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BUREAU OF WILDLIFE MANAGEMENT
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PROJECT CODE NO.: 06010

TITLE: Conservation Reserve Enhancement Program (CREP) Monitoring

JOB CODE NO.: 01004

TITLE: Impacts of the Conservation Reserve Enhancement Program on the Regional Trends in Bird Populations and Eastern Cottontail Populations.

PERIOD COVERED: 1 July 2005 to 30 June 2006

COOPERATING AGENCIES: The Pennsylvania State University, School of Forest Resources

WORK LOCATION: Southcentral and Southeast Pennsylvania

PREPARED BY: Andy Wilson and Dr. Margaret Brittingham

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Abstract: Grassland bird populations have decreased significantly across North America in recent decades. It is considered that the new grasslands created under the Conservation Reserve Program (CRP) have benefited grassland birds, although most species continue to decline. An enhanced version of CRP, the Conservation Reserve Enhancement Program (CREP) was introduced in southern Pennsylvania in 2001. In order that effects of the program on populations of grassland and other birds could be assessed, a monitoring program was established in 2001. Data from the bird-monitoring program show that some grassland birds have continued to decline, but that others increased during the period 2001-2005. Populations of several grassland species fared better in areas where a higher percentage of farmland was enrolled in CREP. The strongest positive effects of CREP on grassland bird populations were noted for American kestrel and eastern meadowlark, with evidence of at least some positive response for a further 7 species. These responses are early indicators that CREP has benefited some grassland bird species in southern Pennsylvania, but we caution that the program is still in its infancy and that responses for some species may show a considerable time-lag due to the small and fragmented nature of grassland bird communities in the region.

OBJECTIVES

1. To monitor trends in agricultural habitats in 20 southeastern Pennsylvania counties enrolled in CREP.

2. To monitor trends in breeding bird populations and eastern cottontail rabbit populations on agricultural lands in the 20 CREP counties.

3. To determine the impact of establishing undisturbed grassland habitats on the regional abundance and population trends of grassland nesting birds and eastern cottontail rabbits.

4. To provide recommendations on future habitat management programs to restore farmland wildlife populations.

INTRODUCTION

The following report will cover an initial analysis of the bird monitoring data. A final report including a more detailed analysis of the bird and cottontail data will be available at a later date.

Grassland bird populations have been in steady decline across North America for the past 4 decades or more (Vickery 2001; Sauer et al. 2005). The declines are of such magnitude that they have been predicted to become a "prominent wildlife conservation crises of the 21st Century" (Brennan and Kuvlesky 2005). The causes of these declines are many and varied. Loss of grassland extent and habitat fragmentation have undoubtedly been major contributory factors, but changes in grassland management, such as increased frequency of/earlier mowing, and replacement of native grassland with monocultures, often of non-native species, are also important. This intensification of grassland and other agricultural management is acknowledged to have had adverse environmental impacts. To negate some of these impacts, the Conservation Reserve Program (CRP) was introduced in the 1985 Food Security Act, with key aims of curtailing excess agricultural production and reducing soil erosion (Isaacs and Howell 1988). The CRP requires that farmers take erodible land out of arable production and sow grass, for contract periods of 10-15 years, in return for a rental income. The CRP resulted in the creation of millions of acres of grasslands across agricultural areas of the United States. Numerous studies have shown that the new habitat created by CRP has benefited grassland bird species (e.g. Johnson and Igle 1995, Ryan et al. 1998, Swanson et al. 1999), but most grassland bird species have continued to decline since the introduction of CRP (Norment 2001), suggesting that it has not been sufficient to compensate for continuing population losses across the farmed landscape.

Due to unfavorable local economic conditions, CRP enrollment was low in the northeast United States. In order that the program be more suitable for those areas, a subsidiary program, the Conservation Reserve Enhancement Program (CREP) was authorized in the 1996 Farm Bill.

