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# SEED AVAILABILITY IN GRAZED PASTURES AND CONSERVATION RESERVE PROGRAM FIELDS DURING WINTER IN KANSAS

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Abstract.—Studies have documented the importance of Conservation Reserve Program (CRP) fields to breeding birds, but few have examined them as food sources for wintering birds. We compared the biomass of seeds in CRP fields to that in grazed native grass pastures in northeastern Kansas during two winters. Log transformed total seed biomass was significantly lower in grazed pastures than in CRP fields during the first winter but not the second. Total seed biomass in CRP fields was highly variable, and decreased between November and February. Seeds that were typically abundant in CRP fields are important food items of wintering grassland birds. In conclusion, CRP fields are superior to grazed native grass pastures in northeastern Kansas as winter foraging habitat for birds.

**ACCESIBILIDAD DE SEMILLAS EN PRADERAS COSECHADAS Y EN CAMPOS DEL PROGRAMA DE RESERVAS DE CONSERVACIÓN EN KANSAS DURANTE EL INVIERNO**

Sinopsis.—Se ha documentado en estudios la importancia de los campos del Programa de Reservas de Conservación (CRP) para aves que anidan, pero pocos los han examinado como fuentes de alimento para aves invernantes. Durante dos inviernos comparamos la biomasa de semillas en campos del CRP con la de praderas cosechadas de gramas nativas en el noreste de Kansas. Transformaciones logarítmicas del total de biomasa de semillas fué significativamente menor en las praderas cosechadas que en los campos del CRP en el primer invierno pero no en el segundo. El total de biomasa de semillas en campos del CRP fué altamente variable, y se radujo entre noviembre y febrero. Las semillas que aparecieron típicamente abundante en los campos del CRP son alimentos importantes de aves invernantes en las praderas. En resumen, los campos del CRP son habitáculos superiores de alimentación invernal para las aves que las praderas cosechadas de yerbas nativas en el noreste de Kansas.

The Conservation Reserve Program (CRP) was established 1985 to reduce commodity surpluses and soil erosion. A secondary benefit has been the creation of millions of ha of grassland habitat in the Great Plains (Blackburn et al. 1991), a region that has experienced declines in several grassland birds because of the loss of grassland habitat to agriculture (Herkert et al. 1996). Although several studies have documented the value of CRP lands as avian breeding habitat (Burger et al. 1990, Johnson and Schwartz 1993, Johnson and Igl 1995, Kantrud 1993, Rodenhouse et al.

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1993), few studies have investigated the value of CRP lands as avian winter foraging areas.

Food availability may limit the size of wintering bird populations (Dunning and Brown 1982, Gryzbowski 1983, Pulliam and Enders 1971). Because the availability of seeds as a food source for birds in CRP fields during winter is unknown, we collected seed samples in CRP fields and grazed native prairie in northeastern Kansas to determine the amount of seed available during winter. In the Flint Hills of northeastern Kansas, grazed prairie is the dominant landscape feature (Helyar 1991–92) and represents the primary grassland type that would be available to wintering birds in the absence of CRP fields.

## STUDY AREAS AND METHODS

This study was conducted during two winters in Riley County in the Flint Hills of northeastern Kansas. In February 1993 we collected seed data from three CRP fields and three grazed pastures. These fields had been prescribed burned in April 1992. In November 1993 and February 1994 we collected seed data from five CRP fields and five grazed pastures. As in the previous year, these 10 sites all had received prescribed burns in April 1993. Study sites ranged from 9.3–15.4 ha.

The CRP fields and grazed pastures were representative of management practices in the region. All CRP sites had been seeded with a mixture of Indiangrass (*Sorghastrum nutans*), big bluestem (*Andropogon gerardii*), sideoats grama (*Bouteloua curtipendula*), little bluestem (*Schizachyrium scoparium*), western wheatgrass (*Agropyron smithii*), and switchgrass (*Panicum virgatum*) in 1987 or 1988. These six grass species constituted over 95% of the vegetation in the CRP fields during 1992 and 1993. Grazed pasture study sites were located within stands of native tallgrass prairie vegetation and were stocked annually at 1.6 ha/steer from early May to early October or 2.7 ha/cow-calf pair from early July to early December.

