BIRD COMMUNITY ECOLOGY ON POWER-LINE
CORRIDORS IN EAST TENNESSEE
INTRODUCTION

The clearing of power-line corridors through forests in the eastern United States has created large areas of shrublands subjected to periodic vegetation control. Avian communities associated with shrublands in general and with power-line corridors...
attracted to the corridors were made based on other studies in forests along some of the corridors (Kroodsma, unpublished data) as well as on the present study.

To sample vegetation, two line transects (vertical planes) were established in each corridor, one down the middle of each corridor half. Each line transect consisted of 30-m segments corresponding to the 30-m corridor segments mentioned above. Within the first 10 m of each segment, the numbers of saplings (including shrubs and Rubus 1–2 m and >2 m tall contacting the line transect were recorded. Inspection of aerial photographs revealed no obvious bias in coverage, except for the denser growth at forest edges was missed. The data are reported as the number of plants per 20 m (sum of the two 10 m transects in each 30 m corridor segment). The sampling was done during the winter following each breeding season. The abundance of deciduous, coniferous, and mixed deciduous-coniferous forest edge was determined from aerial photographs (1:7920). In addition, areas dominated by Rubus patches, by forbs, and by grasses were mapped from low-level aerial photographs (roughly 1:1400) available for nine study plots. The percent of the plot covered by each category was calculated. Sapling-dominated areas were not mapped, as the photos were taken in the spring before they had leafed out sufficiently to be detected. Horizontal heterogeneity (patchiness) of Rubus and saplings on each plot was estimated by calculating a coefficient of dispersion—CD = s²/Y, where s is the standard deviation for the 20 m samples and Y is the mean number of plants per 20 m sample.

Linear regression was used to relate bird population density to vegetation. In addition, multiple regression was used to obtain the best two-variable model for each dependent variable (maximum R² improvement, SAS Institute, 1979, p. 391). The two-variable models are presented only when each of the two variables explained enough variance (P < 0.05) to be included in the model. Results of curvilinear regression using Marquardt’s compromise method (Marquardt, 1963) or second order equations are presented where deviation from linearity was significant (P < 0.05). In estimating bird species diversity, several diversity indices were used to determine whether they all showed the same patterns; these are the Shannon-Weaver index (– ∑ pᵢln pᵢ), the reciprocal of Simpson’s index (1/∑ pᵢ²) (Hill, 1973), and the Brillouin index [(2·30/N)(log₁₀N! – ∑ log₁₀nᵢ!); Lloyd et al., 1968].

RESULTS

Vegetation

There were large differences in the density of Rubus and saplings between plots and between years following bushhogging. Densities ranged over the plots from 0 to 19.0 Rubus and 1.1 to 7.2 saplings 20 m⁻¹ (averages over three years and all 30 m segments in each plot). There was no significant correlation between Rubus and sapling density.
Sampling density \( (r = 0.20, P = 0.5) \), although *Rubus* density and sapling patchiness were correlated \( (r = 0.57, P = 0.03) \). Increases in density from the first to the third year following bushhogging ranged over the plots from 0.4 to 5.6 saplings and 0.7 to 21 *Rubus* 20 m\(^{-1}\). The smaller increases occurred on plots having low *Rubus* density. On one plot, *Rubus* appeared severely damaged by bushhogging in two consecutive years. This was indicated by a lower *Rubus* density during the third year following the second bushhogging than during the first year following the first bushhogging. *Rubus* density and patchiness were highly correlated \( (r = 0.77, P = 0.002) \), which resulted from the tendency for *Rubus* to occur in small scattered patches. Sapling density and patchiness were not so highly correlated \( (r = 0.53, P = 0.05) \). Field sampling data and aerial photo data on *Rubus* abundance correlated fairly well \( (r = 0.76, P = 0.02) \); lack of a higher correlation was due partly to a lesser tendency for *Rubus* to occur in patches in some plots (only patches could be identified on the aerial photos).

