil (95 L), water (275.5 L), was applied to the bases of all trees and tall shrubs in the wire zone; desirable shrubs or low trees such as witch-hazel (*Hamamelis virginiana*) and bear oak (*Quercus ilicifolia*) were left in the border zones where all tree species were sprayed.

3. *Selective stem-foliage-spray* consisting of

Weedone 2,4-DP (1.9 L) plus Amdon 101 (1.9 L) plus Surfel (0.95 L), and water (372.25 L) was applied to the stems and foliage of all trees and tall shrubs in the wire zone; witch-hazel and bear oak were left in the border zones where all trees were sprayed.

4. *Tordon 10K pellets* were broadcast at a rate of 62.1 kg per ha in the wire zone and applied selectively to trees at a rate of 84 g per tree in the wire and border zones; except for a 25-foot strip along each edge of the ROW which was given a selective basal spray of Garlon 4 in oil-water to avoid potential damage from the Tordon herbicide to trees in the adjoining forest.

5. *Selective frill and squirt* application of Tordon RTU was applied at a rate of 2.7 L per M trees to trees, only, over the entire ROW.

Bird census method. The transect census method was modified to use the entire width of the ROW $\times$ the length of the treatment unit as a belt transect (Mikol, 1980). Two sample treatment units for each of the 5 treatments were carefully selected from the 5 replications available so as to include major variations in plant cover. Each unit averaged 1.1 ha in area.

A pretreatment baseline census was taken from July 12 to 17, 1982, followed by two post-treatment censuses made from June 6 to 11 and July 11 to 16, 1983. Each ROW treatment unit was censused by counting all birds seen or heard on 6 consecutive days beginning at 5:00 a.m. by walking slowly along an established access road with frequent stops. The adjoining forest was censused by walking along a line 30 m from the forest edge to cover a transect width of 59 m.

Results

Vegetation changes. Before treatments were applied in 1982, a shrub-herb-grass community was present on the ROW (Bramble and Byrnes, 1982). This community could be divided into three layers which gave it the following structure:

1. *A tall shrub layer*, 8-12 feet height. Composed of witch-hazel and bear oak.

2. *A low shrub layer*, 3-8 feet height. Dominated by blackberry (*Rubus allegheniensis*) with small amounts of sweet fern (*Comptonia peregrina*).

3. *A herb layer*, 3-4 feet height. Common species were: bracken (*Pteridium aquilinum*),

loosestrife (*Lysimachia quadrifolia*), hay-scented fern (*Dennstaedtia punctilobula*), vernal sedge (*Carex pennsylvanica*), wild sarsaparilla (*Aralia nudicaulis*), sheep sorrel (*Rumex acetosella*), panic grass (*Panicum* spp.), and tall meadow fescue (*Festuca elatior*). Abundant low shrubs also present in the herb layer were: blueberry (*Vaccinium angustifolium* and *V. vacillans*, huckleberry (*Gaylussacia baccata*), dewberry (*Rubus hispidus*) and teaberry (*Gaultheria procumbens*).

The presence of this complex vertical structure on the ROW should be given special recognition as it is considered an important characteristic that affects bird diversity in any certain habitat (MacArthur, 1964). In addition to structure, the wide range of plant species provided abundant fruit throughout the growing season when migratory birds are present.

An additional characteristic of ROW vegetation of importance was a complex horizontal pattern formed by patches of contiguous species that spread by rhizomes or shallow roots, or by seed-fall close to the parent plant. Nearly all of the dominant ROW species were rhizomatous, with witch-hazel and bear oak as important exceptions.

In 1983 (post-treatment), the ROW border zones on all treatment areas retained essentially the same plant community formerly present in 1982, and occupied about 2/3 of the total ROW. Total plant cover on the borders was reduced by only 5 to 15 percent by treatment. In contrast to the borders, the vegetation in the wire zone changed considerably after two of the more drastic herbicide treatments: the stem-foliage spray and the broadcast pellet application. A low herb-grass cover developed in the wire zone to replace the shrub-herb-grass cover after both types of treatments; hay-scented fern was dominant on stem-foliage sprayed areas and a mixture of hay-scented fern, loosestrife, and grass on pelleted areas. Blackberry, which was a dominant shrub in 1982, was nearly eliminated from the wire zone in both cases.

Selective herbicide treatments (summer basal and frill and squirt) caused little change in the ROW plant community of the wire or border zones, and large blackberry patches were retained over the entire ROW.

The wire zone of the typical handcut area was drastically changed in 1983 from a sapling thicket, about 14 feet tall, to a dense thicket of low sprouts. Herbaceous cover value was reduced to 5% of the ROW area. However, the border zones, where witch-hazel and bear oak were not cut, retained their shrubby structure.

