Grassland Bird Use of Conservation Reserve Program Fields in the Great Plains

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Abstract

An enormous area in the Great Plains is currently enrolled in the Conservation Reserve Program (CRP): 19.5 million acres (nearly 8 million ha) in Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma, and Texas. This change in land use from cropland to grassland since 1985 has markedly influenced grassland bird populations. Many, but certainly not all, grassland species do well in CRP fields. The responses by birds to the program differ not only by species but also by region, year, the vegetation composition in a field, and whether or not a field has been hayed or grazed. The large scale and extent of the program has allowed researchers to address important conservation questions, such as the effect of the size of habitat patch and the influence of landscape features on bird use. However, most studies on nongame bird use of CRP in or near the Great Plains have been short-lived; 83% lasted only 1–3 years. Further, attention to the topic seems to have waned in recent years; the number of active studies peaked in the early 1990s and dramatically declined after 1995. Because breeding-bird use of CRP fields varies dramatically in response both to vegetational succession and to climatic variation, long-term studies are important. What was learned about CRP in its early stages may no longer be applicable. Finally, although the CRP provisions of the Farm Bill have been beneficial to many grassland birds, it is critical that gains in grassland habitat produced by the program not be offset by losses of native prairie.

Introduction

Grasslands are among the nation's most threatened ecosystems (Samson and Knopf 1994, Noss et al. 1995). Their declines have been dramatic, with losses of native grasslands reaching 99.9% for tallgrass prairie in many states, and 70–80% for mixed-grass prairies. Grassland communities and the wildlife that depend on them have suffered from these declines, as well as from

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fragmentation of remaining patches, invasion by exotic species, planting of woody vegetation, and disruption of disturbance processes (Johnson 1996).

The Conservation Reserve Program (CRP) was established under the Farm Bill to encourage agricultural producers to plant highly erodible croplands to grasses. The result has been a vast conversion of cropland to perennial grassland (Johnson et al. 1993). The Great Plains has been a priority area for the CRP because of its plentiful winds and highly erodible soils. As of September 2003, the enrollment in CRP in Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma, and Texas totaled 19.5 million acres (nearly 8 million ha). The majority of those lands were planted with introduced or native grasses, the former typically mixed with legumes. Grasslands established under the program offer the potential to mitigate some of the detrimental effects to fish and wildlife associated with the loss of native grassland. Johnson (2000) summarized research findings related to bird responses to CRP. This paper updates the information summarized in Johnson (2000) with new research conducted since that report.

Male lark bunting. (G. Kramer, USDA-NRCS)

Status of Grassland Birds

Johnson (2000) discussed the effects of grassland conversion to croplands. The historical prairies were reported to have rich abundances of wildlife (Dinsmore 1994). Surveys of bird populations over the past 35 years have documented the decline of more prairie bird species than in any other guild of birds (Peterjohn and Sauer 1999). As examples, declines during 1966–1979 were 3.4% per year for lark buntings (*Calamospiza melanocorys*), 4.3% per year for grasshopper sparrows (*Ammodramus savannarum*), and 5.5% for dickcissels (*Spiza americana*) (Sauer et al. 2004). Those numbers appear small, but they translate to declines of 34–52% for that short period of time. Projected for, say, 40 years, those trends would leave only 10–25% of the populations remaining.

Declines of grassland birds associated with the loss of prairies are due to a number of causes. Reduction in availability of habitat through conversion of prairies to croplands or other land uses is a primary cause. While some birds have been found to nest in croplands (e.g., horned lark [*Eremophila alpestris*], vesper sparrow [*Pooecetes gramineus*]) and in hayfields (e.g., waterfowl and vesper sparrow), their nests have high rates of failure because of the frequency of agricultural operations (Rodenhouse and Best 1983, Bollinger et al. 1990, Frawley and Best 1991, Dale et al. 1997, McMaster et al. 2005), producing conditions that can lead to population "sinks" (sensu Pulliam 1988). An additional cause

of decline in many areas is the habitat fragmentation resulting from the high levels of habitat loss, producing patches that lack sufficient size to support many bird species (Johnson 2001), or that have reduced reproductive rates due to edge effects that can increase the densities of predators (Clark and Reeder, *this volume*) or the brood parasite brown-headed cowbirds (*Molothrus ater*) (Koford et al. 2000). These influences are discussed in more detail below.