In the seven plots that each had one half planted to fescue, the average annual abundance of *Rubus* was significantly greater in the naturally revegetated halves than in the grassy halves \( (4.3 \pm 1.8 \text{ *Rubus} \ 10 \text{ m}^{-1}; P = 0.05) \), analysis of variance with paired comparisons, Sokal & Rohlf, 1969). The grassy halves were four years younger (cleared in 1969 vs 1965) than the brushy halves, so any successional changes were probably more advanced on the brushy halves. However, age may not explain the greater abundance of *Rubus* in the brushy halves, because in one 100-m² plot where revegetation occurred naturally, *Rubus* was more abundant in the younger half \( (17.4 \pm 6.3 \text{ *Rubus} \ 10 \text{ m}^{-1}) \).

**Birds**

*Dependence on corridor.* The percent of registrations of birds in corridor, forest edge, and nearby forest differed among species (Fig. 1). Species occurring proportionately more often in the corridor are here referred to as brush species. These are the yellow-breasted chat, prairie warbler, yellowthroat, white-eyed vireo, towhee, indigo bunting, field sparrow, and goldfinch (Table 2). These species were rarely observed in forest more than 30 m from the corridor, and would probably not have been present without the corridor (this applies somewhat less to the towhee). The goldfinch, a mid- to late-summer breeder, occurred frequently on the study plots, but did not appear territorial. Therefore, it was not included in the analyses. The blue grosbeak and brown thrasher may also be brush species, but were registered only a few times during the study. A second group, considered edge species, rarely occurred in the corridor; however, they would probably have been abundant or may have been absent without the corridor. These are the catbird, summer tanager, and yellow-throated vireo. A third group, referred to as generalists, were observed in the corridor only slightly more proportionately than the edge species. They primarily used adjoining forest and also used small openings in relatively deep forest. These are the cardinal, Carolina wren, and bobwhite quail.
Fig. 1. Percent of observations of birds (primarily singing males) in cleared corridor proper, as opposed to the forest edge and forest, during the first, second, and third breeding seasons following bushhogging. The bobwhite quail was not included because of bias that exaggerated its occurrence in the corridor. This bias resulted from the greater tendency of quail within the corridor to flush and be seen than those at the edge. Abbreviations for species are given in Appendix 1.

The standard deviations for the points in Fig. 1 are very large, due to large among-plot variation. Therefore, in any one breeding season, many differences between species are most likely not statistically significant (statistical tests were not done). However, because each species' position relative to other species remains fairly constant over the 3 years following bushhogging, the differences between many species appear real.

Many forest bird species occurred at the edge of the corridor. But because their occurrence appeared to be independent of the corridor, they were not included in any analyses. Rarely, some of these species were registered in the corridor, including Carolina chickadee, Kentucky warbler, and tufted titmouse.

*Species density.* My spot-map coverage did not allow the extent of territories in the forest to be determined. Therefore, density estimates for edge and generalist species are probably overestimates, because these species probably used much more forest than just the 4-6 m edge width used in calculating density. This also applies to the towhee.

The densities of brush, edge, and generalist species were correlated with different habitat parameters (Table 2, Fig. 2). Four of the seven brush species (chat, prairie warbler, yellowthroat, and white-eyed vireo) included in the analyses showed a
TABLE 2
SIMPLE LINEAR COEFFICIENTS OF DETERMINATION (× 100) FOR POWER LINE BIRD DENSITIES (PAIRS KM⁻²) REGRESSED ON VARIOUS VEGETATION PARAMETERS AND CORRIDOR WIDTH

