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Effects of the Conservation Reserve Program on Selected Wildlife Populations in Southeast Nebraska

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EFFECTS OF THE CONSERVATION RESERVE PROGRAM ON SELECTED WILDLIFE POPULATIONS IN SOUTHEAST NEBRASKA

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In 1989-90 spring censuses, pheasant (*Phasianus colchicus*) numbers were significantly higher ($P \leq 0.05$) in areas with approximately 20% of the cropland in the Conservation Reserve Program (CRP) than in areas with $\leq$ 5% of the cropland in CRP. Meadowlark (*Sturnella magna* and *neglecta*) numbers were not significantly different ($P > 0.05$) between the areas. Cottontail (*Sylvilagus floridanus*) populations were significantly higher in areas with low CRP enrollment. In 1989-90 summer censuses, meadowlark, northern bobwhite (*Colinus virginianus*), and cottontail populations were not significantly different between the low and high CRP enrollment areas.

Avian density and diversity, vegetation structure, and plant species composition were also compared on 40-80 ha study sites with the following cover types: CRP land seeded to cool-season grass, CRP land seeded to warm-season grass, native prairie, and sorghum. In 1989-90 spring bird censuses, the cropland sites had significantly lower numbers of birds than all other sites except one of the native prairies in 1989. Only killdeer (*Charadrius vociferus*) and horned larks (*Eremophila alpestris*) were recorded in sorghum fields. In 1989, dickcissels (*Spiza americana*) were the most abundant species, followed by grasshopper sparrows (*Ammodramus savannarum*). In 1990, the order was reversed. In the winter of 1989-90, warm-season grass sites had the highest densities of birds and numbers of species. Multiple linear regression analyses indicated that vegetation height and ground cover influenced bird density and diversity more than plant species composition. Lastly, an artificial nest predation study found no significant differences in rates of predation between the 4 cover types in either year.

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Introduction

There is growing concern about the global loss of biological diversity. Agriculture has been the primary reason for the simplification and fragmentation of natural ecosystems in the Midwest. Millions of acres of native prairies have been plowed or converted to agricultural practices. Preserving and restoring biotic diversity are major challenges for biologists and ecologists. The Conservation Reserve Program provides an excellent opportunity to restore simplified agricultural ecosystems to more diversified ones.

The Conservation Reserve Program (CRP) is a provision of the Federal Food Security Act of 1985 (Chapman 1987). This program encourages farmers to stop growing crops on highly erodible cropland and plant it to grass or trees through 10-year contracts with the U.S. Department of Agriculture. Goals of the CRP include (1) reduction in crop surpluses; (2) control of soil erosion; (3) water quality improvement; and (4) additional habitat for wildlife. The U.S. government has set a national objective of enrolling 16-18 million hectares in the CRP. In Nebraska approximately 540,000 ha of farmland have been enrolled (U.S. Soil Conserv. Serv., unpubl. data). A variety of conservation practices are allowed under current CRP rules and certain plantings may be more beneficial for wildlife than others. At the time of this study, there were 14 different conservation practices (CP's) under CRP regulations in Nebraska (U.S. Soil Conserv. Serv., unpubl. data). CP-1 (introduced grasses and legumes) and CP-2 (native grasses) are the primary cover types that were being seeded in the Great Plains (Newman 1987).

Wetland drainage and perpetuation of monoculture farming has severely reduced the numbers of ring-necked pheasants (*Phasianus colchicus*) and northern bobwhites (*Colinus virginianus*) in Nebraska (Taylor et al. 1978). Rowcrops increased from 40% to 58% of the land area between 1955 and 1976. Vance (1976) reported that prairie chicken (*Tympanuchus cupido*), bobwhite, and cottontail (*Sylvilagus floridanus*) populations in southeastern Illinois declined drastically from 1939-74 due to intensive agriculture. Additionally, nongame grassland birds such as grasshopper sparrows (*Ammodramus savannarum*) and dickcissels (*Spiza americana*) also declined nationwide from 1965-79 (Robbins et al. 1986). CRP grasslands should provide shorter distances between undisturbed habitats (Higgins et al. 1987) and nesting areas for many species of birds. Also, CRP fields might attract breeding birds away from hayfields and annual set-aside land into more secure nesting cover.

How CRP land actually affects wildlife populations remains to be seen. Changes in agricultural practices (e.g., larger field sizes and increased chemical use) in the last 10-20 years may influence the way wildlife populations respond to long-term set-aside land. However, based on wildlife increases during the Soil Bank years, I hypothesized that CRP land would positively influence wildlife populations. My objectives were several-fold: (1) to determine the relative abundance of selected wildlife populations in areas of farmland containing substantial (≥ 20%) amounts of CRP land with areas of farmland containing small (≤ 5%) amounts; (2) to compare numbers of bird species and bird population densities among 4 habitats [cool-season (CP-1) and warm-season (CP-2) grasses planted ≤ 3 years, cropland (planted to sorghum), and established (≥ 10 years old) native grass]; (3) to determine the structural characteristics and species composition of vegetation in the 4 habitats; and (4) to compare the relative risks of nest predation for birds nesting in the same 4 cover types.

LITERATURE REVIEW

The first federal land retirement program, the Cropland Adjustment Act of 1935-36, was designed to divert cropland (6.4-8 million ha) from production of feed grains (Brown 1984). The CAA did not require a cover crop and most farmers let the weeds grow without mowing their diverted acres. Along with the CAA, farm abandonment from the Depression provided an abundance of idle land for wildlife habitat between 1935 and 1941 (Schrader 1960).

From 1937 to 1940, Good and Dambach (1943) worked with the Soil Conservation Service in Ohio to help farmers adopt good land management practices. They evaluated 9 types of habitat and 13 species of birds. Their studies showed that breeding pairs of birds increased dramatically: 37.7% in southwest Ohio and 44.9% in southeast Ohio. Meadow strips averaged 90-93 pairs per 100 acres while cropland, not in strips, averaged only 23-24 pairs per 100 acres.

After World War II started, most idle cropland was put back into production and farming became increasingly mechanized to the detriment of wildlife (Schrader 1960). By the end of the Korean War, crop surpluses were becoming enormous due to more land being put into production, hybrid plants, and fertilizer.

The Soil Bank Act of 1956 provided for land retirement contracts of 5-10 years. The Soil Bank Program idled land two ways, the Acreage Reserve (4.8-8.4 million ha) and the Conservation Reserve (0.6-4 million ha) (Berner 1984). The Acreage Reserve program, consisting of annual contracts, required no cover crop and the land was usually mowed every year to control weeds. The Conservation Reserve program (3-10 year contracts) required the establishment of perennial grasses and mowing only where needed to control weeds (Schrader 1960). In some counties, Soil Bank land accounted for as much as 80 acres per square mile. Schrader (1960) also reported that pheasant populations were the highest in counties where more than 5% of the cropland was idle.

In Utah, Bartmann (1969) found that 85% of all successful pheasant nesting sites were on Soil Bank land. Without the Soil Bank program, approximately half of the idled land would have been summer-fallowed and no nesting would have occurred on that land due to the lack of residual cover.

Erickson and Wiebe (1973) reported that at its peak in 1960, Soil Bank idled 720,000 ha of cropland in South Dakota . Pheasant populations responded positively if there was residual cover to nest in from previous years. South Dakota's pheasant numbers went from 4-6 million birds in the mid-fifties to 8-11 million birds in the late fifties (Erickson and Wiebe 1973).

In 1961, the Kennedy Administration initiated the Federal Feed Grain Program and in 1962, added the Wheat Program (Bedenbaugh 1987). Both were annual, diverted-acre programs administered by the Agricultural Stabilization and Conservation Service.

The Cropland Adjustment Program began in 1966 and at its peak 4 million acres were retired (Harmon and Nelson 1973). Land was retired under 5 and 10 year contracts and a cover crop (grass and/or trees) had to be maintained throughout the life of the contract (Berner 1984).

In Illinois, Joselyn and Warnock (1964) studied the Federal Feed Grain Program's contribution to pheasant production. Unharvested hay accounted for 52.4% of all successful nests in 1962 and 28.6% of all successful nests in 1963 on their 1000-acre study site. In 1962, 38.8% and in 1963, 27.5% of all successful nests were produced on land that would have been in rowcrops but for the diverted acres.