Effect on number of birds. The average number of birds counted per hectare per day on both the ROW and in the adjoining forest increased after treatment, but the changes were not significantly different at the 5% level (Table 1). It was evident, therefore, that both the herbicide treatments and handcutting as carried out by the special maintenance technique had little impact on the number of individual birds present on the ROW or in the adjoining forest.

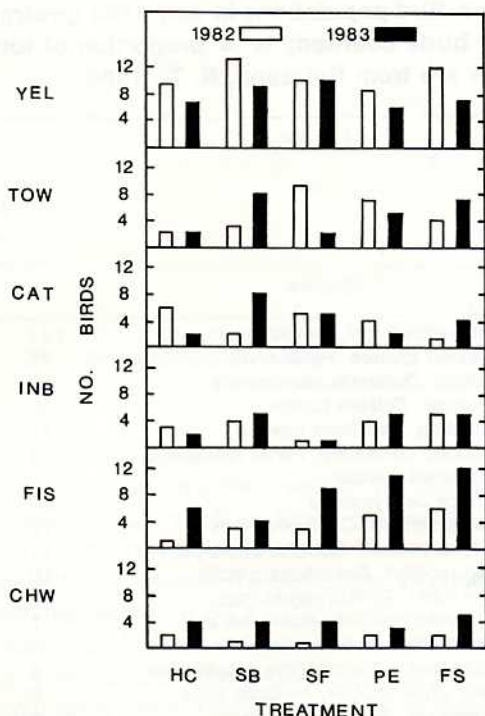


Figure 2. Number of birds per hectare on the ROW for the 6 most common species in July 1982 (pretreatment) and July 1983 (posttreatment). Treatment: HC = handcutting, SB = summer basal, SF = stem-foliage, PE = pellets, FS = frill & squirt. Bird key: YEL = yellowthroat, TOW = towhee, CAT = catbird, INB = indigo bunting, FIS = field sparrow, BLC = black-capped chickadee, CHW = chestnut-sided warbler.

	ROW				Forest			
Treatment	July 1982	June 1983 No. of birds ¹	July 1983	Change (July)	July 1982	June 1983 No. of birds ¹	July 1983	Change (July)
Handcutting	5.5	5.3	5.0	-0.5	3.0	3.8	2.8	-0.3
Summer basal	6.0	7.3	8.0	+2.0	3.3	4.8	4.5	+1.3
Stem-foliage	6.3	5.5	7.5	+1.0	2.0	2.5	3.3	+1.3
Pellets	7.3	5.8	6.8	-0.5	3.5	4.3	2.3	-1.3
Frill & squirt	6.3	7.0	8.3	+2.1	2.8	5.0	4.3	+1.5
Average	6.3	6.3	7.0	+0.7	3.0	4.0	3.5	+0.5

Table 2. Bird populations in July 1982 (pretreatment) and in 1983 (post-treatment). Abundance (A) = no. of birds counted; % = proportion of total population; rank (R) = rank among all species. Bird names are from Peterson, R. T., 1980.

[illegible]

Species	ROW						Forest					
	1982 July			1983 July			1982 July			1983 July		
	A	%	R	A	%	R	A	%	R	A	%	R
Least flycatcher, <i>Empidonax minimus</i>	2	1	17	5	1	13	2	1	14	1	•1	15
Yellow-rumped warbler, <i>Dendroica coronata</i>	2	1	17									
Brown creeper, <i>Certhia familiaris</i>	1	•1	18							2	1	14
Canada warbler, <i>Wilsonia canadensis</i>	1	•1	18									
American crow, <i>Corvus brachyrhynchos</i>	1	•1	18							2	1	14
Golden-winged warbler, <i>Vermivora chrysoptera</i>	1	•1	18	2	1	15						
Ovenbird, <i>Seiurus aurocapillus</i>	1	•1	18	3	1	14	20	7	5	33	10	3
Ruffed grouse, <i>Bonasa umbellus</i>	1	•1	18				1	•1	15			
Great horned owl, <i>Bubo virginianus</i>										1	•1	15
House wren, <i>Troglodytes aedon</i>				2	1	15				1	•1	15
Blue jay, <i>Cyanocitta cristata</i>										1	•1	15
Tufted titmouse, <i>Parus bicolor</i>				3	1	14						
Northern raven, <i>Corvus corax</i>												
Yellow-shafted flicker, <i>Colaptes auratus</i>							2	1	14			
Eastern pewee, <i>Contopus virens</i>				1	•1	16	12	5	4	21	7	6
Worm-eating warbler, <i>Helmitheros vermivorus</i>				1	•1	16	6	2	11			
Yellow-billed cuckoo, <i>Coccyzus americanus</i>												
Black-throated blue warbler, <i>Dendroica caerulescens</i>												
Northern oriole, <i>Icterus galbula</i>				1	•1	16						
Brown thrasher, <i>Toxostoma rufum</i>				2	1	15						
Eastern bluebird, <i>Sialia sialis</i>				1	•1	16						
Northern cardinal, <i>Cardinalis cardinalis</i>							1	•1	15			
Pileated woodpecker, <i>Dryocopus pileatus</i>										2	1	14
Hermit thrush, <i>Catharus guttatus</i>										1	•1	15
Veery, <i>Catharus fuscescens</i>										1	•1	15
Hairy woodpecker, <i>Picoides villosus</i>										1	•1	15
Total number	525			586			270			334		
No./hectare/day	6.3			7.0			3.0			3.5		
No. species (51 total)	32			30			25			30		

