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Winter Bird Use of Conservation Reserve Program Fields Harvested for Biomass

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As Conservation Reserve Program (CRP) contracts expire, many fields may be returned to agricultural production. Growing switchgrass (Panicum virgatum) as a biomass fuel is an alternative to returning fields to rowcrops. CRP fields provide winter cover for birds, but the harvest of biomass would remove most of the cover and affect bird use of the fields. We estimated winter bird abundances in nonharvested, total-harvested, and partially (strip) harvested switchgrass fields in southern Iowa. Song sparrows (Melospiza melodia) were observed only in strip-harvested fields and ring-necked pheasants (Phasianus colchicus) were observed only in nonharvested fields and uncut areas of strip-harvested fields. American tree sparrows (Spizella arborea) were observed in all three treatments, but abundances were not significantly different among treatments. Tree sparrows, however, were observed more often in uncut strips of strip-harvested fields than in cut strips, with 87% of observations in strip-harvested fields in uncut strips. Abundances in strip-harvested fields were in general higher than abundances in rowcrop and CRP plantings in other studies. Strip-harvested switchgrass fields may be more beneficial in winter than total-harvested fields, rowcrop, or idle CRP fields for some bird species.

INDEX DESCRIPTORS: biomass, switchgrass, avian community, birds, harvest, winter, Conservation Reserve Program.

To evaluate the effects of biomass harvest on winter bird use of switchgrass fields, we compared bird abundances in nonharvested (control), total-harvested and strip-harvested CRP switchgrass fields. The strip-harvested treatment was evaluated because it allowed the harvest of some biomass without removing all of the protective cover for birds.

STUDY AREA AND METHODS

Our study was conducted during January and February 2000 in Appanoose, Lucas, Monroe and Wayne counties in south-central Iowa. The primary land cover in the area is grasslands (54%; pastures, hayfields, CRP fields) mixed with rowcrops (22%; corn, soybeans) and riparian woodlands (20%) (1992 Iowa Land Cover, Iowa Gap Analysis Program, Department of Natural Resource Ecology and Management, unpublished data). In 2000, the average temperatures for January (-3°C) and February (1°C) were warmer than the long-term average temperatures for those months (-6°C and -3°C, respectively) (National Oceanic and Atmospheric Administration 2000a,b,c). The amount of snowfall in 2000 was below the averages for January (18 cm) and February (15 cm) (Midwestern Climate Center 2000) with 13 and 12 cm of snowfall, respectively (National Oceanic and Atmospheric Administration 2000a,b). At the times surveys were conducted, snow accumulation was negligible.

We used 21 CRP switchgrass fields that ranged from 4 to 13 ha (\(\bar{x} = 6.6 \) ha) and were > 0.5 km apart. Fields were grouped into seven blocks of three fields each. Fields in each block were of similar size and were adjacent to similar habitats to reduce the effect of variation in bird abundance caused by these factors. Each of the three harvest treatments (total-, strip-, and nonharvested) was then randomly assigned to one field of each block. Strip-harvested fields consisted of alternating cut and uncut strips, with 60% of each field being harvested. Four strip-harvested fields had 60-m-wide cut strips and 40-m-wide uncut strips. Abundances in strip-harvested fields were in general higher than abundances in rowcrop and CRP plantings in other studies.
strips; three fields had 30-m-wide cut strips and 20-m-wide uncut strips. Strip-harvested fields were cut using different strip widths to test for differences in breeding bird abundance between fields with different strip widths; breeding bird abundances, however, did not differ between strip types (Murray and Best 2003). We did not test for differences in winter bird abundances between strip widths because of the small number of surveys conducted. The switchgrass on harvested fields was cut with a disc mower set at a height of 9 cm, baled, and removed from the fields before sunset (Best et al. 1998) once in January and once in February 2000.

We surveyed birds between 2 hours after sunrise and 1.5 hours before sunset (Best et al. 1998) once in January and once in February 2000 by using 50-m fixed-width, nonoverlapping transects that covered each field entirely. Transects were perpendicular to the strips in strip-harvested fields. Efforts were made by observers to record each bird only once. Birds flying overhead and believed to be searching for food, based on behavior, were considered to be using the fields and were included in the counts. Total-harvested and strip-harvested fields were surveyed after they were harvested. One total-harvested field was not surveyed either month because the field was not harvested until late February and therefore was excluded from all analyses, and three strip-harvested fields and one total-harvested field were not surveyed in January because they had not been harvested before surveys were conducted. Paired t-tests of bird abundances in fields that were surveyed in both January and February revealed no significant differences between months for the 3 most abundant species and total abundance (P > 0.05), thus the numbers of birds seen per survey in each field were then averaged across months and divided by the area surveyed in each field to standardize bird abundance measures among fields. For fields not surveyed in January, relative abundances for February only were used in analyses. Relative abundances are presented as birds seen per 5 ha to facilitate comparison with winter abundances reported in CRP and rowcrop fields in the Midwest (Best et al. 1998).