The value of grasslands to many bird species (e.g., Sprague's pipit [*Anthus spragueii*] and Baird's sparrow [*Ammodramus bairdii*]) has been found to be reduced by the invasion or planting of woody vegetation (Johnson 2000), even though areas supporting woody vegetation may contain more bird species than those without (Arnold and Higgins 1986). This increase in species tends to be due to the presence of edge or generalist species, such as brown thrasher (*Toxostoma rufum*), gray catbird (*Dumetella carolinensis*), song sparrow *(Melospiza melodia*), American robin (*Turdus migratorius*), and common grackle (*Quiscalus quiscula*). Woody vegetation has been found to influence grassland birds in several ways. First, the presence of trees and shrubs reduces the total area of grassland and fragments it. Second, it precludes some species from using the remaining grassland areas (Wiens 1969, Whitmore 1981, Kahl et al. 1985, Bollinger and Gavin 2004). Third, woody plants provide perches for raptors, other avian predators, and brown-headed cowbirds, as well as travel lanes for mammalian predators (Winter et al. 2000), which can result in reduced nest success near trees and shrubs (Johnson and Temple 1990, Bollinger and Gavin 2004). Fourth, species attracted to the woody vegetation may forage in nearby grasslands and potentially compete with prairie species.

CRP as Habitat for Grassland Birds

Evaluations of bird use of CRP fields in the Great Plains, summarized by Johnson (2000), have demonstrated that many species of birds utilize CRP, including lark bunting, western meadowlark (*Sturnella neglecta*), horned lark, Savannah sparrow (*Passerculus sandwichensis*), clay-colored sparrow (*Spizella pallida*), bobolink (*Dolichonyx oryzivorus*), common yellowthroat (*Geothlypis trichas*), sedge wren (*Cistothorus platensis*), and grasshopper sparrow, with different species occurring at different densities in different locations (Johnson and Schwartz 1993a,b; Hanowski 1995, Johnson and Igl 1995, Delisle and Savidge 1997, Horn 2000). Table 1 lists the primary species reported to occur in CRP in these studies.

Species	Great Plains Roughlands Johnson and Schwartz 1993a	Missouri Coteau Johnson and Schwartz 1993a	Drift Prairie Johnson and Schwartz 1993a	Black Prairie Johnson and Schwartz 1993a	Minnesota Hanowski 1995	Nebraska Delisle and Savidge 1997	North Dakota Horn 2000
Lark bunting	1	1					
Grasshopper sparrow	2	2	1.5	6	11	2	11
Red-winged blackbird	5	3	1.5	1	2	4	8
Western meadowlark	4	6	10	9.5	15	9	12
Horned lark	3	5	11				
Savannah sparrow	7	8	4	5	4		5
Brown-headed cowbird	6	4	8	9.5	11	3	1
Clay-colored sparrow	10.5	10	3	7	3		2
Bobolink	8	11	5.5	3	1	7	7
Common yellowthroat		12	5.5	4	8	5	6
Sedge wren			8	2	5	6	3
Chestnut-collared longspur	9	7					
Dickcissel		13	8	8		1	
Baird's sparrow	10.5	9	12				
American goldfinch[a]					6		9
Brewer's blackbird[b]					7		
Common grackle					9		
Tree swallow[c]					10		
Vesper sparrow					13		
Song sparrow					14		10
Mourning dove					16	9	
Northern bobwhite						9	
Ring-necked pheasant						11	
Le Conte's sparrow							4

a Carduelis tristis b Euphagus cyanocephalus c Tachycineta bicolor.

Table 1. Reported densities of breeding birds (by ranking) in Conservation Reserve Program fields in the northern Great Plains.

Johnson (2000) also reported that, in general, CRP fields supported larger populations of grassland birds than croplands, citing studies by Kimmel et al. (1992), Johnson and Igl (1995), and Wachob (1997). Johnson (2000) did note that the species composition of birds using CRP fields can vary dramatically from one year to the next, depending on climatic variation, succession of vegetation communities within CRP fields, and fluctuations in the numbers and distributions of birds. Johnson et al. (1997) surveyed breeding birds annually in several hundred CRP fields in 4 northern Great Plains states during 1990–1996. Ecological succession had taken place in these grasslands during that time as the plantings matured. In addition, the region experienced drought conditions early in the study but received above-average precipitation in the latter years. Bird populations responded to these changes in a variety of ways (Table 2). Many species had similar densities in 1990–1991 and 1995–1996, but several species increased in number fairly steadily throughout that period. They included common yellowthroat, bobolink, and clay-colored sparrow, all of which favor tall or dense vegetation. After the drought ended in mid-1993, several species increased, including northern harrier (*Circus cyaneus*), Wilson's phalarope