Gates and Ostrom (1966) compared the nesting success of non-Program land and set-aside land in Wisconsin. Of the fields enrolled in the Program, only unharvested hayfields and idle lowlands were used for nesting by pheasants. Unharvested hayfields with residual cover from previous years had almost twice as many nests as first year unharvested fields. On Program lands, 59% of the nests were successful, whereas on the non-Program lands 25% of the nests were successful (Gates and Ostrom 1966). Overall, wetlands, comprising 9.7% of total sample area, produced 54.5% of the successful nests, while diverted acre lands, comprising 2.4% of total sample area, came in second with 16.7% of all successful nests (Gates and Ostrom 1966). Their study concluded the Federal Feed Grain Program land was responsible for a 10% increase in pheasant chicks.

Other than the preceding two studies, annual set-aside programs are generally not seen as being beneficial for wildlife. The SCS reported in 1971 that 64% of all cropland was eroding at an unacceptable rate, especially land in annual programs (Harmon and Nelson 1973). A Farm Programs Committee formed by 13 states conducted a study of set-aside land in 1973. They found that 75% of retired land had little to no cover to prevent erosion and two-thirds had only marginal cover for wildlife (Harmon and Nelson 1973).

In 1983, the Reagan administration started the Payment-In-Kind farm program. In the first year, 32 million ha of cropland were put into set-aside and 12 billion dollars were paid out to farmers and landowners (Berner 1984). Surveys in 1983 showed the Federal Grain Program and the Wheat Program provided 11.5 ha of worthless wildlife habitat for every 1 ha of good cover (Berner 1984).

The 1985 Farm Bill resulted from the combined efforts of conservation organizations, professional agencies, and concerned legislators. The CRP is an important component of the 1985 Farm Bill and holds great promise for benefitting the nation's farmland, water, and wildlife. Newman (1987) stated that the CRP would cut soil erosion by 639 million tons/year if a total of 18 million hectares enrolled was reached. The CRP could also reduce the hectares of cropland up to 15% and increase vegetative cover (grass and trees) by possibly 7%. The fulfillment of these conditions would enhance soil regeneration, improve water quality, positively influence groundwater recharge, increase water yield overall, and contribute to wildlife habitat (Newman 1987). The possible effects of CRP land on wildlife are the focus of this project.

STUDY AREAS

The study was conducted in Cass, Gage, Johnson, Lancaster, Nemaha, and Saunders counties in southeast Nebraska (40°40'N, 96°30'W). The region consisted mainly of rounded ridges, sloping areas, and valleys that were left behind when the glaciers dissected the plains. Soils varied from fertile sandy loams in the river bottoms to eroded clays on steep slopes. The area (978,238 ha) was predominantly farmland (rowcrops and small grains) and elevations ranged from 265 to 463 m. Normal annual rainfall varied from 68 cm (Lancaster) to 85 cm (Nemaha). Yearly snowfall over the last 20 years has averaged 65-70 cm in the area.

Low Versus High CRP Enrollment

Six 23.3 km^2 blocks of farmland were identified in Gage, Johnson, and Nemaha counties (Fig. 1). Approximately 75% of each block was cropland with 50% of the cropland in rowcrops. Blocks were chosen to minimize differences in soils, quantity of woody vegetation, and amount of pasture-land. Three blocks had 2-3% of their cropland in CRP and 3 had 18-21% of their cropland in CRP. The two CRP conservation practices most often used in this region are CP-1 and CP-2. National Oceanic and Atmospheric Administration data showed that the 3 counties received below normal precipitation in 24 of the 36 months from July 1987 to June 1990.

Cover Type Comparisons

Study sites were located in Cass, Lancaster, and Saunders counties (Fig. 1) and were selected to minimize variables such as soil type, surrounding habitat, and management practices. Study areas included cool-season grass CRP fields (n_{1989} = 2; n_{1990} = 3), warm-season grass CRP fields (n_{1989} = 2; n_{1990} = 3), conventionally tilled sorghum fields (n_{1989} = 2; n_{1990} = 3) and native prairies (n = 2). They ranged in size from 48-80 ha in 1989 and from 40-80 ha in 1990. Local county Soil Conservation

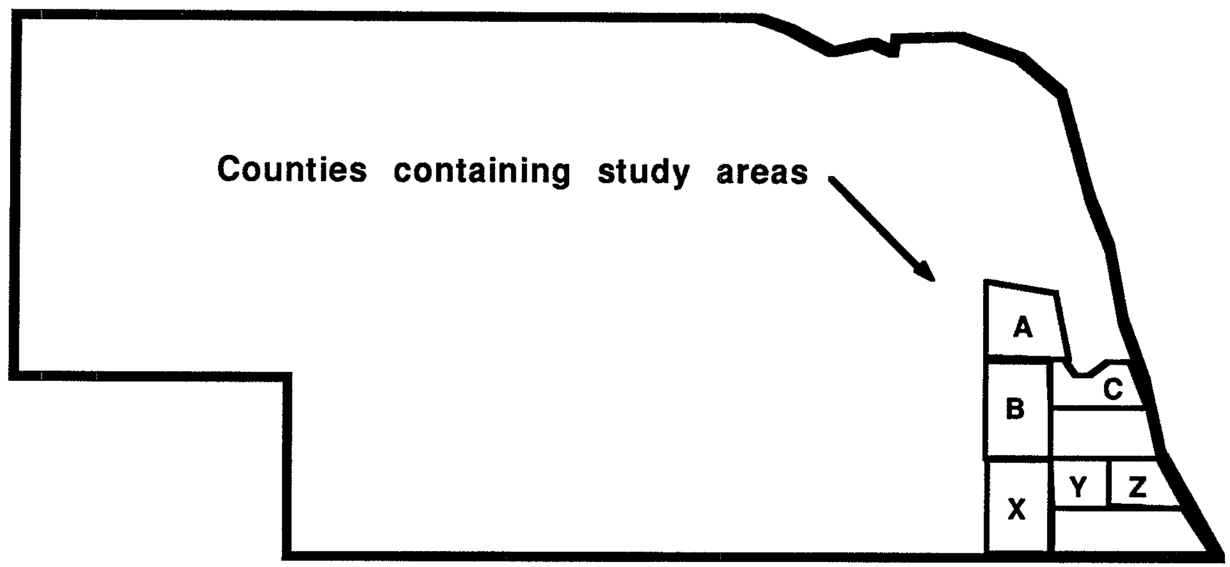

Fig. 1. Area of study in southeast Nebraska, 1989-90. Cover type comparison studies were conducted in A (Saunders), B (Lancaster), and C (Cass) counties. Call counts in blocks of farmland were done in X (Gage), Y (Johnson), and Z (Nemaha) counties.

Services and Agricultural Stabilization and Conservation Services were contacted for information regarding possible study sites and cooperative landowners.

Two of the cool-season CRP sites were seeded to smooth brome (*Bromus inermis*) while the third was seeded to smooth brome and alfalfa (*Medicago sativa*). One warm-season CRP field was seeded with a 5-way grass mixture consisting of big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), and switchgrass (*Panicum virgatum*). The other 2 warm-season CRP fields were seeded to switchgrass. I was informed after the study was initiated that 1 of the 2 native prairies was hayed yearly in August. Prior to the winter census, both sorghum fields were either fall-plowed or field-cultivated. Due to crop rotations, different but similar-sized sorghum fields in the same vicinities as the spring 1989 and winter 1989-90 sites were used in the spring of 1990. Also, in April 1990, half of one warm-season CRP site and all of the non-hayed native prairie were burned.

METHODS

Low Versus High CRP Enrollment

Four species were censused (pheasants, bobwhites, meadowlarks, and cottontails) during the springs and summers of 1989-90. These species have been selected as indicator species by the International Association of Fish and Wildlife Agencies, U.S. Fish and Wildlife Service, and the Nebraska Game and Parks Commission.

