Grassland Bird Use of CRP Fields that Differ by Age-class and Cover Type

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Abstract

During the past 50 years increasing agricultural practices have transformed native habitats into row-crop fields, making the Conservation Reserve Program (CRP) grasslands important habitat for wildlife populations. Limited information exists on how nongame grassland bird species relate to different stand ages and cover types of Conservation Reserve Program. Conservation Reserve Program grassland study sites (n = 42) were stratified by stand age (old [10–13 years] and new [0–3 years] grasslands), and cover types (CP1-cool-season grasslands and CP2-warm-season grasslands) in eastern South Dakota. Field age rather than cover type was more predictive of grassland bird occurrence and density. Sedge wrens (*Cistothorus platensis*), common yellowthroats (*Geothlypis trichas*), savannah sparrows (*Passerculus sandwichensis*), and bobolinks (*Dolichonyx oryzivorus*) reached their highest occurrence and/or densities in old CRP grasslands while upland sandpipers (*Bartramia longicauda*), western meadowlarks (*Sturnella neglecta*), and vesper sparrows (*Pooecetes gramineus*) reached their highest densities in new CRP plantings. Grasshopper sparrow (*Ammodramus savannarum*) and dickcissel (*Spiza americana*) occurrence and density were more closely associated with temporal changes in vegetation structure. No species was consistently associated with cool- or warm-season grasslands. Based on our findings, we submit that extending ten-year CRP contracts for another five to ten years is justified relative to grassland birds.

Keywords: Conservation Reserve Program, grassland birds, South Dakota, warm-season grasses, cool-season grasses

Introduction

Ecosystems of the northern Great Plains have been transformed from vast mosaics of grasslands into highly fragmented landscapes characterized by large blocks of croplands interspersed with smaller, more isolated grassland patches. Conversion rates in eastern South Dakota counties range from 20% to over 90%. In 2001 alone, 40,054 acres (16,216 hectares) of previously untilled land were converted to agricultural uses in South Dakota with many grassland-dominated counties converting more than 1,000 acres (405 hectares) (U.S. Fish & Wildlife Service, Wildlife Habitat Office, Brookings, SD). Grassland bird populations are declining faster and more consistently than any other group of North American birds (Samson and Knopf 1994, Herkert 1995). Linked to the declines have been the loss and degradation of grassland habitats. Many of the remaining grasslands are overgrazed or degraded by exotic plant species.

The primary objective for CRP was to reduce soil erosion (Mortensen and others 1989). The secondary objective was to improve habitat for fish and wildlife populations (King 1991, Luttschwager and Higgins 1992, Hall and Willig 1994, Johnson and Igl 1995). The Conservation Reserve Program (CRP), started in 1985 as a provision of the Federal Food Security Act and administered by the United State Department of Agriculture (USDA 1997), has led to changes in landscape composition, especially in the northern Great Plains (Johnson and Schwartz 1993). As of September 1999, landowners in the Great Plains had enrolled more than 17 million acres (7 million hectares) of land into CRP, with a majority of this land planted to native or introduced grasses often mixed with native or exotic legumes (Heard and others 2000).

Research conducted in the Midwest has indicated that grassland birds are 21 times more likely to be found in CRP habitats than in cropland and their nests are 32 times more likely to hatch in CRP fields (Wildlife Management Institute 1994). This program has been credited with the reversal in population declines for several grassland bird species. For example, data from the USFWS's Breeding Bird Survey (BBS) indicated that populations of eastern meadowlarks (*Sturnella magna*), grasshopper sparrows (*Ammodramus savannarum*), and lark buntings (*Calamospiza melanocorys*) were increasing in areas with high CRP enrollment (Wildlife Management Institute 1994).

Although numerous studies have focused on the benefits that CRP provides (Luttschwager and Higgins 1992, Johnson and Igle 1995, Best and others 1997, Delisle and Savidge 1997, Koford 1999), few studies have evaluated influences of stand age and cover types on bird use of CRP fields. Objectives of this study were to 1) assess cover quality characteristics (e.g., height-density, litter depth) of differing age class stands and cover types of CRP, and to 2) compare the occurrence and density of nongame birds in two age classes (< 3 and > 10 yrs) of cool-season (CP–1) and warm-season (CP–2) CRP grasslands in eastern South Dakota.