(*Phalaropus tricolor*), and Savannah sparrow, and some populations mushroomed, such as sedge wren and Le Conte's sparrow (*Ammodramus leconteii*) (Igl and Johnson 1999). Horned larks, chestnut-collared longspurs (*Calcarius ornatus*), and lark buntings typically declined in number (Table 2). These latter species prefer sparser, more open vegetation.

Species	Average density (pairs/100 ha)	
	1990–1991	1995–1996
Savannah sparrow	6	20
Clay-colored sparrow	5	12
Bobolink	5	9
Common yellowthroat	4	6
Sedge wren	3	11
Le Conte's sparrow	0	16
Lark bunting	21	4
Horned lark	7	1
Chestnut-collared longspur	2	0

Table 2. Average density of breeding birds in CRP fields in the northern Great Plains during 1990–1991 versus 1995–1996 (Johnson et al. 1997). Several species increased dramatically, while others declined.

Delisle and Savidge (1997) noted that grasshopper sparrow densities declined with time in CRP fields (1991–1994), a change they attributed to a buildup of litter and dead vegetation. Winter et al. (2005) noted that responses of densities and nesting successes of grassland birds to vegetation parameters varied by regions, years, and species.

Conservation Reserve Program fields have been found to support higher reproductive rates of grassland birds than croplands. Johnson (2000) noted work conducted by Berthelsen and Smith (1995), Clawson and Rotella (1998), and Koford (1999) that supported this relationship. However, because of the difficulty of finding nests (Winter et al. 2003), reproductive success has not been well studied in CRP fields in the Great Plains. Winter et al. (2005) emphasized the variability in nesting success that can occur due to the factors mentioned above for densities, and suggested that more research is needed before the relationships of many factors to nesting success will be understood. Further, some studies on nesting success in CRP fields have used artificial nests for their research focus, and extrapolation of the results of these studies to actual nests must be viewed with some caution (e.g., Major and Kendal 1996, Davison and Bollinger 2000).

Effects of Patch Size and Landscape Features on Bird Use

As identified above, and discussed by Johnson (2000, 2001) and Johnson and Winter (1999), habitat fragmentation can affect bird use of CRP. Habitat-fragmentation effects involve the size, shape, and distribution of patches as well as surrounding landscape conditions. Some patches may be too small to be used by certain species, or birds that do use smaller

patches may suffer more from competition, brood parasitism, or predation than birds in larger patches, resulting in lower nesting success. Smaller patches have a relatively greater proportion of their area near an edge, so edge effects (Faaborg et al. 1993, Clawson and Rotella 1998, Winter and Faaborg 1999, Winter et al. 2000) may be more pronounced, causing lower densities or reduced nesting success. Distribution of patches may also have an effect on bird use, as isolation from other grassland patches can affect occupancy by birds. Finally, arrangement of patches and presence of other vegetation types in the surrounding landscape can provide habitat conditions favorable to competing species, which in turn can reduce densities or nesting success of grassland birds.

These features have been found to operate among several species of grassland birds, in several regions, and in different types of grasslands (e.g., Herkert et al. 2003, Winter et al. 2005). In CRP fields specifically, Johnson and Igl (2001) related the occurrence of species and their densities to the patch size of each field. They conducted 699 fixed-radius point counts of 15 bird species in 303 CRP fields in 9 counties in 4 northern Great Plains states (Figure 1). They found that northern harriers, sedge wrens, clay-colored sparrows, grasshopper sparrows, Baird's sparrows, Le Conte's sparrows, and bobolinks favored larger grassland patches in 1 or more counties. In contrast, 2 edge species, mourning doves (*Zenaida macroura*) and brown-headed cowbirds, tended to prefer smaller grassland patches. Horn (2000) reported that bobolinks, grasshopper sparrows, and red-winged blackbirds (*Agelaius phoeniceus*) were more common in larger CRP fields, while brown-headed cowbirds preferred smaller fields. Wachob (1997) investigated sharp-tailed grouse (*Tympanuchus phasianellus*) and found that it favored larger CRP patches for nesting but not for brood-rearing. He also reported that leks were more common closer to CRP fields and in areas with extensive CRP grassland within 0.6 mile (1 km).