From 23 April to 10 May 1989 and from 20 April to 11 May 1990, each block was censused twice for pheasants and meadowlarks (eastern and western). Each block was censused at 16 bird-call stations that were established in a 1.6 x 1.6-km pattern along existing roads (Fig. 2). Calls were recorded for 2 minutes at each station while standing outside of the vehicle. Blocks were censused in random order during the first week and

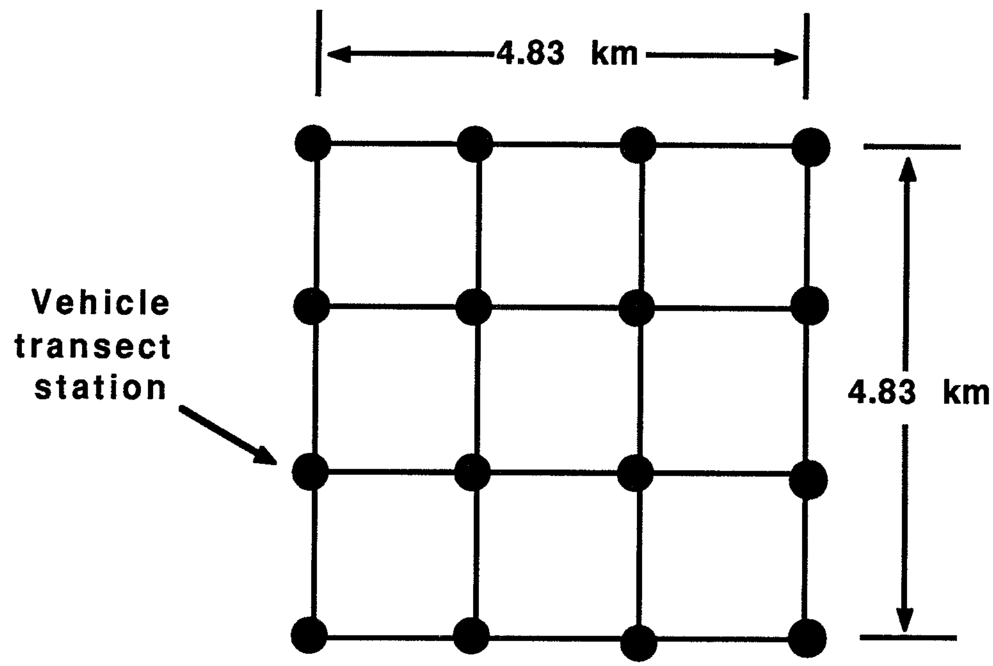

Fig. 2. An example of a study area, 23.3 km^2 (9 sq. mi^2), showing transect stations located 1.6 km apart, 1989-90.

then again during the second week. Spring censuses began 30 minutes before sunrise and continued until completed, usually within 1.5-2 hours after sunrise. Censuses were conducted only if wind speed was $\leq$10 mph and rainfall was minimal (Kimball 1949).

From 16 June to 5 July 1989 and from 18 June to 7 July 1990, each block was again censused twice. During these summer censuses, bobwhite cock calls and meadowlark calls were recorded for 2 minutes at each station (Rosene 1957). Censuses began at sunrise and were completed within 1.5-2 hours after sunrise. While driving (30-40 km/hour) between call stations during both spring and summer censuses, I counted all cottontails seen on or along the road. Because all data were not normally distributed, a Mann-Whitney U-test ($P \leq 0.05$) was used to compare numbers of the 4 selected species between the low and high CRP enrollment areas. A T-test ($P \leq 0.05$) was used to analyze the difference in pheasant count numbers from 1989 to 1990.

Cover Type Comparisons: Vegetation

In each field, vegetation height and ground cover (standing vegetation and litter) were sampled at 4 (spring 1989 and winter 1989-90) or 5 (spring 1990) points 100 m apart with the first point 50 m from the edge. Four vegetation height and 8 ground cover readings using a Daubenmire frame (Daubenmire 1959) were taken at each point, totaling 16 (spring 1989 and winter 1989-90) or 20 (spring 1990) height readings and 32 (spring 1989 and winter 1989-90) or 40 (spring 1990) ground cover readings per field. Measurements were determined during or immediately following the bird censuses, and also were taken prior to the bird censuses in May 1990. In addition, visual obstruction readings were obtained using a Robel pole (Robel et al. 1970) in June 1990. ANOVA ($P \leq 0.05$) was used to compare vegetation height and percent ground cover among the sites. Tukey HSD tests were used for post hoc comparison of means.

From 14 July to 9 August 1989 and from 8-16 August 1990, vegetation composition was determined with the modified step-point method (Owensby 1972).

Approximately 2000 (1989) and 500-1000 (1990) sample points were randomly taken per site. Fewer readings were taken in 1990 after it was determined that a smaller sample size sufficiently indicated the dominant plant species on the sites. Data obtained were used to calculate basal cover and percent composition of plant species on each location. Vegetation species diversity was then calculated with the Shannon-Weaver index (H') (Shannon and Weaver 1949), which utilizes both the abundance and numbers of species.

Cover Type Comparisons: Bird Usage

Avian censuses were conducted during the peak of the nesting season (May and June) in 1989-90 and during late winter (February 1990). Each site was censused for birds using the fixed-width transect method (Mikol 1980). Total transect length varied from 1.3-1.8 km in 1989, but were all 1.6 km in 1990. Field transects were marked with flags spaced 100 m apart and all transects started and ended at least 50 m from field edges. All male birds flushed, observed sitting, or heard singing within 30 m (spring 1989) or 50 m (spring 1990) on either side of the line were counted. In winter 1990, all birds flushed, observed sitting, or heard calling within 30 m on either side of the line were recorded. Birds observed flying overhead during counts but not landing within transects were not counted. All sites were censused 3 times in a random order during a survey period. Spring bird censuses were conducted between sunrise and 3 hours after sunrise, weather permitting. Winter bird censuses were completed between 2 hours after sunrise and 1 hour before sunset, weather permitting. Bird diversity was measured with the Shannon-Weaver index (H'). ANOVA ($P \leq 0.05$) was used to compare bird density and diversity among the sites. Tukey HSD tests were used for post hoc comparison of means.

Multiple linear regression was not used because of concerns over multiple collinearity (Wilkinson 1989) and the independent variables were analyzed with simple linear regression. The variables included bird density, bird diversity, maximum vegetation height, ground cover, visual obstruction, and vegetation diversity.

Cover Type Comparisons: Relative Nest Predation

Between 7-14 June 1989 and 4-11 June 1990, I assessed differences in relative rates of predation among the different cover types. In 1989, 25 and in 1990, 20 artificial nests were set out on each study area. Rubber gloves and boots were worn to minimize human odor, both when setting out and checking nests. Each nest contained 2 coturnix quail (*Coturnix coturnix*) eggs. Nests were at 30-m intervals along a transect and alternately placed 5 m perpendicular on either side of the transect. Eggs were put on the ground in either a depression or surrounded by ground litter. Nests were checked every other day for 6 days and the outcome (predated vs. non-predated) was noted. A nest was considered predated if 1 of the eggs was damaged or missing. Also when checking egg outcomes, the observer stayed as far from the nest as possible. In 1989, heavy rains washed away nests on 2 study sites, and they were not included in the final analysis. Data were analyzed with a Chi-square contingency table ($P \leq 0.05$).

RESULTS

Low Versus High CRP Enrollment:

Pheasant counts were significantly higher ($P < 0.01$) in areas with high CRP enrollment in both 1989 and 1990, but northern bobwhite and meadowlark surveys did not differ ($P > 0.05$) in either year (Table 1). Spring cottontail counts were higher ($P < 0.05$) in areas with low CRP enrollment, but summer surveys showed no differences ($P > 0.05$) (Table 1). Pheasant count numbers declined significantly ($t = 3.31$, 5 df, $P = 0.021$) from 1989 to 1990.

Table 1. Censuses of 6 23.3 km^2 agricultural areas with low (<5%) or high (20%) amounts of CRP acreage in southeast Nebraska, 1989-90.