Study Area and Methods

During 1998–2000, we evaluated effects of field age and cover type on occurrence and density of grassland birds in 42 CRP fields that were randomly selected from the pool of available fields in eight eastern South Dakota counties identified by USDA staff (Figure 1). The same fields were studied each year. We further separated CRP fields into categories based on field age and cover type: Old cool-season (n = 13), old warm-season (n = 8), new cool-season (n = 8) and new warm-season (n = 13) fields. Permission to access an additional old cool-season site increased our sample size from 12 to 13 fields in 1999 and 2000. We dropped one new warm-season site from study in 2000 after the landowner decided to reseed the field. Old fields were 10–13 yrs of age at the onset of the study and new fields (1–3 yrs old) were planted in spring 1998 and monitored for three years. Tall wheatgrass (*Thinopyrum ponticum*) or intermediate wheatgrass (*Thinopyrum intermedium*) and smooth brome (*Bromus inermis*) were dominant in cool-season (CP1) fields, some of which also contained alfalfa (*Medicago sativa*) and sweet clover (*Melilotus officinalis*). Switchgrass (*Panicum virgatum*), big bluestem (*Andropogon gerardii*), and Indiangrass (*Sorghastrum nutans*) dominated the warm-season fields (CP2). Size of available CRP fields was 10.9–180.1 acres (4.4–72.9 ha). Disturbance to CRP fields during this study was confined to spot-spraying of noxious weeds with herbicides.

Vegetation Measurements

We evaluated cover quality in 42 CRP fields in 1998–2000. We assessed cover quality in June each year by estimating vegetation height and density (Robel and others 1970) and litter depth (mm) at ten stations spaced 10 m apart along transect lines within study fields. We placed transect lines randomly within fields > 30 m from wetland and field borders (Arnold and Higgins 1986). We recorded vegetation structure (nearest 0.25 dm) at the highest point above ground level at which vegetation limited visibility of the pole by 100% from a sighting height of 1 m and a distance of 4 m (Robel and others 1970, Higgins and Barker 1982). Litter depth was measured to the nearest millimeter with a ruler inserted into the detritus until it made contact with soil.

Grassland Bird Surveys

We surveyed birds in CRP grasslands using fixed-width belt transects from sunrise to 1000 hours once each June 1998–2000 (Emlen 1971, Wakely 1987, Ralph and others 1993). Birds were only surveyed in favorable conditions. Fixed-width transects were 100 m in length and all birds seen or heard within 50 m on either side of the transect were counted. Bird surveys were completed along the same transects used for vegetation measurements. We noted bird movements to avoid double counting. Transects were walked slowly (about 1 km/hour) with frequent stops to identify birds to species by sight or sound.

Data Analysis

We hypothesized that different CRP stand ages and cover types would influence bird species occurrence and density. We calculated mean vegetation structure (Robel) and litter depth for each study field and used ANOVA to evaluate cover quality among CRP fields of differing field ages and cover types. We also calculated individual species occurrence and density in each study field and used ANOVA to evaluate effects of differing age classes and cover types and their interactions on occurrence and density estimates. Post-hoc tests (Bonferroni) were used to evaluate the influence of age, cover type, and year on these estimates. All statistical tests were considered significant at $P \leq 0.05$. We used field size as a covariate in analyses because study fields were randomly selected from available fields without regard to habitat area to ensure adequate samples sizes throughout the eight-county area (Figure 1).

