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GRASSLAND BIRD ASSOCIATIONS WITH INTRODUCED AND NATIVE GRASS CONSERVATION RESERVE PROGRAM FIELDS IN THE SOUTHERN HIGH PLAINS

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ABSTRACT.—We examined relative abundances of grassland birds among Conservation Reserve Program (CRP) fields seeded with 2 monocultures of introduced grass species and 2 mixes of native grasses in the Southern High Plains of Texas. We assessed bird compositions among these 4 cover types and between the cover types pooled into categories of introduced and native fields. Breeding season bird diversity and total abundance did not differ among cover types or between introduced and native fields. Grasshopper Sparrows (*Ammodramus savannarum*), Cassin's Sparrows (*Aimophila cassinii*), and Western Meadowlarks (*Sturnella neglecta*) accounted for more than 90% of breeding season detections. Grasshopper Sparrows were the most abundant and found in all cover types. Cassin's Sparrows were 38% to 170% more abundant among the native seed mix without buffalograss (*Buchloë dactyloides*) compared to 3 other cover types. Although this association was statistically lost when cover types were pooled into introduced or native fields ($U = 93.5$, $P = 0.91$), the species was still 50% more abundant among native CRP than introduced CRP fields. Meadowlarks occurred ubiquitously but at very low numbers during the breeding season. During winter, avian abundance was 44% greater among native CRP than introduced CRP fields. Meadowlarks, Horned Larks (*Eremophila alpestris*), and Savannah Sparrows (*Passerculus sandwichensis*) accounted for 94% of all winter detections. Meadowlarks occurred ubiquitously, but Horned Larks and Savannah Sparrows were 157% and 96% more abundant, respectively, among native CRP than introduced CRP fields. Our data suggest that monocultures of introduced grasses may benefit some bird species but also that native seed mixes may have a more positive influence through increased diversity and abundance of grassland birds. However, pooling cover types into the broader categories of introduced or native grasses may dampen or occlude biologically meaningful results. It may be prudent to avoid broad categorization of CRP fields based solely on native or introduced grass cover when assessing habitat associations of grassland birds.

Key words: Ammodramus savannarum, Aimophila cassinii, *Cassin's Sparrow, Conservation Reserve Program,* Eremophila alpestris, *Grasshopper Sparrow, Horned Lark,* Passerculus sandwichensis, *Savannah Sparrow,* Sturnella neglecta, *Western Meadowlark.*

Grassland birds have experienced steeper, more consistent, and more geographically widespread population declines than any other behavioral or ecological guild in North America (Knopf 1994: 251)—a pattern that appears to be continuing into the present (e.g., Sauer et al. 2008). Landscape fragmentation, degradation, and conversions of native prairies are considered driving forces behind these declines of obligate grassland birds (Knopf 1994, Peterjohn and Sauer 1999). For example, only 20% of the historic 1.7 million hectares of shortgrass prairie are estimated to remain on the High Plains of Texas (Samson and Knopf 1994) where many obligate grassland birds are considered declining.

An important tool in conservation of grassland birds is the Conservation Reserve Program (CRP). Originally enacted to conserve soil and water resources and reduce agricultural surplus, CRP also is recognized for providing valuable habitat for wildlife (Wildlife Management Institute 2000). Although the CRP is not intended to restore native prairie, CRP fields provide areas of vegetation more characteristic of natural grassland conditions than croplands and are valuable as breeding and wintering habitat for some grassland birds (Johnson and Schwartz 1993, Best et al. 1997, Brennan and Kuvlesky 2005).

The CRP enrolls grass fields for contract periods of at least 10 years. Except during emergency declarations, these areas cannot be grazed or mowed (Young and Osborn 1990). Numerous studies have examined abundances of grassland birds among croplands and CRP

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fields consisting of perennial introduced grasses and legumes (i.e., introduced fields) or perennial native grasses (i.e., native fields), but few have examined the influence of specific CRP seeding mixes on grassland bird composition and abundance. Berthelsen and Smith (1995) found bird nesting densities were similar among 3 CRP cover types in the Southern High Plains of Texas. Similarly, King and Savidge (1995) found no relationship between bird numbers and vegetation diversity among CRP plots in Nebraska. In contrast, Delisle and Savidge (1997) found that some species were associated with introduced or native fields in Nebraska, and Davis and Duncan (1999) found that vegetative structure was more important than plant-species composition in grassland bird habitat selection in Saskatchewan.