<table>
<thead>
<tr>
<th></th>
<th>Rubus density</th>
<th>Rubus CD density</th>
<th>Sapling density</th>
<th>Sapling CD density</th>
<th>Rubus patch coverage</th>
<th>Grass average edge length</th>
<th>Coniferous Width</th>
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<tr>
<td></td>
<td>N = 14</td>
<td>N = 14</td>
<td>N = 14</td>
<td>N = 14</td>
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<tr>
<td>Brush species</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Chat</td>
<td>62***</td>
<td>31*</td>
<td>28*</td>
<td>39**</td>
<td>60**</td>
<td>-50*</td>
<td>-9</td>
</tr>
<tr>
<td>Yellow-throat</td>
<td>28***</td>
<td>45***</td>
<td>9</td>
<td>30*</td>
<td>52*</td>
<td>-40*</td>
<td>-1</td>
</tr>
<tr>
<td>Prairie warbler</td>
<td>27*</td>
<td>17</td>
<td>11</td>
<td>31*</td>
<td>47*</td>
<td>-56**</td>
<td>4</td>
</tr>
<tr>
<td>Field sparrow</td>
<td>1</td>
<td>18</td>
<td>1</td>
<td>7</td>
<td>-67***</td>
<td>22</td>
<td>-1</td>
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<tr>
<td>Indigo bunting</td>
<td>14</td>
<td>23</td>
<td>1</td>
<td>9</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>White-eyed vireo</td>
<td>42**</td>
<td>43**</td>
<td>1</td>
<td>28*</td>
<td>31</td>
<td>-44*</td>
<td>2</td>
</tr>
<tr>
<td>Towhee</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>-2</td>
<td>12</td>
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<td>Generalist species</td>
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<td></td>
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<td></td>
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<tr>
<td>Carolina wren</td>
<td>25</td>
<td>64***</td>
<td>0</td>
<td>21</td>
<td>4</td>
<td>-5</td>
<td>29*</td>
</tr>
<tr>
<td>Cardinal</td>
<td>15</td>
<td>30*</td>
<td>0</td>
<td>22</td>
<td>-2</td>
<td>2</td>
<td>-14</td>
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<td>Quail</td>
<td>10</td>
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<td>0</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>-3</td>
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<td>Edge species</td>
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<td></td>
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<tr>
<td>Gnatcatcher</td>
<td>4</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>-34</td>
<td>0</td>
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<tr>
<td>Yellow-throated vireo</td>
<td>7</td>
<td>0</td>
<td>-4</td>
<td>-5</td>
<td>-2</td>
<td>-28</td>
<td>0</td>
</tr>
<tr>
<td>Summer tanager</td>
<td>0</td>
<td>1</td>
<td>13</td>
<td>15</td>
<td>2</td>
<td>1</td>
<td>-1</td>
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</table>

Symbols: CD, coefficient of dispersion; *, **, and *** significant at P < 0.05, 0.025, and 0.01, respectively; N, number of plots, minus signs show inverse relationships; underlining indicates use of second-degree polynomial in regression.

significant positive correlation with the density of Rubus and with Rubus CV (see Table 3 for results of multiple regression). The field sparrow showed an inverse correlation with the coverage of Rubus CV patches as determined with aerial photos. The indigo bunting and towhee showed no significant correlations with any measured habitat parameter.

Prairie warbler density correlated better with the coverage of Rubus patches than with any other parameter. As shown in Fig. 2, the 'best fit' model for the prairie warbler regressed on Rubus density is a straight line, rather than an asymptotic curve as for the chat and yellowthroat. This resulted primarily from one plot (55 m wide) with a high prairie warbler density but low Rubus abundance (prairie warbler = 122, Rubus = 1.3). If this apparent outlier plot is dropped, the relationship of prairie warbler to Rubus is very similar to that of the chat and yellowthroat (PW density = 96.1 - 108.34e⁻°.32[Rubus]) and the linear model
Fig. 2. 'Best fit' models for the density (pairs km$^{-2}$) of power-line corridor bird species significantly correlated with vegetation parameters. Significance levels are given in Table 2. CHAT = 93.7·87·82e-0.19 (Rubus) and 108.1·137.88e-0.65 (Rubus patches); PW = 39.6·3.47 (Rubus) and 93.0·136.06e-0.06 (Rubus patches); YT = 76.4·80.58e-0.09 (Rubus); CAR = 15.8·1.51 (Rubus) and 10.9·0.95 (Rubus CD); WEV = 3.0·1.67 (Rubus); FS = 85.9·0.81 (Rubus patches); CARD = 17.0·0.51 (Rubus CD); QUAIL = -2.4·0.23 (Rubus CD). Small tick marks on the X-axes represent observed values of the independent variables. See the methods for explanation of Rubus CD and Rubus patches.