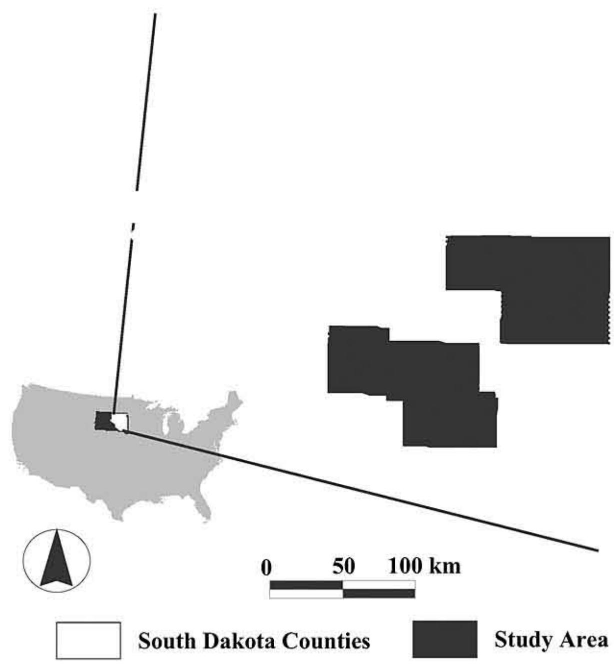

Figure 1. Location of eight counties containing Conservation Reserve Program fields that were surveyed for nongame bird occurrence and abundance in eastern South Dakota, 1998–2000.

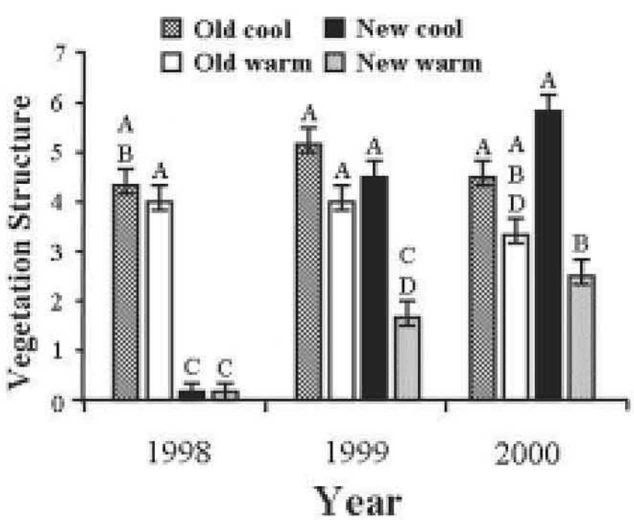

Figure 2. Vegetation structure of Conservation Reserve Program fields that differ in age and cover type in eastern South Dakota, 1998–2000. Mean height and density readings (dm) denoted by the same letter do not differ.

Results

Vegetation Measurements

Vegetation structure increased with age in newly established cool- and warm-season CRP fields ($F_{2,113}$ = 2.90, P = 0.05; Table 1), and increased more quickly in cool- compared to warm-season CRP fields (Figure 2). New cool-season CRP fields were structurally indistinguishable from old cool- and warm-season CRP fields one year after establishment (P = 0.07; Figure 2). In contrast, vegetation structure was lower (P < 0.01) in new compared to old warm-season CRP fields until 2000 (P = 0.98), and never reached values of old or new cool-season CRP fields (P < 0.049). Litter increased with time in all CRP fields ($F_{2,113}$ = 14.73, P < 0.01; Table 1), and was highest in old cool-season fields ($\bar{x}$ = 51.44 mm, SE = 3.05, P < 0.01), intermediate in old warm-season fields ($\bar{x}$ = 35.17, SE = 3.79, P < 0.01), and lowest in new cool- ($\bar{x}$ = 17.40, SE = 3.84) and warm-season fields ($\bar{x}$ = 15.53, SE = 3.05, P < 0.01).

Individual Species Occurrence and Density

Sedge wrens (*Cistothorus plantensis*) (P < 0.01), savannah sparrows (*Passerculus sandwichensis*) (P < 0.01), bobolinks (*Dolichonyx oryzivorus*) (P < 0.01), dickcissels (*Spiza americana*) (P < 0.01), and common yellowthroats (*Geothlypis trichas*) (P = 0.03) occurred more frequently in old than new CRP (Table 2). In contrast, upland sandpipers (*Bartramia longicauda*) (P = 0.04) and vesper sparrows (*Pooecetes gramineus*) (P < 0.01) occurred more frequently in new than old CRP grasslands, vesper sparrows attained their highest occurrence in 1999 (P = 0.01). In 2000, the bobolink (P = 0.03) and dickcissel (P < 0.01) occurred more frequently in cool-season than warm-season CRP grasslands. Grasshopper sparrow occurrence was closely related to structure of grasslands in that they occurred more often in old than new (P < 0.01) CRP fields in 1998, but was more likely to occur in new cool-season (P = 0.03) fields in 1999, and cool-season (P < 0.01) fields, regardless of their age, in 2000. Area did not remove significant amounts of variation in occurrence for any species.