In an attempt to improve grassland habitat for wildlife, the Farm Bill of 1996 (i.e., the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104-127) required landowners reenrolling existing CRP contracts to reseed 51% of CRP land with native grass mixes. Furthermore, all new CRP contracts required seeding of at least 90% of the enrolled area with native grass species (there were exceptions related to existing grasslands). However, the value of CRP fields seeded with native shortgrass species in providing habitat for obligate grassland birds has received little evaluation in regions once dominated by shortgrass prairie. Thus, the use of native seed mixes, which are more expensive than mixes containing introduced species (C.L. Coffman, USDA Natural Resource Conservation Service, personal communication), requires greater financial output by landowners without demonstrated wildlife benefit. To better understand the contributions and values of the different seeding mixtures to grassland bird conservation, we examined associations of grassland birds with introduced and native CRP cover types found in the Southern High Plains of Texas. Based on an evolutionary association of North American grassland birds with native prairie lands, we predicted greater abundance and richness of avifauna among native CRP than introduced CRP cover types. We conducted our study during the breeding seasons of 2001 and 2002 and winters of 2002 and 2003.

Study Area

Our study area lies within the shortgrass prairie region (Bird Conservation Region 18) (Rich et al. 2004). Specifically, we conducted our study in the Southern High Plains of Texas—a region straddling the Texas–New Mexico border and bound by the Canadian River to the north and the Caprock Escarpment to the south and east (Blackstock 1979). The region is characterized by nearly flat to gently undulating featureless plains (880–1200 m elevation) and a dry continental-steppe climate with mild winters. Most rainfall occurrs from April to October (Blackstock 1979). We used data from the National Climate Data Center (http://www7.ncdc.noaa.gov/IPS/cd/cd.html; accessed 11 November 2008) to calculate precipitation and temperature measures for the study area, which included Hale, Lamb, Lubbock, and Terry counties. During 2001–2003, the 4-county area received an average annual precipitation of 38.8 cm, with average winter and summer temperatures of 4.2 °C and 27.2 °C, respectively, and extremes of –12.8 °C and 41.7 °C. This period tended to be slightly cooler and warmer than the long-term average temperatures of 7.7 °C and 22.7 °C, with less precipitation than the average 47.3 cm. Historically, the region was dominated by short- and mixed-grass prairie, with large portions of buffalograss (*Buchloë dactyloides*) and blue grama (*Bouteloua gracilis*). During our study, the landscape was mostly agricultural with large portions of the study area being used for cotton, grain sorghum, wheat, corn, and other grain-crop production.

Methods

Field Selection

Our study was conducted on CRP fields seeded with grass mixes that were most common in the south central portion of the Southern High Plains. These included 2 types of introduced grasses (hereafter, introduced fields) and 2 types of native grass mixes (hereafter, native fields). The introduced fields were monocultures of weeping lovegrass (*Eragrostis curvula;* hereafter, Lovegrass) and Old World bluestem (*Bothriochloa ischaemum;* hereafter, Bluestem). The native fields were mixes of native grass species, principally sideoats grama (*Bouteloua curtipendula*), blue grama, green sprangletop (*Leptochloa dubia*), switchgrass (*Panicum virgatum*), and buffalograss. Because of the historical importance and abundance of buffalograss in native shortgrass prairies and because it is not always selected in native mixes due to cost, we separated native mixes into 2 cover types based on whether buffalograss was included in (hereafter, Native B) or absent from (hereafter, Native A) the seeding mix.