TABLE 3

<table>
<thead>
<tr>
<th>Y</th>
<th>Intercept</th>
<th>Slope, $X_1$</th>
<th>Slope, $X_2$</th>
<th>$r_1^2$</th>
<th>$r_2^2$</th>
<th>$P_{X_1}$</th>
<th>$P_{X_2}$</th>
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<tbody>
<tr>
<td>All species</td>
<td>168</td>
<td>12.85 Rubus density</td>
<td>4.90 Rubus CD</td>
<td>69</td>
<td>79</td>
<td>0.05</td>
<td>0.05</td>
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<tr>
<td>Chat, PW, IB, FS, YT</td>
<td>80</td>
<td>10.63 Rubus density</td>
<td></td>
<td></td>
<td></td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>All other species</td>
<td>17</td>
<td>3.60 Rubus CD</td>
<td></td>
<td></td>
<td></td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Chat</td>
<td>6</td>
<td>3.96 Rubus density</td>
<td>6.50 Sapling density</td>
<td>67</td>
<td>80</td>
<td>0.001</td>
<td>0.03</td>
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<tr>
<td>Cardinal</td>
<td>12</td>
<td>0.916 Rubus CD</td>
<td>-0.390 Coniferous edge length</td>
<td>44</td>
<td>79</td>
<td>0.001</td>
<td>0.002</td>
</tr>
<tr>
<td>Carolina wren</td>
<td>-25</td>
<td>1.02 Rubus CD</td>
<td>0.217 Coniferous edge length</td>
<td>83</td>
<td>92</td>
<td>0.001</td>
<td>0.006</td>
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<tr>
<td>Bobwhite quail</td>
<td>13</td>
<td>-0.185 width</td>
<td>0.231 Rubus CD</td>
<td>28</td>
<td>52</td>
<td>0.03</td>
<td>0.04</td>
</tr>
</tbody>
</table>

* See Appendix 1 for explanation of abbreviations; CD, coefficient of dispersion; $r_1^2$, the percent of variation explained by $X_1$ in the 'best' one-variable model; $r_2^2$, the percent of variation explained by $X_1$ and $X_2$ in the 'best' two-variable model; $P_{X_1}$ and $P_{X_2}$ are the significance levels for $X_1$ and $X_2$ in the two-variable model; one apparent outlier plot was not included.
becomes significant at $P < 0.01$ ($r^2 = 0.43$). Coverage of *Rubus* patches was not obtained for this outlier plot, which explains the better correlation of this vegetation parameter with prairie warbler density.

None of the brush species' densities correlated with the type of edge (coniferous or hardwood) or corridor width. Sapling density was significantly correlated with only one brush species, the chat. Sapling patchiness (CD) correlated significantly with several brush species, but was a better correlate than *Rubus* density for only the prairie warbler.

Densities of all three edge species correlated in some way with corridor width. Gnatcatcher density was inversely correlated. However, the number of pairs per km of edge (or corridor) remained relatively constant, which indicates that the species depends on edge or forest vegetation rather than corridor vegetation. The yellow-throated vireo occurred along only the 100 m- and 88 m-wide corridors, but the correlation of density or pairs per km with width was not quite significant. This vireo and the summer tanager were not observed using corridor vegetation. Summer tanager density showed no significant correlation with any of the parameters measured, including corridor width. However, as corridor width increased and tanager density remained constant, the number of pairs per km of edge increased ($\text{pairs/km} = -0.02 + 0.0203 \times \text{width}$, $r^2 = 0.36$, $P = 0.025$).

Density of the three generalist species correlated best with *Rubus* patchiness. Carolina wren density also increased with the amount of pine edge. This may have resulted from the dense honeysuckle growth in many of the pine plantations. The honeysuckle and shrubs and saplings appeared to provide a denser understory than that in deciduous forests. Quail density was inversely correlated with corridor width, indicating some dependence on the edge. Cardinal pairs/km correlated best with the percent of deciduous forest edge ($\text{pairs/km} = 1.2 + 0.03 \times \text{deciduous edge}$, $r^2 = 0.46$, $P = 0.01$), indicating a preference for deciduous forests.