Effect on species dominance. Although a constant group of 5 to 6 species were recorded on the ROW in 1982 and 1983, there was a notable shift in the number of individuals within those species (Figure 2). Most prominent was the change in field sparrow which increased after ROW treatment from fourth place in 1982 to first in July 1983 among all species (Table 2). This sparrow is typical of mixed shrub-grass habitats such as that found on brushy pastures and has been called the "bush sparrow" by John Burroughs. It was evidently favored by the increase in grass and herbaceous openings produced in the wire zone by ROW treatments.

Significant increases also occurred for the

chestnut-sided warbler which is common in brushy habitats such as those developed on the ROW borders. In contrast to these increases, yellowthroat dropped significantly in abundance over the entire ROW in 1983, after 4 of the 5 treatments. However, it still remained among the top 5 species on the ROW. Catbirds decreased significantly after handcutting had removed the thickets of tall saplings from the ROW, and towhee also decreased significantly after the stem-foliage spray treatment possibly owing to a decrease in shrub cover.

Effect on species diversity. The total number of bird species on the ROW, as a simple measure of diversity, remained highly constant; 32 species

were present in 1982 and 30 in 1983 (Table 2). Of the 32 species recorded in 1982 (pretreatment), 27 were still present after treatment in 1983, 9 species were not recorded and 6 new species appeared. The number of species in the adjoining forest was 25 in 1982 and 30 in 1983.

This simple comparison of number of species present was amplified by use of the Simpson diversity index (Simpson, 1949), which essentially indicates the evenness of spread of individuals among species present.

The diversity index for the 15 common bird species was not significantly different between treatments and between the ROW and the forest

in July 1982 and 1983. The index was relatively high and averaged 0.83 ± 0.02 in 1982 and 0.84 ± 0.02 in 1983 on the ROW, with a maximum possible index of 0.93. The diversity index for the forest was 0.85 in both 1982 and 1983. This indicated that individual birds were uniformly distributed among the common species.

Activities on the ROW. When each bird was counted during the censuses, a note was taken of its activity. This gave an indication as to whether the ROW was being used for normal activities such as mating, nesting, feeding, and rearing of young.

The major activity on the ROW was singing;

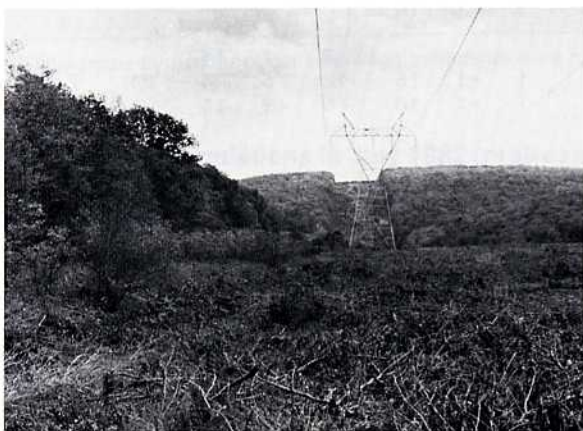


Figure 3. ROW after handcutting which drastically altered the vegetation structure in the wire zone; shrubs were retained on the borders.

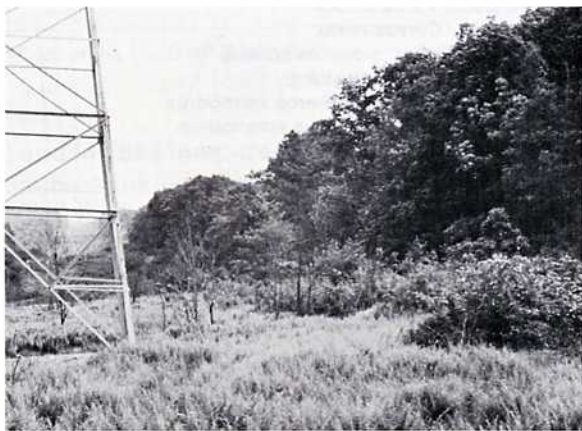


Figure 5. ROW after a broadcast stem-foliage spray in the wire zone which is now dominated by hay-scented fern; a shrubby border is on the right.