We selected our study fields from the initial pool of potential CRP fields based on 2 criteria. First was that the seeded grasses had become established, because native grasses seeded in some CRP fields had not yet become established. Second was a willingness of landowners to allow us to access their property. Our final selection of 14 CRP fields consisted of 6 introduced fields and 8 native fields. The introduced fields were cover types of over 90% of either Lovegrass (3 fields) or Bluestem (3 fields; Table 1). Within the native fields were 4 fields of Native B, which were composed of 5 species accounting for over 97% of the grass cover, and 4 fields of Native A, composed of 10 species accounting for over 96% of the grass cover (Table 1). All study fields were approximately 65 ha in area and separated by more than 0.5 km. All CRP fields had been established for at least 3 years, but it was not possible for us to be consistent in the age of fields due to different seeding requirements at different periods of enrollment. Introduced fields were enrolled during either the 1987, 1988, or 1992 signups and then extended into continuous enrollment, whereas native fields were enrolled in 1993, 1997, and 1998.

Breeding Season Surveys

We used 75-m fixed-radius points (1.8 ha) to survey birds in our study fields. Survey points were separated by 200 m and were ≥125 m from any field edge and ≥75 m from any changes in cover vegetation to reduce the possibility of edge effects during the surveys. These criteria allowed for 9 survey points and a total surveyed area of 16.2 ha in each field. We conducted surveys from one-half hour before sunrise until approximately 3 hours after sunrise; we did not conduct surveys if it was raining or if winds exceeded 18 km · h^{-1} (Ralph et al. 1993). While conducting surveys we recorded all birds seen or heard within the 75-m radius during a 5-minute interval. We did not record birds that flew overhead unless they landed within the 75-m-radius survey area. Because we wanted to assess use of CRP types across the breeding season, we surveyed each field 3 times during the breeding season (May, June, and July) of 2001 and 2002 (Hutto et al. 1986).

Winter Surveys

Grassland passerines are generally quiet and secretive during winter, which may lead to low detection rates for fixed-radius point surveys (Heath et al. 2008). Therefore, we walked fixed-width transects spaced 50 m apart and recorded all birds detected within 25 m of either side of the transect (Delisle and Savidge 1997). We kept transect width narrow to reduce potential biases associated with this method (Buckland et al. 2001). We conducted surveys in 400 × 400-m blocks located approximately in the middle of each study field. Each block contained 8 parallel, 400-m-long transects, resulting in 3.2 km of transect and a total surveyed area of 16 ha in each study field. We surveyed each field twice each winter (7 January–26 February 2002 and 3 January–4 March 2003). We conducted surveys throughout the day but started no earlier than an hour and a half after sunrise and ended before sunset. We did not conduct surveys if there was any precipitation or if winds exceeded 18 km · h^{-1} (Ralph et al. 1993).

Analytical Approach

For season-specific estimates and comparison of species richness and average abundance, we included all species detected during surveys in each season. We used Shannon's index to calculate species richness. To assess differences among CRP cover types being masked when pooled at the broader categories of "introduced" or "native," as has been frequently done in other studies, we also tested for differences between pooled introduced fields and native fields for each year and for the years combined.

Project constraints that limit the number of species whose numbers can be reliably estimated by detectability methodology dictate that indices of abundance be used for individual species assessments (Thompson et al. 1998). Indices provide a means for comparisons among treatments and similar habitat types (e.g., shortgrass CRP; Dale et al. 1997, Hutto and Young 2002). We suspect that variance in detectability among plots in our study was negligible due to

TABLE 1. Percent cover of grass species accounting for ≥1.0% of species among CRP fields seeded with weeping lovegrass (Lovegrass), Old World bluestem (Bluestem), native grass mixes with buffalograss (Native B), and native grass mixes without buffalograss (Native A) studied in the Southern High Plains of Texas, 2001–2002 (from Thompson 2003).