Regression of pairs/km and density on corridor width (Table 2) and percent use of the corridor (Fig. 1) appear to separate the corridor-associated species into two groups. The first group includes the five species (chat through indigo bunting, Table 2) that make the greatest use of the corridor, show no correlation or insignificant positive correlation of density with corridor width, and show high slopes for pairs/km regressed on corridor width (0.049 to 0.075). The prairie warbler is an exception, as its slope was only 0.016, indicating greater dependence on edge than any of the other four species of this first group (Fig. 1). The slopes for chats, prairie warblers, and yellowthroats would have been still higher if portions of the 100 m-wide corridors had not been planted with grass.

The other group (white-eyed vireo through summer tanager, Table 2) shows generally negative correlations of density with corridor width, except the yellow-throated vireo and the summer tanager. Slopes of pairs/km on width for this group range from $-0.004$ to $0.026$, which indicates a greater dependence on edge and adjoining forest than on corridor vegetation.
Community density. Total densities, averaged over the 3 years following bushhogging, varied among plots from approximately 210 to 750 pairs km\(^{-2}\) and increased asymptotically with Rubus density (Fig. 3). Multiple regression indicated that Rubus patchiness also accounted for a significant portion of the variation in total density (Table 3). This high variation in density is consistent with, and may help explain, some of the variation noted in other shrublands (see Fig. 4 in Wiesn, 1973). Because the density estimates for the edge and generalist species may be overestimates, the total density estimates may also be too high. Anderson et al. (1977) estimated total densities of Oak Ridge Reservation birds associated with corridors of 9 to 15 territorial males per acre. They included some forest species in this estimate. If I had also included forest species occurring at the forest edge (in addition to deep forest), my density estimates would have been higher than otherwise. However, they would have been only slightly higher, because only a small fraction of a forest bird's territory would be at the edge. Considering that my present density estimate would be lower if the appropriate fractions of the edge and generalist territories were used in the density calculations, but higher (up to 15% if birds had been censused during the fourth breeding season following bushhogging), my estimate would not be half as high as the Anderson et al. (1977) estimate.

Total bird density decreased with an increase in the percent coverage of planted grasses ($Y = 423 \text{ pairs km}^{-2} - 3.03X; r^2 = 0.54; P < 0.05$). The species primarily responsible for this relationship were chat, prairie warbler, yellowthroat, and white-eyed vireo (Table 2). These results are consistent with the finding of lower bird densities in grasslands than in shrublands (see Johnston & Odum, 1956).
Densities of power-line corridor bird species (pairs km\(^{-2}\)) during the first three breeding seasons following bushhogging and of *Rubus* and saplings (number of plants/20 m) during the following winter seasons. The data are averages over all plots during each season. The densities of the yellow-throated warbler up through the gnatcatcher may be overestimates (see text). The lines for birds were drawn by least squares regression of density on season. Season was considered a continuous variable for the purpose of defining the lines.

**Diversity.** The Shannon-Weaver, Brillouin, and Simpson reciprocal bird species diversity indices showed virtually identical relationships to *Rubus* density. Each index, within a range of *Rubus* density from 1·3 to 5 plants 20 m\(^{-1}\), increased rapidly to an asymptote (approximately 2·3, 2·25, and 9·2, respectively), which extended from 5 to 19 *Rubus* 20 m\(^{-1}\). The lowest diversity value occurred in a plot that was both the smallest and had the lowest *Rubus* density. Thus, the combination of small plot size and low *Rubus* density probably caused this low value. The number of species was 7, 10, and 11 in three plots with the lowest diversity values, 12 and 13 in two medium diversity plots, and 11 (one plot), 12 (seven plots), and 13 (one plot) in the highest diversity plots.

**Effect of bushhogging.** The three species that were more dependent on *Rubus* density (prairie warbler, chat, and yellowthroat) were affected more by bushhogging than most other species (Fig. 4). Bushhogging caused their populations to be about an order lower during the first year than during the third year following bushhogging. The reduction may have been greater if the plots were entirely brushy, rather than
consisting partly of planted fescue. Field sparrow and indigo bunting densities were less affected (about a 13% reduction), as expected based on their relative independence of Rubus and sapling density. The high reductions of gnatcatcher (45%), cardinal (54%), and Carolina wren (65%) densities are puzzling, because of their low use of the corridor as compared with edge and forest. Bushhogging also caused a significant reduction in the proportion of birds observed in the corridor compared with the edge (Fig. 1), indicating a greater dependence on edge immediately following bushhogging.