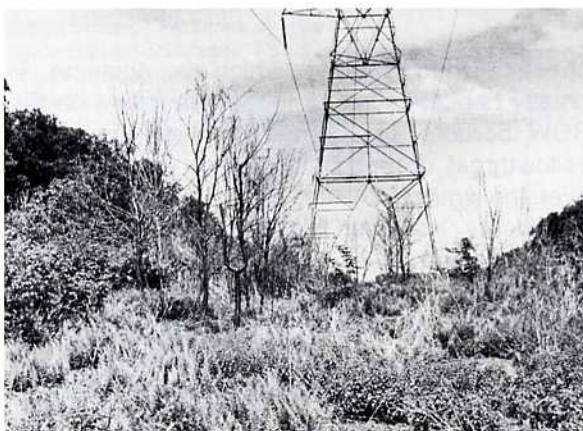


Figure 4. ROW after treatment with picloram pellets. A herb-grass-fern cover is in the wire zone; a shrubby border has been retained.

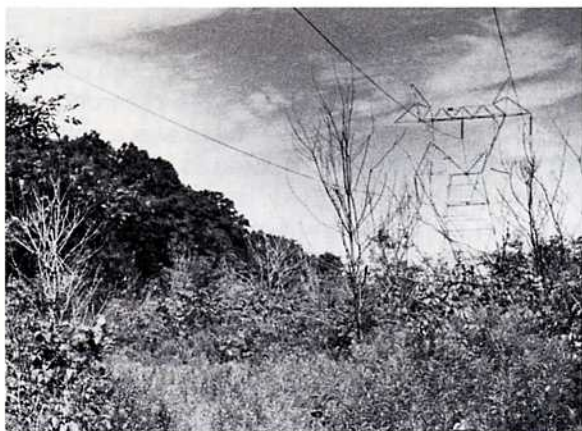


Figure 6. ROW after a selective basal spray. Blackberry was retained in both wire and border zones; a grass-herb opening is in the wire zone.

58% of the birds were observed singing in June, 1983, and 36% in July. Calling and fleeing were also high on the list of activities and made up 45% of the observations, probably owing to disturbance by the census taker. Although a special study was not made of nesting, nests with eggs or young of yellowthroat, catbird, towhee, goldfinch, and robin were found on the ROW. Foraging and feeding, which made up 13% of the observations in 1983, were of special interest as adults were often observed feeding immature birds, or accompanied by them in the act of foraging. Birds were commonly observed using the small dead trees left on the ROW as a result of herbicide treatment as perches.

Use of wire and border zones. As wire and border zones of the ROW were treated differently, all trees and tall shrubs were cut or sprayed in the wire zone and only tall-growing tree species treated in the border zones, plant cover development in these zones in 1983 was different in both species composition and structure. This was accompanied by a significant difference in the number of birds observed in the two zones for both field sparrow and chestnut-sided warbler. The other four common species were recorded in approximately equal numbers in both wire and border zones (Table 3).

A concentration of field sparrows in the wire zone was not unexpected, as it is a species typical of shrubby pastures, and grass-herb open-

ings which covered 30 to 50% of the wire zone areas in 1983 were developed as a result of treatments. Chestnut-sided warbler that was found mostly in the shrubby border zones is typical of cutover forests with thickets and briars.

Discussion

As the special ROW maintenance techniques used in this study controlled woody brush and did not produce an unfavorable impact on the bird population, they appear to be eminently fitted for use on sensitive forest areas where minimum

Table 3. Comparison of the total number of birds on 10 sample areas for the 6 most common species in the wire and border zones of the ROW in July, 1983 (post-treatment).

Species	Number of individual birds	
	Wire zone	Border zone
Yellowthroat	55	54
Towhee	35	28
Catbird	27	26
Field sparrow	80 ^a	44 ^a
Indigo bunting	24	25
Chestnut-sided warbler	8 ^b	44 ^b

^aMeans followed by the same letter are significantly different from each other at $P = 0.05$ based on the Wilcoxon sign test for paired observations.



Figure 7. Field sparrows perched on a dead tree in the wire zone were the most abundant species on the ROW after treatments.



Figure 8. A catbird nest with young on a witch-hazel in the wire zone on a stem-foliage treatment area in 1983 (posttreatment).

wildlife impacts are important. The different treatments given wire versus border zones can be carried out simply in one herbicide spray operation. It is only necessary to instruct the crew carefully and to monitor the applications so that all woody plants over 3 feet height are sprayed in the wire zone and only tall-growing trees sprayed in the border zones. Another version that is more complicated could be used whereby the wire zone would be mowed in one operation followed by a selective herbicide spray on the border zones. This approach would immediately remove all potential danger trees from under the wires, and restrict possible errors of judgment in selective treatment by the spray crew to the borders. Other treatment combinations could also be used to fit different specific conditions.

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