	Introduced fields				Native fields			
	Lovegrass		Bluestem		Native B		Native A	
Species	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
Aristida purpurea							3.2	0.9
Bothriochloa ischaemum		91.4	1.8	3.2	0.9			
Bothriochloa laguroides							3.8	1.1
Bouteloua curtipendula					75.2	2.0	32.6	2.3
Bouteloua gracilis			4.4	1.2	11.4	1.4	11.8	1.5
Bromus japonicus					3.6	0.8		
Buchloë dactyloides					5.1	1.0		
Digitaria californica							3.3	0.3
Eragrostis curvula	98.2	0.8					11.2	1.6
Leptochloa dubia							5.5	1.0
Panicum virgatum							16.0	1.7
Sorghum halepense			2.9	1.1			3.9	1.1
Sporobolus cryptandrus							5.3	1.1

minimal diversity in structural characteristics likely to influence detection rates differently among plot types (see Table 1). Furthermore, during the breeding season we assessed species-specific abundances among plot types on the basis of singing males only, which, by announcing their presence and territory occupancy, are making themselves detectable. We therefore express our data as a relative abundance per hectare, which should not be construed to be an actual density.

We report all species detected by study plot type, and we compare avian richness, average overall species abundances, and species-specific abundances among the 4 cover types and between the introduced and native fields using repeated-measures analysis of variance (rmANOVA; Zar 1999). The cover type and field type (introduced or native) were our independent variables, with year as the repeated measure. We used Tukey's HSD test to identify differences among means when they were significant ($P < 0.05$). We used natural-log transformation to normalize data as necessary. In cases where we could not normalize data, we used Kruskal-Wallis one-way analyses to test among cover types and the Mann-Whitney *U* test to detect differences between pooled introduced fields and pooled native fields (Conover 1980) for years combined. We used STATISTICA 6.1 (StatSoft, Inc., Tulsa, OK) for data analysis. In addition to statistical analysis, we calculated the percent differences in abundance by dividing the difference in abundance estimates between 2 cover types by the average of those cover types. The use of trade, product, industry, or firm names or products is for informative purposes only and does not constitute an endorsement by the U.S. Government or the U.S. Geological Survey.

RESULTS

Breeding Avian Composition and Abundances

We identified 16 bird species among the 14 CRP study fields during the breeding seasons (May–July) of 2001 and 2002 (Table 2). Species richness was similar among cover types ($F_{3,10}$ = 1.27, P = 0.34), between introduced and native fields ($F_{1,12}$ = 3.38, P = 0.09), and between years ($F_{1,10}$ = 0.34, P = 0.57 and $F_{1,12}$ = 0.37, P = 0.55); there were no cover type × year ($F_{3,10}$ = 0.38, P = 0.77) or introduced or native field type × year ($F_{1,12}$ = 0.01, P = 0.94) interactions (Table 3). During the breeding season, all study fields were dominated by 1 or 2 species that accounted for approximately 80% of all individuals detected. Bird abundances also did not differ among cover types ($F_{3,10}$ = 0.80, P = 0.522), between introduced or native fields ($F_{1,12}$ = 2.25, P = 0.159), or between years ($F_{1,10}$ = 3.06, P = 0.1109 and $F_{1,12}$ = 3.27, P = 0.0958); there were no cover type × year ($F_{3,10}$ = 0.96, P = 0.448) or introduced or native field type × year ($F_{1,12}$ = 1.76, P = 0.2096) interactions (Table 3).

Grasshopper Sparrows (67%), Cassin's Sparrows (17%), and Western Meadowlarks (7%)

TABLE 2. Season-specific detections of bird species among CRP fields of monocultures of introduced weeping lovegrass (Lovegrass) and introduced Old World bluestem (Bluestem), and native grass mixes with buffalograss (Native B) and without buffalograss (Native A) in the Southern High Plains of Texas, 2001–2003.