Spring	Low CRP Mean/Station		High CRP Mean/Station		
Species - Year	$\bar{X}$	SD	$\bar{X}$	SD	P>F
Pheasant - 1989	1.71	1.60	2.43	1.70	0.003 *
Pheasant - 1990	1.35	1.11	1.75	1.15	0.009 *
Meadowlark - 1989	2.12	1.54	2.14	1.71	0.828
Meadowlark - 1990	1.87	1.43	2.32	1.60	0.058
	Mean/Block		Mean/Block		
Cottontail - 1989	5.83	2.32	2.00	2.10	0.023 *
Cottontail - 1990	4.50	2.17	1.83	0.75	0.017 *

Summer	Low CRP Mean/Station		High CRP Mean/Station		
Species - Year	$\bar{X}$	SD	$\bar{X}$	SD	P>F
N. Bobwhite - 1989	2.03	1.50	2.24	1.54	0.357
N. Bobwhite - 1990	2.08	1.50	2.06	1.32	0.984
Meadowlark - 1989	1.82	1.30	1.74	1.34	0.514
Meadowlark - 1990	1.49	1.21	1.75	1.31	0.202
	Mean/Block		Mean/Block		
Cottontail - 1989	7.33	2.33	8.17	2.32	0.569
Cottontail - 1990	5.50	2.17	4.67	2.73	0.571

* Significant at the 0.05 level, Mann-Whitney U-test.

Cover Type Comparisons: Vegetation

In June 1989, maximum vegetation height and ground cover were significantly lower ($P < 0.01$) in the sorghum fields with one exception; the first native prairie and the second cropfield were not different ($P = 0.17$) in maximum vegetation height. The warm-season (WS) CRP fields had taller vegetation than the other sites ($P < 0.01$). Vegetation height ranged from 2.8 cm (first sorghum field) to 68.4 cm (first WS grassfield) and ground cover ranged from 2.6% (first sorghum field) to 95.3% (second native prairie) (Table 2).

In May 1990, ground cover was significantly less ($P < 0.01$) in the sorghum fields. Maximum vegetation height was lower ($P < 0.05$) on the sorghum fields compared with the first and second cool-season (CS) grassfields and all 3 WS grassfields. Maximum vegetation height on the third CS CRP field and both native prairies was not different ($P > 0.10$) from the cropfields. Again, the WS CRP fields had taller vegetation than the other sites ($P < 0.05$). Vegetation height ranged from 0.0 cm (first sorghum field) to 159.7 cm (second WS grassfield) and ground cover ranged from 0.0% (first sorghum field) to 96.5% (second CS grassfield) (Table 2).

In June 1990, maximum vegetation height, visual obstruction, and ground cover were lower ($P < 0.05$) on the sorghum fields. Vegetation height ranged from 2.0 cm (first sorghum field) to 155.6 cm (second WS grassfield) and ground cover ranged from 0% (first sorghum field) to 100% (second WS grassfield). Visual obstruction readings were proportionally similar to the maximum height readings and ranged from 0.0 cm (all 3 sorghum fields) to 77.5 cm (second WS grassfield) (Table 2). The second WS CRP field had higher visual obstruction readings than the other 10 sites ($P < 0.001$).

In February 1990, similar differences in maximum vegetation height and ground cover were observed, when compared to June 1989. The WS CRP fields had taller ($P < 0.001$) vegetation than the other sites. Average vegetation height in the WS grassfields

Table 2. Cool-season (CS) CRP, warm-season (WS) CRP, sorghum, and native prairies' vegetation structure and ground cover readings on 40-80 ha study sites in Cass, Lancaster, and Saunders counties, Nebraska, 1989-90.
(CS = cool-season grasses, WS = warm-season grasses)

	1989				1990											
	June				winter				May				June			
	Maximum Vegetation Height (cm)		Ground Cover (%)		Maximum Vegetation Height (cm)		Ground Cover (%)		Maximum Vegetation Height (cm)		Ground Cover (%)		Maximum Vegetation Height (cm)		Visual Obstruction (cm)		Ground Cover (%)	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
First CS CRP	33.1	(1.2)	66.1	(16.3)	30.9	(6.1)	99.7	(1.3)	39.8	(9.2)	94.5	(4.6)	65.5	(14.3)	35.5	(5.6)	99.8	(0.8)
Second[a] CS CRP	42.2	(1.2)	85.0	(10.4)	46.9	(12.4)	97.7	(3.5)	49.5	(8.4)	96.5	(5.2)	75.3	(23.6)	43.5	(13.2)	98.0	(3.4)
Third CS CRP									32.0	(6.2)	79.6	(14.0)	67.3	(13.2)	24.3	(9.9)	93.5	(8.6)
First[b] WS CRP	68.4	(1.7)	74.7	(18.2)	139.4	(19.4)	64.1	(15.9)	84.0	(72.5)	56.6	(39.3)	88.6	(43.8)	50.3	(25.0)	64.6	(36.8)
Second WS CRP	65.0	(3.7)	57.7	(34.5)	148.8	(28.5)	94.4	(7.9)	159.8	(16.1)	89.3	(20.2)	155.5	(48.0)	77.5	(32.3)	100.0	(0.0)
Third[c] WS CRP									124.3	(54.3)	69.3	(24.5)	73.5	(17.9)	34.3	(15.9)	81.4	(21.0)

(continued)

Table 2. Continued.

	1989 June				1990 winter				1990 May				1990 June					
	Maximum Vegetation Height (cm)		Ground Cover (%)		Maximum Vegetation Height (cm)		Ground Cover (%)		Maximum Vegetation Height (cm)		Ground Cover (%)		Maximum Vegetation Height (cm)		Visual Obstruction (cm)		Ground Cover (%)	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
1989 First Cropfield	12.8	(4.0)	2.6	(1.5)	1.3	(2.2)	3.6	(2.2)										
1989 Second Cropfield	10.6	(9.1)	3.4	(2.1)	3.4	(3.5)	30.8	(27.2)										
1990 First Cropfield																		
1990 Second Cropfield									0.0	(0.0)	0.0	(0.0)	2.0	(2.5)	0.0	(0.0)	5.4	(3.5)
1990 Third Cropfield									1.8	(2.9)	4.8	(3.3)	3.5	(3.7)	0.0	(0.0)	6.6	(5.0)
First[d] Prairie									2.8	(2.6)	2.0	(1.7)	5.5	(3.6)	0.0	(0.0)	7.6	(5.6)
	25.6	(7.0)	87.0	(4.6)	8.4	(3.0)	99.4	(2.5)	19.3	(5.2)	95.6	(4.7)	48.8	(11.6)	25.4	(5.7)	99.1	(2.5)
Second[e] Prairie	33.8	(8.1)	95.3	(3.9)	39.7	(9.2)	100.0	(0.0)	13.0	(7.7)	28.3	(13.5)	33.3	(6.3)	21.5	(6.5)	60.0	(12.3)

[a] This field was hayed in July 1989 when CRP land was opened up for emergency haying by the ASCS due to drought-like conditions.
[b] Half of this site was burned in April 1990.
[c] This site was seeded with a 5-way grass mixture.
[d] This site was hayed annually in August.
[e] Entire site was burned in April 1990.

($\bar{x}$ = 144.1) was over 3 times that in the CS grassfields ($\bar{x}$ = 38.9). Vegetation height ranged from 1.3 cm (first sorghum field) to 148.8 cm (second WS grassfield). Ground cover ranged from 3.6% (first cropfield) to 100% (second native prairie) (Table 2).

In 1989, vegetation diversity ratings varied from 0.05 (first sorghum field) to 2.62 (second native prairie) (Table 3) and in 1990, from 0.05 (second cropfield) to 2.21 (first native prairie) (Table 4). The third WS CRP field had a higher diversity rating than the other 2 WS grassfields. Big bluestem was the dominant plant in both 1989 and 1990 on the second native prairie. Little bluestem was dominant on the first prairie in 1989, but was replaced by smooth brome as the most common plant in 1990. The most common plant species found on all sites are listed in Tables 3 and 4.