Total densities averaged over the plots increased from 431 pairs km\(^{-2}\) in the first season following bushhogging, to 514 and 656 during the second and third season. (Density = 287 + 123·06 Season, \(r^2 = 0·55, P < 0·001\)). Density during the fourth season, which was not sampled, would have been approximately 780 pairs km\(^{-2}\).

An analysis of covariance model that accounted for density differences between plots as well as between seasons explained 91% of the variation in density (36% for plots, \(P < 0·001\); 55% for season, \(P < 0·001\)).

The densities of affected species would probably have been more reduced if all corridor areas had been bushhogged. Vegetation in shallow valleys and other depressions in many of the plots was often not bushhogged, because it was low enough not to be a hazard to power-line operation. In addition, some brush vegetation including Rubus and saplings usually remained at the edges of the corridor after bushhogging.

**DISCUSSION**

**The corridor community**

The correlation of species with attributes of both corridor and adjoining forest vegetation makes it difficult to separate the corridor and forest communities. The five most abundant species along the corridor (chat, yellowthroat, prairie warbler, indigo bunting, and field sparrow) were clearly present because of the corridor. These species rarely occurred in forest more than several metres from the edge. Most of the remaining corridor-associated species were less abundant, and ranged more deeply into the forest or occurred at forest openings smaller than the power-line corridors. Thus, their degree of dependence on forest or corridor is less clear. Thirteen other edge and open-country bird species that breed in the Oak Ridge area were not observed along the corridors (song sparrow, eastern bird, chipping sparrow) or were registered only a few times (mourning dove, blue Grosbeak, meadowlark, mockingbird, bluebird, red-tailed hawk, eastern kingbird, brown thrasher, and robin). Of these 13 species, 10 are listed by Johnston & Odum (1956) as upland forest-edge species.

Bird and plant community relationships on the corridors appear to conform in general with those relationships found in other habitats. Bird density and diversity on the corridors generally increased with the addition of Rubus and shrub or sapling layers. Whin 1971: White Oak Ridge density in 1973, 1977 diversity.
layers, which increased foliage height diversity (MacArthur, 1964; Karr & Roth, 1971; Willson, 1974; Moss, 1978; Dickson & Segelquist, 1979). Diversity and density also generally increased with horizontal heterogeneity of vegetation (Wiens, 1973, 1974; Cavanagh et al., 1976; Roth, 1976), with physiognomic coverage diversity (relative cover of plant life forms, Tomoff, 1974), and percent vegetation cover (Karr & Roth, 1971; Willson, 1974).

Edge effect

Johnston & Odum (1956) define a true forest-edge bird as one that is a 'common breeding upland bird of the region which does not occur or occurs but sparingly (as compared with their occurrence in the region as a whole) in plots of uniform habitat representing the major stages in succession.' According to this definition and to the habitat preference of bird species in the Piedmont region of northeastern Georgia (Johnston & Odum, 1956), no true forest-edge species occurred in significant numbers along the corridors. I classified three species as edge species (summer tanager, gnatcatcher, and yellow-throated vireo), although these were not considered edge species by Johnston & Odum. Several other species common in the Oak Ridge region, but which did not occur in significant numbers and did not have territories on the corridors, are more clearly true edge species according to the above definition. Because of this lack of true edge species along the corridor, the corridor edge appears to lack features of other types of edges where true edge species are abundant. Such features could be the presence of fields or lawns of short grasses at forest edges, the presence of large (in contrast to long and narrow) open areas, or an intermixture of small plots of trees, grassy areas, and shrubbery. Isolation of the corridors by surrounding forest, which may inhibit immigration into the corridors, probably does not account for the lack of edge species, because (1) the forests are broken by openings and fields in many areas, and (2) brush species, which probably do not have greater dispersal abilities than edge species, were abundant on the corridors in spite of any possible isolation.