Vegetation structure was measured at a random point for each 0.5 ha of each field once in January or February. In strip-harvested fields measurement points were alternated between cut and uncut strips. Vegetation density was measured as visual obstruction 4 m from a Robel pole in the four cardinal directions and at a height of 1 m, and the lowest decimeter that was visible was recorded for each direction (Robel et al. 1970). Vegetation height was measured as the tallest piece of vegetation within 1 cm of the Robel pole. Litter was defined as dead plant material lying flat on the ground, and litter depth was measured to the nearest centimeter.

A one-way ANOVA for a randomized block design, with each set of three similar fields treated as a block, was used to test for differences among the three treatments in total bird abundance, abundances of bird species with > 10 observations, and vegetation structure (SAS Institute, Inc. 1999). All variables were log-transformed to improve normality and homogeneity of variances, however, untransformed means are presented for easier interpretation. Type III sums of squares were used in ANOVAs because of unbalanced sample sizes. Fisher's least significant difference tests were used to test for pair-wise differences between treatments. Differences in vegetation height and density and litter depth between cut and uncut strips in strip-harvested fields were evaluated by using paired t-tests.

**RESULTS**

The standing dead vegetation in total-harvested fields was significantly shorter and sparser than that in the other two treatments (Table 1). In total-harvested fields the lowest decimeter of the Robel pole was visible at each sampling point. Mean vegetation density and height were greater in uncut than cut strips (density: cut = 1.0 dm, uncut = 3.5 dm, t = 38.2, 6 df, P = 0.005; height: cut = 8.6 cm, uncut = 119.6 cm, t = 112.6, 6 df, P < 0.001). Vegetation structure in uncut strips of strip-harvested fields was similar to that in nonharvested fields, and cut strips were similar to total-harvested fields. Mean litter depth was similar among treatments (Table 1) and between strip types (cut = 2.3 cm, uncut = 6.2 cm, t = 2.2, 6 df, P = 0.110).

Mean total bird abundance in strip-harvested fields was more than twice that in fields of the other two treatments (Table 1). Ring-necked pheasants (*Phasianus colchicus*) were observed only in nonharvested and strip-harvested fields. In strip-harvested fields, relative abundance of pheasants was 45% of that in nonharvested

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### Table 1. Mean bird abundance (per survey per 5 ha) and vegetation structure in total-, strip- and nonharvested switchgrass fields in southern Iowa during January and February 2000.

<table>
<thead>
<tr>
<th></th>
<th>Total-harvested (n = 6)</th>
<th>Strip-harvested (n = 7)</th>
<th>Nonharvested (n = 7)</th>
<th>ANOVAa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bird abundanceb</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ring-necked pheasant</td>
<td>0.00 ± 0.00±</td>
<td>0.47 ± 0.36±</td>
<td>1.01 ± 0.46±</td>
<td>1.90</td>
</tr>
<tr>
<td>American tree sparrow</td>
<td>1.30 ± 0.64±</td>
<td>4.92 ± 2.24±</td>
<td>1.20 ± 0.34±</td>
<td>2.25</td>
</tr>
<tr>
<td>Song sparrow</td>
<td>0.00 ± 0.00±</td>
<td>1.02 ± 0.80±</td>
<td>0.00 ± 0.00±</td>
<td>—</td>
</tr>
<tr>
<td><strong>Total abundancee</strong></td>
<td>1.56 ± 0.73±</td>
<td>6.90 ± 3.13±</td>
<td>2.61 ± 0.38±</td>
<td>3.71</td>
</tr>
<tr>
<td><strong>Vegetation structure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density (dm)</td>
<td>1.0 ± 0.0±</td>
<td>2.3 ± 0.3±</td>
<td>4.1 ± 1.1±</td>
<td>9.58</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>7.0 ± 0.7±</td>
<td>65.5 ± 4.8±</td>
<td>120.2 ± 13.0±</td>
<td>123.43</td>
</tr>
<tr>
<td>Litter depth (cm)</td>
<td>1.8 ± 0.2±</td>
<td>4.3 ± 1.2±</td>
<td>5.1 ± 1.2±</td>
<td>1.98</td>
</tr>
</tbody>
</table>

aOne-way analysis of variance test for differences among treatments (df = 2, 11).
bOnly species observed ≥ 10 times are listed separately. Scientific names are given in the text.
cMeans within rows with different letters are significantly different (P < 0.05), Fisher's least significant difference tests.
dANOVAs were not conducted because song sparrows were not observed in total- or nonharvested fields.
eIncludes all bird species observed.
fields, and all observations (n = 6) were in uncut strips which composed 40% of the strip-harvested fields. More American tree sparrows (Spizella arborea) were observed in strip-harvested fields than in fields of the other two treatments (Table 1), however, the differences were not statistically significant. In strip-harvested fields, 87% of tree sparrows observed (n = 55) were in uncut strips. Song sparrows (Melospiza melodia) were only seen in strip-harvested fields, and all observations (n = 13) were in uncut strips.