		Breeding				Winter			
Common name	Binomial	Lovegrass	Bluestem	Native B	Native A	Lovegrass	Bluestem	Native B	Native A
Mallard	*Anas platyrhynchos*		X						
Green-winged Teal	*Anas crecca*		X						
Northern Harrier	*Circus cyaneus*					X		X	X
Prairie Falcon	*Falco mexicanus*					X			
Ring-necked Pheasant	*Phasianus colchicus*	X	X	X	X	X	X		
Mourning Dove	*Zenaida macroura*	X	X	X	X			X	X
Short-eared Owl	*Asio flammeus*						X	X	
Burrowing Owl	*Athene cunicularia*				X		X	X	X
Western Kingbird	*Tyrannus verticalis*	X	X	X	X				
Scissor-tailed Flycatcher	*Tyrannus forficatus*	X	X		X				
Horned Lark	*Eremophila alpestris*				X		X	X	X
Blue Grosbeak	*Guiraca caerulea*				X				
Green-tailed Towhee	*Pipilo chlorurus*								X
Cassin's Sparrow	*Aimophila cassinii*	X	X	X	X				
Grasshopper Sparrow	*Ammodramus savannarum*	X	X	X	X		X	X	
Savannah Sparrow	*Passerculus sandwichensis*					X	X	X	X
Vesper Sparrow	*Pooecetes gramineus*							X	
Lark Bunting	*Calamospiza melanocorys*	X	X	X	X				
Western Meadowlark	*Sturnella neglecta*	X	X	X	X	X	X	X	X
Great-tailed Grackle	*Quiscalus mexicanus*			X					
Bullock's Oriole	*Icterus bullockii*	X							
Red-winged Blackbird	*Agelaius phoeniceus*	X	X	X					

TABLE 3. Number of bird species detected, mean ($s_{\bar{x}}$) overall relative abundance (number · ha⁻¹), and Shannon's index of species richness among CRP fields of weeping lovegrass (Lovegrass), Old World bluestem (Bluestem), native grass mixes with buffalograss (Native B) and native grass mixes without buffalograss (Native A), and the pooled categories of introduced (Lovegrass and Bluestem) and native (Native B and Native A) in the Southern High Plains of Texas, 2001–2003.

	Lovegrass	Bluestem	Native B	Native A	Introduced	Native
Breeding season						
Number of species	10	10	9	11	10	13
Avian abundance	1.22 (0.15)	1.32 (0.11)	1.10 (0.10)	0.98 (0.13)	1.27 (0.09)	1.04 (0.08)
Species richness	0.81 (0.09)	0.70 (0.10)	0.45 (0.09)	0.58 (0.12)	0.76 (0.07)	0.52 (0.07)
Winter season						
Number of species	5	7	9	7	9	10
Avian abundance	2.50 (0.89)	2.83 (0.48)	4.38 (0.32)	4.00 (0.63)	2.67 (0.48)	4.19 (0.34)
Species richness	0.47(0.17)	0.71 (0.10)	1.16 (0.08)	1.01 (0.08)	0.59 (0.10)	1.08 (0.06)

TABLE 4. Relative abundance of breeding-season singing males (number · ha⁻¹) of 3 dominant bird species detected among Conservation Reserve Program fields of monocultures of introduced weeping lovegrass (Lovegrass) and Old World bluestem (Bluestem) and native fields of grass mixes with (Native B) and without (Native A) buffalograss in the Southern High Plains of Texas, 2001 and 2002.

	Grasshopper Sparrow		Cassin's Sparrow		Western Meadowlark	
Cover type	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
2001						
Lovegrass	0.38	0.14	0.10	0.07	0.01	0.02
Bluestem	0.55	0.27	0.04	0.07	0.01	0.02
Native B	0.36	0.23	0.00	0.00	0.04	0.06
Native A	0.18	0.23	0.27	0.20	0.03	0.04
Introduced pooled	0.46	0.22	0.07	0.07	0.01	0.02
Native pooled	0.27	0.24	0.14	0.20	0.03	0.05
2002						
Lovegrass	0.37	0.15	0.09	0.13	0.02	0.04
Bluestem	0.42	0.13	0.13	0.12	0.01	0.02
Native B	0.46	0.22	0.04	0.11	0.06	0.11
Native A	0.13	0.18	0.27	0.21	0.00	0.01
Introduced pooled	0.39	0.14	0.11	0.12	0.01	0.03
Native pooled	0.29	0.26	0.16	0.20	0.03	0.08
Years pooled						
Lovegrass	0.38	0.14	0.10	0.10	0.01	0.03
Bluestem	0.49	0.22	0.09	0.11	0.01	0.02
Native B	0.41	0.23	0.02	0.08	0.05	0.08
Native A	0.16	0.20	0.27	0.20	0.02	0.03
Introduced pooled	0.43	0.19	0.09	0.10	0.01	0.02
Native pooled	0.29	0.25	0.15	0.20	0.03	0.06