Cover Type Comparisons: Bird Usage

In 1989-90 spring bird censuses, the cropland sites had significantly lower numbers of birds than all other sites ($P < 0.05$) except the first native prairie in 1989. Only killdeer (*Charadrius vociferus*) and horned larks (*Eremophila alpestris*) were recorded in sorghum fields (Tables 5 and 6). In 1989, 15 species were recorded on the 8 sites and 18 species were observed on the 11 sites in 1990. The second CS CRP field consistently had the highest numbers of birds observed. The second WS grassfield had the highest bird diversities in 1989 and 1990 (H' = 1.75 and 1.90, respectively) and the most species recorded (n = 10). Excluding the sorghum fields, dickcissels were the most abundant species on 4 of the sites in 1989 and grasshopper sparrows the most abundant species on the other 2 sites. In 1990, grasshopper sparrows were the most abundant species on 5 of the sites and this species tied with dickcissels on a sixth field. In general, the same complement of birds was recorded in both years. A noteworthy exception was that sedge wrens (*Cistothorus platensis*) were observed on 2 CS grassfields and 1 WS grassfield in the second field season. In both springs, bird diversity (H') was lower on the cropfields than on the other fields ($P \leq 0.05$).

Table 3. Plant species and basal cover on 8 48-80 ha study sites, 1989. (CS = cool-season grasses, WS = warm-season grasses)

Study site	H'	Species Composition - (%)		Basal Cover - (%)	
First CS CRP (n[a] = 2005)	0.24	Smooth Brome	95.4	Smooth Brome	10.4
		Morning Glory	2.8	Morning Glory	0.6
		Ground Cherry	1.3	Ground Cherry	0.4
		Other species (4)	0.5	Other species (4)	0.1
Second CS CRP[b] (n = 2004)	0.62	Smooth Brome	71.4	Smooth Brome	6.1
		Alfalfa	28.1	Alfalfa	4.2
		Other species (1+)	0.5	Other species (1+)	0.0
First WS CRP (n = 2008)	0.52	Switchgrass	89.4	Switchgrass	16.4
		Green Foxtail	3.0	Smooth Brome	0.6
		Smooth Brome	2.3	Green Foxtail	0.4
		Other species (7)	5.3	Other species (7)	0.6
Second WS CRP (n = 2014)	1.25	Switchgrass	67.8	Switchgrass	12.7
		Yellow Foxtail	9.2	Yellow Foxtail	1.2
		Green Foxtail	8.9	Green Foxtail	1.2
		Wood Sorel	4.2	Wood Sorel	0.4
		Other species (8+)	9.9	Other species (8+)	0.9
First Cropfield (n = 2002)	0.05	Grain Sorghum	99.3	Grain Sorghum	4.4
		Other species (3)	0.7	Other species (3)	0.1
Second Cropfield (n = 2011)	0.11	Grain Sorghum	98.3	Grain Sorghum	4.1
		Other species (5+)	1.7	Other species (5+)	0.1
First Prairie[c] (n = 2009)	2.40	Little Bluestem	21.6	Little Bluestem	1.8
		Sideoats Grama	17.0	Sideoats Grama	1.2
		Smooth Brome	16.9	Smooth Brome	1.2
		Big Bluestem	8.4	Big Bluestem	0.7
		Other species (23+)	36.1	Other species (23+)	2.1
Second Prairie[d] (n = 2021)	2.62	Big Bluestem	15.6	Big Bluestem	1.1
		Little Bluestem	12.7	Little Bluestem	0.8
		Switchgrass	11.0	Switchgrass	0.7
		Smooth Brome	10.3	Smooth Brome	0.6
		Indiangrass	10.3	Sideoats Grama	0.6
		Other species (22+)	40.1	Other species (22+)	2.7

[a] Sample size using modified step-point method (Owensby 1972).

[b] This field was hayed in July. CRP land was opened up for emergency haying by the ASCS due to drought-like conditions.

[c] This site is hayed annually in August.

[d] In the winter of 1988 this site accidently burned and smooth brome invaded. Due to dry conditions, the site was not burned in spring 1989.

Table 4. Plant species and basal cover on 11 40-80 ha study sites, 1990. (CS = cool-season grasses, WS = warm-season grasses)

Study site	H'	Species Composition - (%)		Basal Cover - (%)	
First CS CRP (n[a] = 523)	0.22	Smooth Brome	94.8	Smooth Brome	7.8
		Morning Glory	4.6	Morning Glory	0.4
		Ground Cherry	0.6	Ground Cherry	0.0
Second CS CRP (n = 523)	0.58	Smooth Brome	78.3	Smooth Brome	3.8
		Alfalfa	20.5	Alfalfa	2.3
		Other species (3)	1.2	Other species (3)	0.0
Third CS CRP (n = 541)	0.21	Smooth Brome	95.7	Smooth Brome	6.1
		Muskthistle	3.1	Muskthistle	0.6
		Other species (3)	1.2	Other species (3)	0.0
First WS CRP[b] (n = 515)	0.91	Switchgrass	73.6	Switchgrass	7.7
		Foxtail spp.	13.2	Foxtail spp.	1.2
		Marestail	9.5	Marestail	0.8
		Other species (9)	3.7	Other species (9)	0.0
Second WS CRP (n = 523)	0.50	Switchgrass	89.5	Switchgrass	10.1
		Foxtail spp.	4.4	Foxtail spp.	0.2
		Smooth Brome	2.1	Smooth Brome	0.2
		Other species (4)	4.0	Other species (4)	0.2
Third WS CRP (n = 522)	1.92	Indiangrass	26.4	Sideoats Grama	1.5
		Sideoats Grama	20.3	Indiangrass	1.3
		Big Bluestem	16.5	Big Bluestem	1.0
		Marestail	16.5	Marestail	0.6
		Other species (8+)	20.3	Other species (8+)	0.8
First Cropfield (n = 536)	0.05	Sorghum	99.3	Sorghum	2.1
		Other species (3+)	0.7	Other species (3+)	0.0
Second Cropfield (n = 525)	0.05	Sorghum	99.2	Sorghum	2.7
		Other species (2+)	0.8	Other species (2+)	0.0
Third Cropfield[c] (n = 513)	0.62	Sorghum	69.2	Sorghum	7.8
		Shattercane	30.8	Shattercane	2.5
First Prairie[d] (n = 1029)	2.21	Smooth Brome	21.0	Big Bluestem	1.5
		Big Bluestem	20.4	Sideoats Grama	0.9
		Sideoats Grama	18.9	Little Bluestem	0.7
		Little Bluestem	15.3	Kentucky Bluegrass	0.7
		Other species (19+)	24.4	Other species (19+)	1.6
Second Prairie[e] (n = 1018)	2.16	Big Bluestem	39.3	Big Bluestem	3.5
		Western Ragweed	14.7	Western Ragweed	0.5
		Switchgrass	9.8	Prairie Dropseed	0.5
		Other species (24+)	36.2	Other species (24+)	1.0

[a] Sample size using modified step-point method (Owensby 1972).
[b] Half of this field was burned in the spring.
[c] The sorghum in this field was planted with a drill; it had no distinct crop rows.
[d] This site is hayed annually in August.
[e] Entire field was burned in the spring.

Table 5. Bird censuses on 8 48-80 ha study sites in southeast Nebraska during the breeding season, May-June 1989. (CS = cool-season grasses, WS = warm-season grasses)

	No. of males per 100 ha							
Species	First CS CRP	Second CS CRP	First WS CRP	Second WS CRP	First Cropfield	Second Cropfield	First Prairie	Second Prairie
American Goldfinch				4.0			3.1	3.9
Bobolink		12.8						7.9
Brown-headed Cowbird	8.3	12.8	7.9	36.1			3.1	7.9
Dickcissel	150.0	178.6	142.0	140.6			18.4	130.2
Eastern Kingbird		4.3						
Eastern Meadowlark								7.9
Grasshopper Sparrow	50.0	38.3	146.0	84.3			42.9	82.8
Killdeer						3.1		
Mourning Dove	8.3	4.3	31.6	44.2				3.9
Northern Bobwhite				8.0				
Northern Oriole		4.3						
Red-winged Blackbird	16.7	110.5	7.9	24.1				
Ring-necked Pheasant	8.3			4.0				
Upland Sandpiper				4.0				
Western Meadowlark	4.2	17.0	3.9	20.1			15.3	3.9
3 censuses ($\bar{x}$)[a]	245.8[b]	382.9[c]	339.3[bcd]	369.4[bce]	0.0[f]	3.1[fg]	82.8[fgh]	248.4[bcde]
No. of Species (total)	7	9	6	10	0	1	5	8
Diversity (H')	1.22	1.46	1.18	1.75	0.0	0.0	1.23	1.23

[a] Means with the same letters are not significantly different ($P > 0.05$).