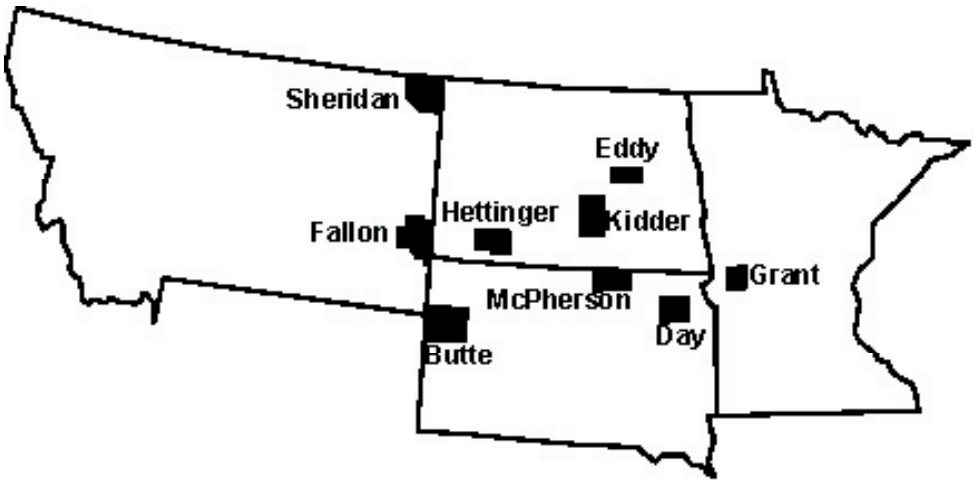

Figure 1. Counties containing study areas used in the Northern Prairie Wildlife Research Center long-term study of breeding-bird use of Conservation Reserve Program fields. Fallon (Montana), Butte (South Dakota), and Hettinger (North Dakota) counties are in the Great Plains Roughland geologic landform; Sheridan (Montana), Kidder (North Dakota), and McPherson (South Dakota) counties are in the Missouri Coteau; Eddy (North Dakota) and Day (South Dakota) counties are in the Drift Prairie; and Grant County (Minnesota) is in the Black Prairie.

Effects of Haying of CRP

In many counties, in certain years, CRP fields have been released for haying or, less frequently, grazing, due either to drought or to excessive precipitation, often in combination with landowner and political pressure. Johnson et al. (1998) assessed densities of breeding birds in hayed versus idled CRP, the year after the disturbance occurred. Because the authors used the same fields in all years, they had essentially a before-and-after, treatment-and-control design. They had data from nearly 300 fields that had been hayed and more than 2,600 fields that had been left idle in a year. A few species responded positively the year following haying; these were horned lark, chestnut-collared longspur, and lark bunting, all of which favor short and sparse vegetation. Many more species, in contrast, had reduced densities the year following haying, including vesper sparrow, sedge wren, common yellowthroat, bobolink, clay-colored sparrow, dickcissel, and Le Conte's sparrow.

Horn and Koford (2000) reported fewer sedge wrens and, possibly, clay-colored sparrows, Le Conte's sparrows, red-winged blackbirds, common yellowthroats, and grasshopper sparrows in mowed than in uncut CRP fields in the year after mowing. Savannah sparrows showed the opposite tendency, being more common in mowed CRP.

McCoy et al. (2001) noted that mowing of cool-season CRP plantings in Missouri in late summer and early fall permitted sufficient regrowth to provide habitat for wintering birds. In contrast, the value of mowed warm-season planting was reduced for at least 2 years. McMaster et al. (2005) investigated bird use of croplands converted to hayfields in Saskatchewan. They found nests of 26 species using the hayfields, and also found high levels of nest success compared to other related studies, but they noted that haying of the fields they investigated was delayed in the years of their study because of high precipitation. They acknowledged that mowing earlier in the season could have significantly reduced nesting success.

Use of CRP Habitat During the Nonbreeding Season

Johnson (2000) summarized studies of bird use of CRP during the nonbreeding season. King and Savidge (1995), Delisle and Savidge (1997), and Best et al. (1998) investigated winter use of CRP fields. Species noted to utilize CRP during this season included American tree sparrow (*Spizella arborea*), ring-necked pheasant (*Phasianus colchicus*), meadowlark, northern bobwhite (*Colinus virginianus*), dark-eyed junco (*Junco hyemalis*), red-winged blackbird, and horned lark. Johnson (2000) noted the lack of studies that have investigated nonbreeding-season bird

use of CRP. No new information has been identified relative to this subject since that report.