accounted for more than 90% of all detections. Thus we assessed habitat relationships only for these species. We found no differences in abundance of singing male Grasshopper Sparrows among cover types ($F_{3,10}$ = 3.07, P = 0.08), between introduced and native fields ($F_{1,12}$ = 2.26, P = 0.16), between years within cover type ($F_{1,10}$ = 0.29, P = 0.60), or within introduced fields and native fields ($F_{1,12}$ = 0.28, P = 0.60). However, Grasshopper Sparrows were 39% more abundant among introduced fields than native fields. When examining cover types, it was apparent that the species occurred in relatively equal numbers among the Lovegrass, Bluestem, and Native-B fields but were 81% to 101% less abundant in Native-A fields (Table 4).

Abundances of singing male Cassin's Sparrows did not differ between years (U = 81.0, P = 0.43), between years within cover types (Lovegrass: U = 3.5, P = 0.66; Bluestem: U = 2.0, P = 0.28; Native B: U = 4.0, P = 0.25; Native A: U = 7.0, P = 0.77), or between years within introduced fields (U = 15.5, P = 0.69) and native fields (U = 26.0, P = 0.53). Cassin's Sparrows were more abundant in Native-A fields (92% to 170%) than in any other cover type (H = 14.27, P = 0.003; Table 4). When cover types were pooled, the species was 50% more abundant in native fields, but this difference was not statistically significant ($U = 93.5$, $P = 0.91$).

We found no difference in abundance of singing male Western Meadowlarks between years ($U = 85.0$, $P = 0.55$), between years within the cover types of Lovegrass ($U = 4.0$, $P = 0.83$), Bluestem ($U = 4.5$, $P = 1.00$) and Native B ($U = 6.0$, $P = 0.56$), or between years within introduced ($U = 17.0$, $P = 0.87$) and native ($U = 23.5$, $P = 0.37$) fields. There was no detectable difference among cover types when the years were pooled ($H = 2.79$, $P = 0.43$). Unlike the 2 sparrow species, for which there were no detectable statistical differences in abundance between pooled introduced and native fields, meadowlarks were less abundant in introduced fields ($U = 55.0$, $P = 0.04$; Table 5). Unfortunately, the low encounter rates for meadowlarks in all cover types render statistical tests of questionable interpretive value.

Winter Avian Composition and Abundances

We recorded 12 bird species on our study fields during winters of 2002 and 2003 (Table 2). Species richness differed among cover types ($F_{3,10} = 4.49$, $P = 0.035$) and between introduced and native fields ($F_{1,12} = 11.74$, $P = 0.005$), with native fields having a richness index of 1.08 compared to 0.59 among introduced grass fields ($P < 0.05$). Species richness did not differ between years ($F_{1,10} = 0.11$, $P = 0.741$ and $F_{1,12} = 0.13$, $P = 0.72$), and there were no cover type × year ($F_{3,10} = 0.11$, $P = 0.95$) or introduced or native field type × year ($F_{1,12} = 0.02$, $P = 0.90$) interactions.

Overall relative abundance of birds differed among cover types ($F_{3,10} = 3.98$, $P = 0.04$) and between introduced and native fields ($F_{1,12} = 14.31$, $P = 0.003$) but not between years ($F_{1,10} = 2.63$, $P = 0.13$ and $F_{1,12} = 2.59$, $P = 0.13$). Among cover types ($P < 0.05$) and between introduced and native fields ($P = 0.003$), introduced fields had lower relative abundance (1.76 birds $\cdot$ ha^{-1}, $s = 0.40$) than native fields (4.47 birds $\cdot$ ha^{-1}, $s = 0.73$). Additionally, there were no cover type × year ($F_{3,10} = 0.90$, $P = 0.476$) or introduced or native field type × year ($F_{1,12} = 0.49$, $P = 0.499$) interactions.