Seeds were collected to determine availability in February 1993, November 1993, and February 1994. Seed samples were collected along six parallel transects placed perpendicular to the longest axis of each study site. Transects were evenly spaced along the entire length of each site. Six sampling points were established 25 m apart along each transect, beginning at a random point at least 25 m from the field edge, for a total of 36 samples per study site. At each sampling point a 20 × 20-cm sampling frame was placed on the ground. All seed-bearing fallen plant material and the top 1-cm layer of soil were collected from within the frame. Seeds were taken from standing vegetation, if the stem originated within the sampling frame. Samples were placed in paper bags, marked by site and date, and stored frozen until sorted.

Sorting was conducted by first washing the samples through a 0.833-mm mesh sieve with warm water to remove soil and small debris. The wet samples were dried partially at 65 C, shaken through sieves of various sizes to remove large debris, then placed in a seed blower to remove chaff and small debris. Remaining debris was removed by hand.

Seeds were classified to the lowest taxonomic category practicable and stored frozen in glass vials. Taxonomy follows the Great Plains Flora Association (1986). Seeds were dried at 65 C for 48 h and weighed to 0.0001 g to determine dry biomass. Biomass values were converted to kg/ha for analysis and pooled into forb, grass, and legume growth-form categories.

Analyses were conducted to determine differences in total seed biomass between CRP fields and grazed pastures. Prior to analysis, seed biomass data were transformed to natural logarithms. Log-transformed total seed biomass data from February 1993 were analyzed using one-way analysis of variance (ANOVA) to compare CRP fields to grazed pastures. Log-transformed total seed data from November 1993 and February 1994 were analyzed using a repeated measures design in a pseudo split-plot model (Milliken and Johnson 1992). The type of field was the whole plot main effect and plot within type of field was the whole plot error term and month was the subplot main effect. The model also included the month and the type of field by month interaction as the subplot error term. The data were analyzed using the GLM procedure in SAS (SAS Inst. 1990).

## RESULTS

Seeds of 45 species of plants were identified from CRP fields and grazed pastures. Seeds of 22 species were found in both habitats; 13 were unique to CRP fields and 10 to grazed pastures. Biomasses of seeds of individual plant species are presented in Klute (1994). Seeds of *Ambrosia artemisiifolia, Setaria* spp., and *Melilotus* spp. contributed the most to the biomass of forb, grass, and legume seeds, respectively, collected from CRP fields. On grazed pasture, seeds of *Ambrosia psilostachya, Dicanthelium oligosanthes,* and *Amorpha* spp. contributed the most to the biomass of forb, grass, and legume seeds, respectively.

During February 1993, total seed biomass on CRP fields ranged from 13.01 to 37.29 kg/ha ($\bar{x}$ = 18.73 kg/ha) compared to 0.67 to 0.89 kg/ha ($\bar{x}$ = 0.79 kg/ha) on grazed pastures. In November 1993, mean total seed biomasses were 5.24 kg/ha (range 0.96 to 23.76 kg/ha) on CRP fields and 1.57 kg/ha (range 1.00 to 2.36 kg/ha) on grazed pastures. During February 1994, the mean total seed biomass was 1.97 kg/ha on CRP fields (range 0.33 to 9.89 kg/ha) compared to 1.12 kg/ha on grazed pastures (range 0.73 to 2.09 kg/ha).