Eight of the 11 species observed were recorded fewer than 10 times in all treatments. In nonharvested fields three red-tailed hawks (Buteo jamaicensis) were seen searching for food overhead, and three species were observed once (rough-legged hawk [Buteo lagopus], red-winged blackbird [Agelaius phoeniceus], wild turkey [Meleagris gallopavo]). A single dark-eyed junco (Junco hyemalis), field sparrow (Spizella pusilla), northern harrier (Circus cyaneus), and red-tailed hawk were observed in strip-harvested fields. In total-harvested fields, three American crows (Corvus brachyrhyncos) and one northern harrier were recorded.

**DISCUSSION**

Only three bird species (ring-necked pheasant, American tree sparrow, song sparrow) were observed frequently enough to evaluate their habitat-use patterns. In general, abundance was greater in strip-harvested than in nonharvested and total-harvested fields, except for ring-necked pheasants. Greater detectability of birds in strip-harvested fields because of the open areas in cut strips could contribute to the observation of more birds in strip-harvested fields than in non-harvested fields, however, more birds were observed in uncut strips than in cut strips for the three most abundant species.

That all song sparrow and most American tree sparrow observations in strip-harvested fields were in uncut strips suggests that the dead vegetation in uncut strips may provide more protection from predators, greater thermal benefits or a better food source than cut strips. Watts (1990) showed that song sparrow abundance was greater in unmowed sections of horse weed (Conyza canadensis) fields, but that the proportion of kills by raptors was greater in the mowed sections. The harvest, however, probably did not affect seed abundance because switchgrass seeds fall in mid-November (West 1967) before most fields were harvested. But the removal of vegetation in harvested areas might have made fallen seeds more accessible to American tree and song sparrows because they commonly forage in open areas by scratching the ground to extract and/or uncover food items (West 1967, Whalen and Watts 2000). Thus in strip-harvested fields sparrows may be able to forage in cut strips and quickly retreat to nearby uncut strips for protection. In total-harvested fields protective cover in adjacent habitats and fencerows was generally more distant than in strip-harvested fields. The greater distance to protective cover might have deterred sparrows from foraging in total-harvested fields, as has been seen at feeding stations in other studies (Grubb and Greenwald 1982, Lima 1987, Giesbrecht and Anktkey 1998).

Ring-necked pheasants might have spent more time foraging in nearby rowcrop fields than in switchgrass fields. Bogenschutz et al. (1995) found that when rowcrops were available nearby, pheasant diets usually included small amounts of wild material (e.g., weed seeds, insects) and large amounts of crop grain (i.e., corn and soybeans). Crop contents of pheasants collected in switchgrass fields in southern Iowa consisted mostly of crop grains with little evidence of foraging in switchgrass fields (Murray and Best pers. obs.). Protective cover, however, is important for pheasant survival in the winter (Gabbett et al. 1999). In our study, pheasants were observed only in nonharvested areas of fields, and their abundance was roughly proportional to the amount of nonharvested area in each treatment. Thus, pheasants probably used switchgrass fields primarily for escape and roosting cover and not as foraging sites because no nonharvested areas of switchgrass fields provided better cover than rowcrop fields.

Abundances of American tree sparrows in total- and nonharvested switchgrass fields were similar to relative abundances recorded by Best et al. (1998) in CRP fields (0.00–2.31 per 5 ha) in the Midwest, and were higher than abundances in rowcrop fields (0.00–0.69), except in Missouri (4.51). The numbers of tree and song sparrows seen per 5 ha in strip-harvested fields, however, were higher than recorded abundances in CRP and rowcrop fields in every state included in Best et al. (Iowa, Indiana, Kansas, Michigan, Missouri, and Nebraska). Ring-necked pheasant abundance in total-harvested fields was similar to abundances observed by Best et al. in rowcrop fields but lower than abundances recorded in CRP fields. Abundances of pheasants in strip- and areas harvested fields were similar to abundances in CRP fields in Best et al., but much higher than abundances recorded in rowcrop fields. Comparisons of abundances in strip-harvested switchgrass fields for tree sparrows, song sparrows, and pheasants from our study to abundances in rowcrop and other CRP fields suggest that strip-harvested fields may provide more benefit to these three species in the winter than rowcrop or nonharvested CRP plantings. The total number of species observed, however, was consistently lower in our switchgrass fields (5–7 species) than in rowcrop (8–18) and other CRP plantings (6–32) (Best et al. 1998).

Availability of both food and protective cover affects bird abundance (Beck and Watts 1997). Thus, providing both food and cover in the same habitat patch may benefit birds during winter. Conservation Reserve Program fields planted to switchgrass provided protective winter cover for American tree and song sparrows and ring-necked pheasants, but harvesting such fields for biomass would drastically reduce this cover. Strip-harvested biomass fields would not completely remove protective cover for some species of birds. If switchgrass fields are to be harvested, harvesting them in alternating cut and uncut strips may be more beneficial to the winter bird community than harvesting them completely. The economic feasibility of strip-harvesting switchgrass fields for use as a biomass fuel is unknown, but the large amounts of switchgrass required for use as a biomass fuel may restrict the use of partial harvest options. In addition, our data were collected in an atypically warm winter with little snow, and Best et al. (1998) demonstrated a negative relationship between bird abundance and snow depth. Thus a colder or snowier winter may affect the bird community response to harvesting of switchgrass and should be investigated.

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LITERATURE CITED