We assessed winter species-specific abundances only for those species accounting for over 94% of all detections: Western Meadowlarks (37%), Horned Larks (*Eremophila alpestris;* 32%), and Savannah Sparrows (25%). Winter abundances for Western Meadowlark were similar among cover types ($F_{3,10} = 0.46$, $P = 0.71$) and between introduced and native fields ($F_{1,12} = 1.06$, $P = 0.28$; Table 5). Although we had higher detection rates for the species in 2003 ($F_{1,10} = 7.16$, $P = 0.02$), we did not detect any cover type × year ($F_{3,10} = 0.23$, $P = 0.87$) or introduced or native field type × year ($F_{1,12} = 0.14$, $P = 0.71$) interactions.

We found Horned Larks in all cover types except lovegrass. Abundances did not differ between years ($U = 87.5$, $P = 0.63$), between years within cover types (bluestem: $U = 2.0$, $P = 0.27$; native B: $U = 6.0$, $P = 0.66$; native A: $U = 6.5$, $P = 0.73$), or between years within introduced ($U = 19.5$, $P = 0.81$) or native ($U = 21.0$, $P = 0.74$) fields. When we pooled years, we detected more Horned Larks in the native-B cover type than in the bluestem cover type ($H = 10.69$, $P = 0.03$). The greater abundance (157%) among native fields compared to introduced fields was striking.

We found no differences in abundances of Savannah Sparrows among cover types or between introduced and native fields between years ($F_{1,10} = 3.75$, $P = 0.08$ and $F_{1,12} = 2.97$, $P = 0.11$), and there were no cover type × year ($F_{3,10} = 1.73$, $P = 0.22$) or introduced or native type × year ($F_{1,12} = 0.04$, $P = 0.84$) interactions. However, on a percent abundance basis, Savannah Sparrows were 55% to 133% more abundant among native-A fields compared to other cover types. When years were pooled, Savannah Sparrows were significantly more abundant (96%) in native fields ($F_{1,12} = 6.36$, $P = 0.03$; Table 5)

DISCUSSION

We predicted greater use by grassland birds of native grass CRP fields than introduced grass CRP fields. However, we found no breeding season difference among cover types in total avian abundance or species richness. Similar studies in Nebraska (King and Savidge 1995, Delisle and Savidge 1997) and Missouri (McCoy et al. 2001) also found no differences among introduced and native fields in terms of total avian abundance or species richness during the breeding season. In contrast to the breeding season, however, our prediction held

TABLE 5. Winter season relative abundance (number · ha^{-1}) of 3 dominant bird species detected among Conservation Reserve Program fields of monocultures of introduced weeping lovegrass (Lovegrass) and Old World bluestem (Bluestem) and native fields of grass mixes with (Native B) and without (Native A) buffalograss in the Southern High Plains of Texas, 2002 and 2003.

	Western Meadowlark		Savannah Sparrow		Horned Lark	
Cover type	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
2001						
Lovegrass	0.17	0.05	0.05	0.09	0.00	0.00
Bluestem	0.08	0.05	0.02	0.02	0.10	0.18
Native B	0.22	0.15	0.19	0.14	0.35	0.32
Native A	0.16	0.04	0.17	0.13	0.14	0.20
Introduced pooled	0.13	0.07	0.04	0.06	0.05	0.13
Native pooled	0.19	0.11	0.18	0.13	0.25	0.27
2002						
Lovegrass	0.25	0.25	0.15	0.20	0.00	0.00
Bluestem	0.29	0.18	0.09	0.14	0.06	0.10
Native B	0.39	0.30	0.15	0.10	0.34	0.21
Native A	0.35	0.18	0.42	0.19	0.49	0.78
Introduced pooled	0.28	0.20	0.12	0.16	0.03	0.08
Native pooled	0.37	0.23	0.28	0.20	0.42	0.54
Years pooled						
Lovegrass	0.21	0.16	0.10	0.15	0.00	0.00
Bluestem	0.19	0.16	0.06	0.10	0.08	0.13
Native B	0.30	0.24	0.17	0.12	0.35	0.25
Native A	0.25	0.16	0.30	0.20	0.32	0.56
Introduced pooled	0.20	0.16	0.08	0.12	0.04	0.10
Native pooled	0.28	0.20	0.23	0.17	0.33	0.42

up during the winter, with more species and a greater abundance of grassland birds detected among CRP fields with native seeding than CRP fields with introduced seeding.