Species with their highest densities in old CRP grasslands were the sedge wren (P < 0.01), savannah sparrow (P < 0.01), and common yellowthroat (P = 0.03). In new CRP grasslands, the grasshopper sparrow (P = 0.01), vesper sparrow (P = 0.03), and in 1999, the western meadowlark (*Sturnella neglecta*) (P = 0.03) attained their highest densities. Western meadowlarks (P = 0.04) attained their highest densities in new cool-season CRP (P < 0.01) grasslands in 1999. Dickcissels preferred old, warm-season grasslands (P = 0.03) in 1998 but by 2000 new cool-season fields (P < 0.01) acquired the vegetation structure necessary. Grasshopper sparrows had significantly higher density in new cool-season (P < 0.01) fields in 1999 and warm-season fields (P < 0.01) in 2000. Analysis of bobolink data revealed that neither stand age nor cover type had a significant effect on density. Field area removed significant portions of variation in western meadowlark density (df = 1, F = 5.05, P = 0.03)—areas that were not attributable to the effects of CRP field age or cover type.

Data analyses on horned lark (*Eremophila alpestris*), red-winged blackbird (*Agelaius phoeniceus*), and clay-colored sparrow (*Spizella pallida*) data revealed that neither stand age nor cover type had a significant effect on species occurrence or density, likely due low occurrence rates, or in the case of the red-winged blackbird, high use of all CRP fields.

Discussion

We found that field age rather than cover type was more predictive of grassland bird occurrence and density in our study. Sedge wrens, savannah sparrows, bobolinks, and common yellowthroats attained their highest occurrence and/or densities in old (10–13 yrs of age) CRP grasslands, while upland sandpipers, vesper sparrows and western meadowlarks were more common in the less dense vegetation typical of newly (1–3 yrs of age) planted CRP. Similar species-vegetation associations were documented in eastern South Dakota (Bakker 2000, Bakker and others 2002) and North Dakota (Madden and others 2000).

No species was consistently detected in cool-season or warm-season grasslands in our study. Other studies have also indicated no statistical differences in grassland bird species richness and density between cool-season and warm-season grasslands (McCoy and others 2001, Bakker and Higgins 2005). However, grasshopper sparrow occurrence and density was significantly higher in warm-season mixes and native sod prairie as compared to warm- and cool-season monotypes and cool-season mixes in eastern South Dakota and western Minnesota (Bakker and Higgins 2005), and more pheasant

Table 1. Cover quality characteristics ($\bar{x}$, SE) in CRP fields of different ages and cover types in eastern South Dakota, 1998–2000.

Year Field Type	No. Fields	Vegetative Characteristics Vegetation Structure (dm)	 Litter Depth (mm)
1998			
Old cool-season	12	4.2 (0.3)	38.5 (7.0)
Old warm-season	8	4.0 (0.6)	29.5 (8.3)
New cool-season	8	< 0.1 (< 0.1)	0.0 (0.0)
New warm-season[a]	13	0.0 (0.0)	0.0 (0.0)
1999			
Old cool-season	13	5.0 (0.3)	54.5 (6.6)
Old warm-season	8	3.9 (0.5)	35.6 (8.0)
New cool-season	8	4.5 (0.8)	22.4 (6.3)
New warm-season	13	1.6 (0.3)	22.0 (4.5)
2000			
Old cool-season	13	4.3 (0.3)	61.3 (6.1)
Old warm-season	8	3.5 (0.4)	40.4 (7.7)
New cool-season	8	5.7 (0.6)	29.8 (4.5)
New warm-season	12	2.5 (0.3)	24.6 (4.2)

[a]Vegetative characteristics were collected in seven rather than eight fields.