Because of the lack of true edge species along the corridor and the much greater number and abundance of corridor, generalist, and forest species, corridor 'edge effect' appears to result primarily from the presence of two adjacent bird community types, rather than from the presence of bird species unique to and dependent upon the edge itself. Thus, greater bird diversity at the corridor edge would not occur because of any great attraction to the edge. Furthermore, the composition and density of the corridor bird community depended to the greatest extent on the type of vegetation within the corridor itself rather than on edge vegetation or corridor width. These observations seem to de-emphasize the importance often attached to edge effect, and to emphasize the importance of plant species composition and vegetation structure in the two plant communities forming the edge.

This emphasis is supported by the results of Gates & Gysel (1978), who studied nest dispersion within 100 m of forest-field edges. Almost 75% of the nests they found were of shrubland birds, including the indigo bunting, song sparrow, field
sparrow, brown thrasher, towhee, and others. The nests were concentrated at the edge. However, nests were less concentrated at the edge when a field contained some shrubby vegetation and the forest canopy was more open and allowed greater development of shrubby vegetation. Gates & Gysel (1978) state that "the closed forest stand and complete absence of woody vegetation in the field seemed to restrict these species to the interface."

In this paper, the abundance of species whose density was negatively correlated with corridor width was reported in pairs per unit length of corridor (or edge) as well as in density. This was done because (1) a lack of correlation of the density of an edge species with corridor width (e.g. summer tanager) indicates an increase in pairs per km with corridor width; (2) a positive correlation of pairs/km with width could occur simultaneously with a negative correlation of density with width; (3) a decreasing density of a species with corridor width does not necessarily mean a decreasing density of the species in the forest-corridor mosaic; and (4) the density of a species (e.g., cardinal) in the forest-corridor mosaic might depend on the length of each of the various types of edges (e.g. coniferous forest) along the corridor.

CORRIDOR MANAGEMENT

To mitigate impacts of corridor clearing, some patchiness and a rich composition of shrubs and forbs (including *Rubus*) would be beneficial. Areas of grasses should be kept minimal. The sharpness of edges should be minimized through selective cutting (feathering), in order to prevent concentration and reduced fledging success of shrubland birds (Gates & Gysel, 1978). Finally, to minimize bird population reduction associated with vegetation maintenance, bushhogging of corridor halve could be staggered. Also, low shrubby vegetation that would not grow to a height hazardous to power line operation should not be cut.

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REFERENCES


APPENDIX 1

Common names, scientific names, and abbreviations (in parentheses) used in text.

Red-tailed hawk, *Buteo jamaicensis*  
Bobwhite quail, *Colinus virginianus* (Quail)  
Mourning dove, *Zenaida macroura*  
Common flicker, *Colaptes auratus*

Species names follow the American Ornithologists’ Union *Check-list of North American Birds* (1957, 2nd ed.) and the thirty-second and thirty-third supplements (*Auk*, 90, 411-19 and *Auk*, 93, 875-9).
Eastern kingbird, *Tyrannus tyrannus*
Carolina chickadee, *Parus carolinensis*
Tufted titmouse, *Parus bicolor*
Carolina wren, *Thryothorus ludovicianus* (Car)
Mockingbird, *Mimus polyglottos*
Brown thrasher, *Toxostoma rufum*
American robin, *Turdus migratorius*
Eastern bluebird, *Sialia sialis*
Blue-gray gnatcatcher, *Polioptila caerulea* (Gnat)
White-eyed vireo, *Vireo griseus* (Wev)
Yellow-throated vireo, *Vireo flavifrons* (Ytv)
Prairie warbler, *Dendroica discolor* (Pw)
Kentucky warbler, *Oporornis formosus*
Yellowthroat, *Geothlypis trichas* (Yt)
Yellow-breasted chat, *Icteria virens* (Chat)
Eastern meadowlark, *Sturnella magna*
Orchard oriole, *Icterus spurius*
Summer tanager, *Piranga rubra* (Sum)
Cardinal, *Cardinalis cardinalis* (Card)
Blue grosbeak, *Guiraca caerulea*
Indigo bunting, *Passerina cyanea* (Ib)
American goldfinch, *Spinus tristis*
Rufous-sided towhee, *Pipilo erythrophthalmus* (Tow)
Chipping sparrow, *Spizella passerina*
Field sparrow, *Spizella pusilla* (Fs)
Song sparrow, *Melospiza melodia*