Table 6. Bird censuses on 11 40-80 ha study sites in southeast Nebraska during the breeding season, May-June 1990. (CS = cool-season grasses, WS = warm-season grasses)

	No. of males per 100 ha										
Species	First CS CRP	Second CS CRP	Third CS CRP	First WS CRP	Second WS CRP	Third WS CRP	First Cropfield	Second Cropfield	Third Cropfield	First prairie	Second prairie
American Robin											2.1
Bobolink	41.7										
Brown-headed Cowbird	2.1	35.4	25.0	6.3	43.8	22.9				2.1	8.3
Brown Thrasher											2.1
Common Yellowthroat		16.7			12.5						
Dickcissel	20.8	95.8	75.0	100.0	83.3	64.6				2.1	22.9
Eastern Kingbird	2.1		6.3							2.1	
Eastern Meadowlark										12.5	4.2
Grasshopper Sparrow	79.2	66.7	104.2	100.0	62.5	133.3				91.7	37.5
Horned Lark							2.1	4.2	4.2		
Killdeer							2.1				
Mourning Dove		4.2		10.4	14.6	47.9					
Northern Bobwhite			4.2		12.5	6.3					2.1
Red-winged Blackbird	2.1	150.0	4.2	2.1	2.1	6.3					
Ring-necked Pheasant	4.2	2.1		8.3	8.3						
Sedge Wren	18.8	16.7			12.5						
Upland Sandpiper				6.3						4.2	6.3
Western Meadowlark	10.4	10.4	20.8	6.3	14.6	22.9				10.4	4.2
3 censuses ($\bar{x}$)[a]	181.4^{b}	398.0^{c}	239.7^{bd}	239.7^{bde}	266.7^{def}	304.2^{defg}	4.2^{h}	4.2^{hi}	4.2^{hij}	125.1^{bk}	89.7^{k}
No. of Species (total)	9	9	7	8	10	7	2	1	1	7	9
Diversity (H')	1.61	1.66	1.41	1.31	1.90	1.53	0.69	0.0	0.0	0.98	1.67

[a] Means with the same letters are not significantly different (P > 0.05).

Five species were observed on the 8 sites in the February 1990 bird census. The WS CRP fields were the only sites with more than 1 species recorded and these also had the most birds (Table 7). Although not the most abundant, western meadowlarks were the most common species, found on 4 of the 8 sites. Horned larks were the only species found in a sorghum field. Bird diversity could be calculated only for the WS grassfields and was not different ($P > 0.05$) between the 2 sites.

In 1989, both bird density and diversity were positively correlated with maximum vegetation height ($R^2 = 0.805$, 7 df, $P = 0.002$ and $R^2 = 0.650$, 7 df, $P = 0.016$, respectively) and bird diversity was correlated with ground cover ($R^2 = 0.729$, 7 df, $P = 0.007$). Neither bird density or diversity were positively correlated with vegetation diversity ($R^2 = 0.019$, 7 df, $P = 0.748$ and $R^2 = 0.244$, 7 df, $P = 0.213$, respectively) and bird density was not correlated with ground cover ($R^2 = 0.463$, 7 df, $P = 0.063$).

In 1990, both bird density and diversity were positively correlated with maximum vegetation height ($R^2 = 0.608$, 10 df, $P = 0.005$ and $R^2 = 0.615$, 10 df, $P = 0.004$, respectively), ground cover ($R^2 = 0.638$, 10 df, $P = 0.003$ and $R^2 = 0.706$, 10 df, $P = 0.001$, respectively), and visual obstruction readings ($R^2 = 0.749$, 10 df, $P = 0.001$ and $R^2 = 0.657$, 10 df, $P = 0.002$, respectively). Neither bird density or diversity were correlated with vegetation diversity ($R^2 = 0.012$, 10 df, $P = 0.745$ and $R^2 = 0.083$, 10 df, $P = 0.390$, respectively).

Cover Type Comparisons: Relative Nest Predation

Rates of nest predation differed among the 8 sites in 1989 ($X^2 = 16.80$, 7 df, $P = 0.02$) (Table 8). The first CS CRP field, second WS CRP field, and first native prairie had lower rates of predation and a separate Chi-square analysis showed no differences among these 3 sites ($X^2 = 3.70$, 2 df, $P = 0.16$). Predation rates varied from 0% (first CS grassfield) to 35% (second cropfield).

Table 7. Bird censuses on 8 48-80 ha study sites in southeast Nebraska during the winter, February-March 1990 (CS = cool-season grasses, WS = warm-season grasses)

	No. of individuals per 100 ha							
Species	First CS CRP	Second CS CRP	First WS CRP	Second WS CRP	First Cropfield	Second Cropfield	First Prairie	Second Prairie
American Tree Sparrow			100.0	66.7				
Horned Lark						44.4		
Red-winged Blackbird				266.6				
Ring-necked Pheasant			100.0	66.7				51.3
Western Meadowlark	55.6	22.2	11.1				3.07	
3 censuses ($\bar{x}$)[a]	55.6[b]	22.2[bc]	211.1[bcd]	400.0[bde]	0.0[bcdf]	44.4[bcdfgh]	3.07[bcdfgh]	51.3[bcdefgh]
No. of Species (total)	1	1	3	3	0	1	1	1
Diversity (H')	0.0	0.0	0.86	0.87	0.0	0.0	0.0	0.0

[a] Means with the same letters are not significantly different ($P > 0.05$).

* Feb 1991

Table 8. Artificial nest predation results on 8 (1989) and 11 (1990) study sites in southeast Nebraska.
(CS = cool-season grasses, WS = warm-season grasses)

	1989		1990	
Study sites	Number of predated nests	Total number of nests	Number of predated nests	Total number of nests
First CS CRP	0 *	25	0	20
Second CS CRP	7	25	1	20
Third CS CRP[b]			5	20
First WS CRP	7	25	2	20
Second WS CRP	3 *	25	3	20
Third WS CRP[b]			5	20
First Cropfield[a]	5	24[c]		
Second Cropfield[a]	8	23[c]		
First Cropfield[b]			0	20
Second Cropfield[b]			5	20
Third Cropfield[b]			3	20
First Prairie	1 *	25	1	20
Second Prairie	6	25	2	20
Overall totals	37	197	27	220

a Sorghum fields used in spring 1989.

b Sites added in spring 1990.

c Originally both 1989 cropfields had 25 nests but rains washed 3 nests away.

* Significantly lower rates of predation ($P \leq 0.05$).

In 1990, no differences in rates of predation could be detected among the 11 sites (X^2 = 17.06, 10 df, P = 0.07) (Table 8). Predation rates varied from 0% (first CS CRP and first cropfield) to 25% (third CS CRP, third WS CRP, and second cropfield).

DISCUSSION

Low Versus High CRP Enrollment

The 1989-90 censuses indicate pheasants were more abundant in areas with a higher percentage of cropland in CRP. Bartmann (1969) estimated 85% of the successful pheasant nests to be located on 43% of the Conservation Reserve land retired in the Soil Bank program in a Utah dryland study area; retired fields were seeded to a legume-grass mixture. Joselyn and Warnock (1964) found in 1962-63 that unharvested hayfields, comprising 5.6% and 2.4% of their Illinois study area, produced 52.4% and 28.6% of the successful pheasant nests, respectively. Similarly, Gates and Ostrom (1966) in Wisconsin determined that if hayfields were unharvested 2 or more years in a row, significantly more pheasant nests were found than in first year unharvested hayfields. Pheasant count numbers did decline during this study from 1989 to 1990, possibly a result of the dry weather.