Table 2. Mean frequency of occurrence (%) and density (birds/100 ha) of grassland bird species in CRP fields of different ages and cover types in eastern South Dakota, 1998–2000.

Species	Old %	Old density	New %	New density	Warm %	Warm density	Cool %	Cool density
UPSA	0.0	0.0	6.5	11.0	0.0	0.0	8.0	3.2
HOLA	0.0	0.0	3.2	11.0	2.0	8.0	0.0	0.0
SEWR	33.3*	68.0*	9.7	14.0	15.9	30.0	33.9	68.0
COYE	30.1	52.0*	11.3	22.0	20.6	41.0*	21.0	34.0
DICK[1]	57.1	162.0	56.5	156.0	52.4	146.0	64.5	174.0
CCSP	1.6	1.6	0.0	0.0	1.6	1.6	0.0	0.0
SASP	19.1*	27.0*	0.0	0.0	6.3	6.3	14.5	23.0
GRSP[2]	22.2	37.0	30.7	76.0*	28.6	60.0	24.2	53.0
VESP	0.0	0.0	11.3*[4]	24.0*	6.2	14.0	0.0	0.0
BOBO	46.0*	98.0*	9.7	14.0	17.6	32.0	41.9*	82.0
WEME	39.7	91.0	37.1	111.0*[3]	36.5	86.0	46.8	118.0*
RWBL	60.3	224.0	66.1	234.0	60.3	205.0	62.9	247.0

*Significantly different ($P < 0.05$)

[1]Significanlty higher occurrence in cool CRP fields in 2000 only, significantly higher densities in old warm fields in 1998 and new cool fields in 2000.

[2]Significantly higher occurrence in old CRP fields in 1998, new cool CRP grasslands in 1999, and new fields in 2000. Grasshopper sparrows had significantly higher densities in new CRP, new cool in 1999 and warm CRP in 2000.

[3]Signficantly higher in new cool CRP in 1999 only.

broods were detected in cool-season than in warm-season CRP plantings in eastern South Dakota (Eggebo and others 2003).

Occurrence and density of some species were more closely associated with temporal changes in vegetation structure in our study. Vegetation structure in newly established cool-season fields was similar to that of old cool-season fields after one year of growth. As a result, dickcissel and bobolink occurrence was highest in cool-season grasslands by the third year of our study. Dickcissel density was strongly linked to temporal increases in height/density values (i.e., significantly higher densities in old warm-season grasslands the first year of our study and old cool-season grasslands the second and new cool-season grasslands by 2000). In contrast, after three years of growth, new warm-season grasslands were indistinguishable from old warm-season grasslands but had not yet attained vegetation structure similar to cool-season fields. Grasshopper sparrow densities were higher in new cool-season grasslands the second year and warm-season grasslands in 2000. Other studies have also found grasshopper sparrows prefer grasslands with less dense vegetation (Madden and others 2000, Bakker and others 2002, Fritcher and others 2004).

Management Implications

Our findings indicate that old (10–13 yrs) CRP grasslands, which typically degenerate in vegetation structure as they age (Higgins and Barker 1982), still provide habitat for many grassland bird species. However, we caution managers that idling CRP fields for greater than ten years may not be the best management approach for enhancing CRP habitat for all native grassland birds because CRP use by other species declined with age. Additionally, data are not available to project how long these fields will remain useful for grassland birds.

Guidelines for establishment and maintenance of CRP fields must be based on management objectives because no field can provide habitat for all species of interest, either spatially or temporarily. While there was little difference in bird use between cool-season and warm-season CRP grasslands in this study, when compared to warm-season plantings, cool-season mixtures are easier to establish and cheaper to purchase. Therefore, we suggest flexible guidelines on what seed mixtures can be used with careful consideration to the inherent benefits of planting native species. Based on findings from this study, we recommend extending CRP contracts beyond ten years because they still function as suitable habitat for several grassland bird species. We further recommend continuing the establishment of new CRP contracts to provide habitat for grassland birds with differing requirements, and to prevent a gap in habitat availability for species preferring either young or old fields.

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