Seeds of forbs, grasses, and legumes were represented fairly equally in seed biomass collected from grazed pasture whereas seeds of grasses dominated that collected from CRP fields (Table 1). Log-transformed total seed biomass differed significantly between CRP fields and grazed pastures in February 1993 ($F$ = 79.85; df = 1,4; $P$ = 0.001). During the November 1993/February 1994 field season, log-transformed total seed biomass did not differ significantly ($F$ = 2.32; df = 1,8; $P$ = 0.16) between CRP fields and grazed pastures. There was a significant decrease in total seed biomass from November 1993 to February 1994 (2.86 and 1.49 kg/ha, respectively) ($F$ = 21.48; 1,8 df; $P$ = 0.02). Biomasses of grass seed always

TABLE 1. Antilog means ± standard errors of log-transformed seed biomasses (kg/ha) collected during two winters from CRP fields and grazed pastures in February 1993 (first winter), and November 1993 and February 1994 (second winter) in Riley County, Kansas.

| | Antilogs of seed biomass | | | | | |
|---|---|---|---|---|---|---|
| | February 1993 | | November 1993 | | February 1994 | |
| Plant category | CRP ($n$ = 3) | Pasture ($n$ = 3) | CRP ($n$ = 5) | Pasture ($n$ = 5) | CRP ($n$ = 5) | Pasture ($n$ = 5) |
| Forbs | $1.42^{a} \pm 2.00$ | $0.39^{a} \pm 2.00$ | $1.44^{a} \pm 1.24$ | $0.28^{b} \pm 1.24$ | $0.32^{b} \pm 1.24$ | $0.30^{b} \pm 1.24$ |
| Grasses | $15.65^{a} \pm 1.25$ | $0.23^{b} \pm 1.25$ | $3.30^{a} \pm 1.21$ | $0.30^{c} \pm 1.21$ | $1.51^{b} \pm 1.21$ | $0.22^{c} \pm 1.21$ |
| Legumes | $0.06^{a} \pm 3.06$ | $0.09^{a} \pm 3.06$ | $0.17^{a} \pm 1.48$ | $0.22^{a} \pm 1.48$ | $0.04^{a} \pm 1.48$ | $0.31^{a} \pm 1.48$ |
| Unknown | $0.00^{a} \pm 5.38$ | $0.08^{a} \pm 5.38$ | $0.01^{a} \pm 1.62$ | $0.33^{c} \pm 1.62$ | $0.00^{b} \pm 1.62$ | $0.21^{c} \pm 1.62$ |
| Total biomass | $18.73^{a} \pm 1.28$ | $0.79^{b} \pm 1.28$ | $5.24^{a} \pm 1.15$ | $1.57^{bc} \pm 1.15$ | $1.97^{b} \pm 1.15$ | $1.12^{c} \pm 1.15$ |

Means with the same superscript in the same row within a winter are not significantly different ($P > 0.5$).

were significantly greater in CRP fields than grazed pasture but other seed categories did not show consistant differences (Table 1).

## DISCUSSION

Analyses of log-transformed total seed biomass data detected a statistically significant difference in mean seed availability between CRP fields and grazed pastures. Examination of data from individual study areas shows that some CRP fields could be important sources of seeds for wintering birds. West (1967) calculated that 2.8 kg/ha of *Setaria viridis* seeds alone were sufficient to support a flock of 13 American Tree Sparrows (*Spizella arborea*) for 150 d of winter. Several of the CRP fields we studied (three of three in February 1993 and two of five in February 1994) had seed biomasses in excess of 2.85 kg/ha, whereas none of the grazed pastures had seed biomass exceeding this amount.

Many of the seeds found in abundance in CRP fields are from species (e.g., *Ambrosia artemisiifolia, Setaria* spp.) characteristic of early successional grasslands and often are considered weedy species (Davis 1993, Great Plains Flora Association 1986). Furthermore, these seeds are important food items for wintering birds (Bookhout 1958, Robel and Slade 1965, West 1967).

Other studies have found that winter seed availability generally decreases over time through loss of seeds to deterioration and foraging by insects, birds, and mammals (Dunning and Brown 1982, Robel and Slade 1965, West 1967). When seed biomasses from both CRP and grazed pastures were analyzed, we likewise detected a statistically significant decline in seed availability from November 1993 to February 1994.

The seed biomasses we found on several CRP fields suggest that those fields could be important sources of food for grassland granivores wintering in Kansas. Grazed pastures provided very little seed. In the absence of CRP lands, grazed pastures with a scant food base would be the predominant foraging habitat for avian granivores wintering in northeastern Kansas.

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