Bobwhite populations were not significantly different between areas with low versus high CRP enrollment. Stoddard (1931) and Rosene (1969) indicate bobwhites need semi-open areas with exposed ground and herbaceous vegetation for nesting. Nests are frequently within 15-m of edge (Rosene 1969, Roseberry and Klimstra 1984). In Illinois, Roseberry and Klimstra (1984) found bobwhites preferred nesting in moderately dense stands of herbaceous-grassy vegetation with shrubs and brambles intermixed. Excepting fallow intertilled land, bobwhite nesting was lowest on soilbank fields, which Roseberry and Klimstra (1984) attributed to the rank vegetation growth found there. In the southeast Nebraska counties in this project, cool-season CRP seedings are 2-3 times more prevalent than warm-season CRP plantings (U.S. Soil Conserv. Serv., unpubl. data). Smooth brome is the primary grass species used in cool-season CRP seedings, and it is a sod-forming grass (Stubbendieck et al. 1985). Several years after seeding on my study sites, smooth brome fields became dense with little to no bare ground and a thick layer of dead grass litter.

Similarly, no significant difference between meadowlark populations on low and high CRP areas was found. However, in 1990, there was an increase in densities on study areas with high CRP and differences were nearly significant ($P = 0.058$). According to Wiens (1969), eastern and western meadowlarks in Wisconsin chose to nest in short ($\leq$ 30 cm), moderately dense grassland (87% grazed pasture) with forbs intermingled. Roseberry and Klimstra (1970) reported eastern meadowlarks in Illinois did not prefer to nest on Soil Bank fields where the vegetation had become dense, uniform, and lacked forbs. In South Dakota, Blankespoor (1980) found western meadowlarks increased as vegetation structure deteriorated, which was attributed to drought and grazing. Vegetation in CRP fields in my study may be higher than that preferred by meadowlarks. Also, meadowlarks may have, in general, been limited in my study areas by the lack of elevated singing perches due to spraying of tall weedy forbs and removal of fence lines and shelterbelts.

It is unclear why cottontail populations were higher in areas with low CRP enrollment during the 1989-90 spring censuses, but were not different between low and high CRP areas during the summer censuses. Cottontails are an edge species (Chapman et al. 1982) and should benefit from CRP land where it intermixes with existing land use, creating more edge habitat. It is possible that areas with more cropland are better habitat for cottontails in the spring; perhaps more food is available. Alternatively, road ditches in low CRP areas may have been the only good habitat available in spring. Thus, numbers observed along roads in low CRP areas may not reflect overall population densities. Cottontails in the high CRP areas may spend less time in road ditches as adequate habitat is available in the CRP fields. As the season progresses, perhaps cropfields provide better cover in the low CRP areas and thus attract cottontails away from the ditches.

Cover Type Comparisons: Vegetation and Birds

The sorghum fields had the shortest vegetation and lowest percent ground cover in both springs due to fall and spring tillage operations. Sorghum fields also had the lowest bird diversity ratings and lowest total bird numbers recorded. As other studies have shown (Graber and Graber 1963, Higgins 1975, Warburton and Klimstra 1984, Basore et al. 1986, Best et al. 1990), conventionally tilled cropfields provide marginal habitat for birds. Horned larks and killdeer prefer to nest in open to semi-open areas (Johnsgard 1980) which explains their presence in cropfields that had little cover. Other studies have found horned larks to be the only species to use cropland to any extent (Graber and Graber 1963, Owens and Myres 1973).

In general, vegetation was taller in the WS grassfields than in the CS grassfields and the native prairies. This increase in height is due to the higher growth form of WS grass species in southeast Nebraska. The second WS CRP field had the highest bird diversity rating and tallest vegetation in both years. Also, the second WS grassfield had the most species recorded (n = 10 each spring) and its bird numbers were distributed more evenly among these species, resulting in the higher diversity ratings. In 1988, emergency haying left strips of unmown vegetation in the second CS grassfield. Residual weed stems in these strips, which were taller than the surrounding vegetation, remained in 1989, and were used predominantly by red-winged blackbirds (*Agelaius phoeniceous*) and other nongame birds as singing perch sites (pers. obs.).

Vegetation in the native prairies was shorter than vegetation in WS CRP fields for several reasons. First, smooth brome had invaded the native prairies; in general, smooth brome does not grow as tall as the WS grasses used in southeast Nebraska CRP seedings. Also, the first native prairie probably had shorter vegetation each spring because it was hayed yearly when the native grasses were at their peak growth stage. Native (WS) grasses were in an initial period of growth when the spring measurements were taken. The second native prairie was burned in April 1990. The reduction of residual cover is probably the reason why the first native prairie had lower numbers of birds in both years and the second native prairie had lower numbers of birds in 1990.

Interestingly, eastern meadowlarks were observed only in the native prairies. Zimmerman and Finck (1982) also noted eastern meadowlarks on their native prairie study site. Wiens and Dyer (1975) reported eastern meadowlarks in tallgrass prairies and agricultural areas that consisted of fallow fields, hayfields, pastures, etc.. Also, George et al. (1979) and Westemeier and Buhnerkempke (1982) found eastern meadowlarks on seeded native grassfields while Roseberry and Klimstra (1970) recorded them in permanent pastures and hayfields. According to Johnsgard (1980), eastern meadowlarks are found in tallgrass prairies, meadows, and like habitats of open grassland in eastern Nebraska.

Grasshopper sparrows and dickcissels were the most abundant species on 6 of the 8 sites in 1989 and 7 of the 11 sites in 1990. Grasshopper sparrows appear to be somewhat adaptable, having been found in a variety of grassland habitats (Smith 1963, Wiens and Dyer 1975, Blankespoor 1980, Kantrud 1981, Zimmerman and Finck 1982, Higgins et al. 1984, Cody 1985). Dickcissels are, historically, characteristic of tallgrass prairies (Cody 1985) and prefer tall, heterogeneous grassfields (Wiens and Dyer 1975, Westemeier and Buhnerkempke 1982, Zimmerman 1982, Zimmerman and Finck 1982) which CRP fields during this study emulated.

Sedge wrens were recorded during the 1990 spring census on both CS and WS CRP fields. In August, during vegetation surveys, sedge wrens were observed on all 3 CS grassfields, all 3 WS grassfields, and the second native prairie. Blankespoor (1980) and Higgins et al. (1984) noted sedge wrens on retired cropland seeded to native grasses in South Dakota and North Dakota, respectively. Westemeier and Buhnerkempke (1982) and Schramm et al. (1984) found that sedge wrens colonized restored tallgrass prairie especially when it had been burned in the last 3 years. Breeding sedge wrens in Nebraska prefer wet meadows but have been found in hayfields and retired croplands to a lesser extent (Johnsgard 1980).

Only the WS grassfields had more than one bird species recorded during the 1989-90 winter census; vegetation on these fields was 3 times the height of the next tallest field's vegetation. The high densities of birds on the WS CRP fields were due to flocks of American tree sparrows (*Spizella arborea*), red-winged blackbirds, and pheasants observed during 1 or more of the censuses. Little vegetative cover remained on the sorghum fields due to fall tillage operations. The only species found in cropland was the horned lark, which establishes its territory in late winter-early spring (Beason and Franks 1974).

In general, bird densities and diversities were positively correlated with maximum vegetation height, ground cover, and visual obstruction readings. Although almost significant, the one exception was in 1989 when bird density was not correlated with ground cover. No significant relationships were detected between bird density or diversity and vegetation diversity, suggesting that vegetation structure may be more important to birds than the plant species in the individual fields. Other studies have reported similar results (e.g., Wiens 1969, Westemeier and Buhnerkempke 1982).

Cover Type Comparisons: Relative Nest Predation

Artificial nest predation experiments indicated that no specific habitat was more desirable in terms of reduced predation rates. It was expected that sorghum fields would have higher rates of predation than the other 3 cover types since the nests were more exposed to visual predators. However, open fields may have fewer predators searching them because of reduced food rewards. I was unable to positively identify the type of predator in most cases but potential predators included crows (*Corvus brachyrhynchos*), coyotes (*Canis latrans*), dogs (*Canis familiaris*), raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*), and bull snakes (*Pituophis catenifer*). Martin (1987) and Willebrand and Marcstrom (1988) suggest artificial nests underestimate actual predation rates because of a lack of visual and scent cues to predators. Therefore, this experiment may show lower nest predation rates on the study sites then were actually occurring.