In addition to structural characteristics of different CRP cover types (e.g., Thompson 2003), factors such as abundance of invertebrate prey or seeds may influence occupancy by grassland birds. Availability of insect prey is critical for successful nesting by grassland birds (Wiens and Rottenberry 1979), but McIntyre and Thompson (2003) found no difference in arthropod richness or abundances among CRP fields used in our study. This consistency may partly explain the lack of differences in abundance of some breeding grassland birds among cover types. The differences in species presence and abundance among CRP fields during the winter may be partially explained by Horned Larks forming large winter flocks in native fields. However, other factors likely play a substantive role in breeding and wintering avian distributions and abundances among CRP fields. These include local and regional landscape features (Bakker et al. 2002, Fletcher and Koford 2002) and fragmentation of the surrounding landscape compositions (Coppedge et al. 2001, Johnson 2001).

Grasshopper and Cassin's Sparrows accounted for 83.1% of all breeding-bird detections. Both species are declining (Sauer et al. 2008) and have been identified as migratory nongame birds of management concern (Rich et al. 2004). Based on our information, introduced CRP fields were as attractive to Grasshopper Sparrows as the Native-B CRP fields were. However, there were noticeably fewer Grasshopper Sparrows in the native-A cover type, possibly due to the vegetative features Grasshopper Sparrows are typically associated with (Vickery 1996). The Native-B, Bluestem, and Lovegrass cover types were similar in forb height, low percentage of bare ground, and high percentage of grass cover compared to Native-A cover type (Thompson 2003). Saab et al. (1995) recorded grasshopper sparrows in more-lushly vegetated areas of the southwestern shortgrass prairie, and it has been speculated that the species may rely heavily on CRP fields in the region for that reason (Vickery 1996).

An important habitat component for Cassin's Sparrows are shrubs that provide perches from which skylarking and flight songs are initiated (Dunning et al. 1999, Ruth 2000). These behaviors are important for territory establishment and defense, mate attraction, and predator detection (Anderson and Conway 2000). We found Cassin's Sparrows most abundant in native A, which had only low to moderate shrub densities (Thompson 2003). Although it may be counterintuitive that Cassin's Sparrows would be most abundant in fields with low shrub densities, in native-A fields this species would regularly initiate flight songs from patches of bare ground. Thus Cassin's Sparrows might use areas of adequate nesting substrate with low shrub densities if bare ground or other vegetation is available for song and flight-song perches.

An important point regarding our data on Cassin's Sparrows concerns resolution of habitat types. Although Cassin's Sparrows were more abundant in native-A fields, the ability to discern their association with heterogeneous mixes of native species was lost when cover types were pooled into the coarser categories of introduced or native field types. Thus assessment of Cassin's Sparrow use of CRP fields, and perhaps use by other grassland species, may require examination at finer resolutions than the broad categories of introduced or native field types.

Our data suggest that no one seeding type is most attractive to grassland passerines in general but that CRP fields function as an important conservation tool. Similar to our study, other researchers found that CRP fields planted with mixtures of native grasses promoted increased avian abundance, diversity, use, and production compared to monocultures of introduced grass (Delisle and Savidge 1997, Davis and Duncan 1999, McCoy et al. 2001). In comparison to introduced monocultures, native seed mixes on CRP fields may have more positive influences for grassland birds. Pooling of cover types into the broader categories of introduced or native grasses risks dampening or occluding biologically meaningful results in characterizing vegetative characteristics or avian abundances in CRP fields of different grass compositions. For this reason, it would be prudent to avoid broad categorization of CRP lands as only introduced or native fields when assessing the value of different CRP field cover types.

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