Research Needs and Status

As Johnson (2000) noted, much has been learned about CRP and its value to grassland birds, but a number of issues deserved further investigation, particularly landscape and patch-size effects (Johnson 2001, Johnson and Igl 2001). Johnson (2000) also noted that more information was needed about the influences of specific vegetation conditions on use of CRP by grassland birds.

Few studies have been conducted in the interim to address these questions. McCoy et al. (2001) reported greater use of CRP fields planted to cool-season species than to fields dominated by switchgrass (*Panicum virgatum*), a warm-season species. In CRP fields in eastern South Dakota, Eggebo (2001) observed higher densities of sedge wrens, Savannah sparrows, and bobolinks in cool-season than in warm-season plantings. The reverse pattern held for killdeer (*Charadrius vociferus*), mourning dove, song sparrow, and brown-headed cowbird, species less tightly dependent on grassland. Johnson and Schwartz (1993b) reported on the response of several species to differences in vegetation composition. More recent CRP guidelines have encouraged mixtures of more species in the plantings, which should develop into more diverse grasslands. A study recently concluded by the Northern Prairie Wildlife Research Center, with support from the U.S. Fish and Wildlife Service, is addressing some issues relating to planting mixtures in the northern Great Plains. Preliminary results indicate that plantings of either introduced or native grasses, along with legumes, support populations of breeding birds, although the species composition sometimes differs between the 2 types. Winter et al. (2005) emphasized the need for studies that included larger spatial and temporal scales to address many of the complexities of grassland bird abundances and nesting success.

Hay bales in Missouri CRP fields. (N. Klopfenstein, USDA-NRCS)

The effects of haying on the reproductive success of birds nesting in CRP fields, discussed above, also needs further study. While this need was noted by Johnson (2000), little remains known about the total immediate and long-term effects on reproduction during the year of mowing. In conventionally managed hayfields, mowing can be detrimental to birds that are still nesting, so the actual effect depends on the date of mowing (McMaster et al. 2005). Political and economic pressures continue to mount for earlier mowing dates, before the forage value of CRP vegetation diminishes, but earlier mowing is much more detrimental to breeding birds than is mowing after most of the nesting activities have been completed.

The advent of the Conservation Reserve Program, with the major changes it wrought on the Great Plains landscape, led to a large number of research studies. These projects, many of which were conducted by graduate students, sought to understand how CRP fields were used by birds. Other than the long-term study by Northern Prairie Wildlife Research Center (continuously from 1990 to the present), most of the studies on nongame bird use of CRP in or near the Great Plains were short-lived; 83% had durations of only 1 to 3 years.

Further, attention to the topic seems to have waned in recent years. The number of active studies (excluding those of Northern Prairie Wildlife Research Center) peaked in the early 1990s and has dramatically declined since 1995 (Figure 2). This pattern would pose no problem if the phenomenon under study were unchanging. But, as discussed by Igl and Johnson (1999) and Johnson (2000), breeding bird populations in CRP fields can vary dramatically in response both to vegetational succession and to climatic variation. What was learned about CRP in its early stages may no longer be applicable.

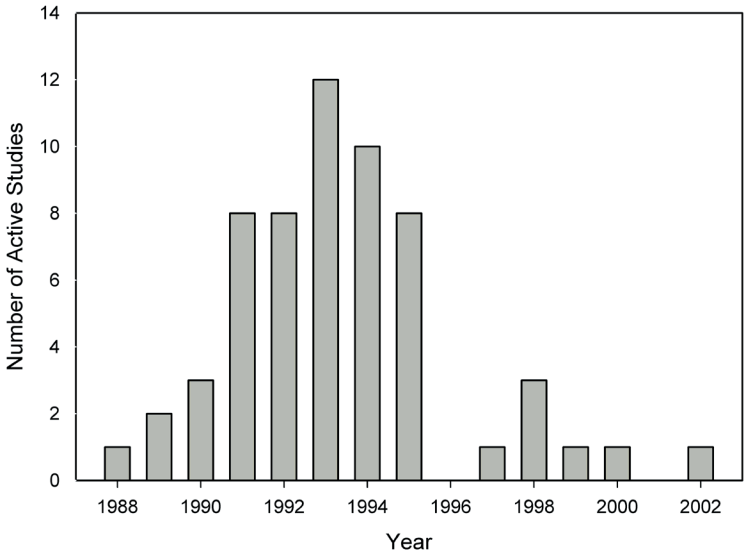

Figure 2. Number of studies involving bird use of Conservation Reserve Program fields in or near the Great Plains, by year, based on a review by the author of theses and published articles.