CONCLUSIONS

Pheasants have positively responded in southeast Nebraska to the nesting, loafing, and roosting cover that CRP fields provide. The cessation of dry weather conditions should help increase pheasant populations in both CRP and non-CRP areas. Further research should be done before any conclusions are made on bobwhite and meadowlark responses to CRP land. The effects of CRP on cottontails were conflicting and may be due to seasonal changes of habitat and/or roadsides acting as reservoirs.

From this study, it appears that CRP land seems to benefit most species of nongame birds by providing nesting and brood-rearing habitat where formerly there was none. This is encouraging since Robbins et al. (1986) reported declines in many nongame grassland bird populations from 1965-79. However, numerous CRP fields are seeded to a single grass species in southeast Nebraska (U.S. Soil Conserv. Serv., unpubl. data). As these grassfields mature and become more homogeneous, habitat suitability will likely decline for some species such as grasshopper sparrows, dickcissels, and red-winged blackbirds (Smith 1963, Westemeier and Buhnerkempke 1982, Zimmerman 1982).

Proper management of CRP land will be essential to provide quality wildlife habitat and to maintain biodiversity. Ryan (1986) concluded that pristine prairie was a mosaic of habitats in various stages of succession. However, "emergency" haying and/or grazing if implemented during the nesting season, may negatively impact many game and nongame species (Berner 1988). Controlled spring burns every 3 to 5 years will rejuvenate fields that have become dense and rank (Best 1979, Westemeier and Buhnerkempke 1982, Schramm et al. 1984). A timely burn should improve habitat suitability for a variety of species, especially if it leaves unburned islands of residual vegetation interspersed throughout the burned area. This study suggests CRP land is providing habitat diversity that benefits many species in a monoculture landscape.

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Appendix A. Plants found on 11 (40-80 ha) study areas in 1989-90.

Common name	Scientific name
Alfalfa	*Medicago sativa* L.
Barnyard grass	*Echinochloa spp.* (L.) Beauv.
Big bluestem	*Andropogon gerardii* Vitman
Canada bluegrass	*Poa compressa* L.
Canadian wildrye	*Elymus canadensis* L.
Common ragweed	*Ambrosia artemisiifolia* L.
Cudweed sagewort	*Artemisia ludoviciana* Nutt.
Cup plant	*Silphium perfoliatum* L.
Downy brome	*Bromus tectorum* L.
Fall panicum	*Panicum dichotomiflorum* Michx.
Fescue sedge	*Carex brevior* (Dew.) Mack ex. Lunell.
Field bindweed	*Convolvulus arvensis* L.
Foxtail barley	*Hordeum jubatum* L.
Goldenrod	*Solidago spp.* L.
Green Foxtail	*Setaria viridis* (L.) Beauv.
Ground cherry	*Physalis spp.* L.
Hoary tickclover	*Desmodium canescens* (L.) DC.
Horse-weed	*Conyza canadensis* (L.) Cronq.
Illinois tickclover	*Desmodium illinoense* A. Gray
Indiangrass	*Sorghastrum nutans* (L.) Nash
Junegrass	*Koeleria pyramidata* (Lam.) Beauv.
Kentucky bluegrass	*Poa pratensis* L.
Lead plant	*Amorpha canescens* Pursh.
Little bluestem	*Schizachyrium scoparium* (Michx.) Nash
Milkweed	*Asclepias spp.* L.
Muskthistle	*Carduus nutans* L.
Pennsylvania smartweed	*Polygonum pennsylvanicum* L.
Pigweed	*Amaranthus spp.* L.
Porcupine-grass	*Stipa spartea* Trin.

(continued)

Appendix A. Continued.

Common name	Scientific name
Prairie dropseed	*Sporobolus heterolepis* (A. Gray) A. Gray
Purple prairieclover	*Dalea purpurea* Vent.
Red clover	*Trifolium pratense* L.
Reed canary-grass	*Phalris arundinacea* L.
Shattercane	*Sorghum halepense* (L.) Pers.
Sideoats grama	*Bouteloua curtipendula* (Michx.) Torr.
Slimleaf scurfpea	*Psoralea linearifolia* T. & G.
Smooth brome	*Bromus inermis* Leyss.
Smooth sumac	*Rhus glabra* L.
Stinkgrass	*Eragrostis cilianensis* (All.) E. Mosher
Switchgrass	*Panicum virgatum* L.
Western ragweed	*Ambrosia psilostachya* DC.
White prairieclover	*Dalea candida* Michx. ex. Willd.
Whorled milkweed	*Asclepias verticillata* L.
Yellow foxtail	*Setaria glauca* (L.) Beauv.
Yellow nutsedge	*Cyperus esculentus* L.
Yellow wood sorrel	*Oxalis spp.* L.

Appendix B. Birds recorded on 11 (40-80 ha) study areas in 1989-90.

Common name	Scientific name
American goldfinch	*Carduelis tristis*
American robin	*Turdus migratorius*
American tree sparrow	*Spizella arborea*
Bobolink[a]	*Dolichonyx oryzivorus*
Brown-headed cowbird[a]	*Molothrus ater*
Brown thrasher	*Toxostoma rufum*
Common yellowthroat	*Geothlypis trichas*
Dickcissel[a]	*Spiza americana*
Eastern kingbird	*Tyrannus tyrannus*
Eastern meadowlark[a]	*Sturnella magna*
Grasshopper sparrow[a]	*Ammodramus savannarum*
Horned lark	*Eremophila alpestris*
Killdeer	*Charadrius vociferus*
Mourning dove[a]	*Zenaida macroura*
Northern bobwhite[a]	*Colinus virginianus*
Northern oriole	*Icterus galbula*
Red-winged blackbird[a]	*Agelaius phoeniceus*
Ring-necked pheasant[a]	*Phasianus colchicus*
Sedge wren[a]	*Cistothorus platensis*
Upland sandpiper[a]	*Bartramia longicauda*
Western meadowlark[a]	*Sturnella neglecta*

[a] Potential breeder on CRP areas.

Appendix C. North American breeding bird population trends for species found on 11 (40-80 ha) study areas in 1989-90.[a]

Species	1965-79 Central Region	1966-89 Change (%) per year	1988-89 Change (%) per year	1988-89 Nebraska
American goldfinch	decrease	-1.3	-3.3	(-)
American robin	increase	+1.1	0.0	(+) *
American tree sparrow				
Bobolink[b]	decline	-0.8	-11.8	
Brown-headed cowbird[b]	increase	-0.8	-10.2	(-)
Brown thrasher	stable	-1.2	+3.1	(+)
Common yellowthroat	stable	-0.4	-6.9	(-)
Dickcissel[b]	decrease[c]	-1.9	+3.4	(-) *
Eastern kingbird	increase	-0.5	-2.8	(-)
Eastern meadowlark[b]	increase	-2.0	-10.0	
Grasshopper sparrow[b]	decrease[c]	-4.4	+0.6	(-)
Horned lark	stable	-0.6	-4.7	(-) *
Killdeer	increase	+0.5	-1.7	(+)
Mourning dove[b]	increase	+0.1	+6.7	(+) *
Northern bobwhite[b]	increase	-2.3	-13.9	(+)
Northern oriole	increase	+0.8[c]	+2.5[c]	(-) [d]
Red-winged blackbird[b]	increase[c]	-0.7	-6.0	(-)
Ring-necked pheasant[b]		-1.1	-13.9	(-)
Sedge wren[b]	decrease	+1.3	-23.0	
Upland sandpiper[b]	increase	+3.7	+9.5	(-)
Western meadowlark[b]	decrease	-0.7	-8.1	(-)

[a] (Robbins et al. 1986, Droege and Sauer 1989).
[b] Potential breeder on CRP areas.
[c] Decreased in Nebraska.
[d] Baltimore variety
* Significant (P = 0.05).