Conclusions

Conservation Reserve Program fields are clearly much more beneficial to a wide variety of breeding birds than are the cropland fields that they replaced. Tracts of untilled native prairie, however, are tremendously important to grassland birds; they support many species that rarely if ever use cropland or even CRP fields, such as burrowing owl (*Athene cunicularia*), Sprague's pipit, Baird's sparrow, and chestnut-collared longspur (D. H. Johnson and L. D. Igl, unpublished data). Likewise, Klute et al. (1997) found greater densities of several grassland species in grazed native prairie than in CRP fields in Kansas. Maintaining extant

Yellow-rumped warbler in a South Dakota prairie pothole. (D. Larson, USDA-NRCS)

native prairie should be a high priority for the conservation of birds (as well as many other animal and plant species). It is critical that farm programs do not directly or indirectly encourage conversion of native prairie to cultivation while seeking to restore perennial grassland to existing areas of cropland.

As reported by Johnson (2000), evidence indicates that native grasslands are being lost at the same time as CRP is reestablishing grassland. Johnson (2000) reported on information compiled by C. Madsen (U.S. Fish and Wildlife Service , personal communication). In South Dakota, 1,776,383 acres (718,884 ha) were enrolled in CRP by 1995. However, during the period (1985–1995), 707,896 acres (286,478 ha) of grassland were converted to cropland. Recent summaries of U.S. Department of Agriculture data indicate that sodbusting continues. Analyses by Ducks Unlimited show that 74,470 acres (30,137 ha) in North Dakota and 191,813 acres (77,625 ha) in South Dakota were broken for crops during 2002–2004 (J. K. Ringelman, Ducks Unlimited, personal communication). Analysis of Landsat satellite imagery of selected counties in North Dakota and South Dakota during 1982–2002 conducted by Ducks Unlimited likewise shows conversion of native grassland continues at an appalling rate (S. Stephens, Ducks Unlimited, personal communication). Tillage of rangeland is being encouraged by new varieties of crops, many of them genetically modified, such as Roundup®-ready (use of trade names does not imply endorsement by the U.S. government) corn and soybeans.

Natural Resources Inventory data tell similar stories of losses of grassland. In North Dakota, rangeland diminished by 791,100 acres (320,000 ha) between 1982 and 1997; pastureland declined by 160,900 acres (65,100 ha) during the same period (USDA 2000). Those losses definitely offset many of the gains in wildlife habitat provided by the 2,802,300 acres (1,133,700 ha) enrolled in CRP in North Dakota by 1997. Similarly, losses of rangeland between 1982 and 1997 totaled 1,089,300 acres (440,800 ha) in South Dakota, 1,076,300 acres (435,600 ha) in Montana, and 506,500 acres (205,000 ha) in Nebraska. More recent Natural Resources Inventory results are not yet available by state, but nationwide values show a continuing decline in the area of land used for grazing (USDA 2004). These changes in land use undoubtedly have had a negative influence on the populations of many grassland bird species.

Although Conservation Reserve Program fields are much more beneficial to breeding birds in the northern Great Plains than in the croplands that they replaced, the continuing loss of native grasslands is a critical concern. Those native grasslands provide habitat for a wide variety of breeding birds, including many species that make little if any use of

cropland or even CRP fields. Further, native rangeland often occurs in large patches and thus is less susceptible to many of the problems associated with fragmentation that were previously described. Conversion of cropland to CRP grasslands may be only temporary, but the conversion of native prairie to cropland is virtually permanent; prairie restoration is a costly process that does not fully restore the integrity of native prairie ecosystems. Recent Farm Bills have made positive contributions to wildlife habitat though the Conservation Reserve Program. Those contributions would be greatly enhanced if they also discouraged further cultivation of existing native grassland and fostered the preservation of these threatened ecosystems. A more balanced and comprehensive program is needed.

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