In April 2000, the Governor of Pennsylvania and U.S. Secretary of Agriculture approved a $210M conservation initiative for 20 counties within the Chesapeake Bay watershed in southern Pennsylvania. The Pennsylvania Conservation Reserve Enhancement Program has a goal of converting 100,000 acres of cropland and marginal pasture to conservation cover for 10-15 years. The program's goals are to improve water quality, reduce soil erosion, increase farm income, and improve wildlife habitat. The most widespread management practice in CREP is reseeding former arable land with grasses, which, it is hoped will help to reverse the rapid and sustained declines of grassland birds noted in Pennsylvania over the last 40 years. The State must provide 20% of the costs and is also responsible for monitoring the effectiveness of the habitat improvements on water quality and targeted wildlife populations.

To monitor the effects of CREP on grassland and other farmland birds in the 20 Chesapeake Watershed counties, a monitoring program was initiated in 2001. Although CREP was expanded to 23 "Northern Tier" counties of Pennsylvania in 2003 and 16 counties in the Ohio River Basin in 2004. There

are, as yet, no specific programs to monitor the effects of CREP in those areas.

Previous research has shown that CREP fields in southern Pennsylvania support primarily generalist species, such as red-winged blackbirds and song sparrows, and edge species, such as indigo buntings and common yellowthroats, with lower numbers of grassland specialists such as grasshopper sparrows and eastern meadowlarks (Wentworth and Brittingham 2005). Species diversity, abundance and nesting success was higher in CREP fields than from paired hayfields. It is not clear whether the positive field-scale effects demonstrated by that study are sufficient to elicit a population level response. The aims of this paper are to examine population trends of bird species within the 20 county study area, for the period 2001 to 2005, to evaluate whether CREP has resulted in large-scale responses by grassland bird populations.

METHODS

Methods: Bird Surveys

The survey protocol is based on The Breeding Bird Survey (BBS) with slight modifications (Sauer & Droege 1990). Birds were surveyed at 5-minutes point counts (BBS is 3-minutes) at up to 50 stops along a survey route. The counts are approximately 0.5 miles apart and all birds seen or heard are counted within an 820 ft (250m) radius of each survey point. The survey routes were selected randomly within areas dominated by farmland, according to land cover data, and were not selected to coincide with CREP agreements. Survey routes are generally along township roads; major highways, where traffic noise could reduce bird detectability, are avoided. A team of 12 highly skilled birdwatchers, who were employed by the Pennsylvania Game Commission (PGC), carried out bird surveys on 90 routes, twice per season, once in May and once in June (Appendix 1). In 2004 and 2005 only the June surveys were conducted.

Methods: spatial data analysis using GIS

Spatial analysis was carried out using ArcView GIS (Ormsby et al. 2004). The sampling unit in this analysis is the survey route (n = 90). The routes averaged 33.4 point counts (range 20-50), or 16.2 miles in length. This analysis is concerned with landscape-scale population changes – our definition of landscape is the area within 790 ft (500 m) of each survey route. Some survey routes were almost contiguous, and hence the landscapes overlapped and could not, therefore, be considered independent samples. In these cases the landscapes were combined, reducing the sample size to 84 landscapes. The landscapes averaged 2,276 acres (range 1,275-4,847). Land cover data (Myers and Bishop 1999) were used to calculate the area of each land use within each landscape. The area of farmed land was the sum of the grassland and arable land use types.

Digitized maps of CREP agreements were supplied by the Natural Resources Conservation Service (NRCS). The following CREP practices were selected for the analysis: CP01 – introduced grasses and legumes (cool season grasses), CP02 – native grasses (warm season grasses), and CP21 – filter strips (grasses). Only CREP enrolled by the start of the 2005 bird-breeding season (April 2005) was included. The area of CREP enrolled by spring 2005 was calculated using ArcView GIS and summed across each landscape. The summed CREP area for each landscape was then calculated as a

percentage of the total farmland within each landscape. The average percentage of farmland enrolled in CREP grassland practices by April 2005 was 2.51, ranging from 0 (13 landscapes) to 15.4.

Methods: Analysis of Bird Count Data

The analysis presented in this paper is based on the June counts for all 5 years, May counts were not carried out in 2004 or 2005. Unfortunately, for 10 survey routes, data for 2004 and 2005 are not available, and hence these routes were not included in the sample, reducing the sample size to 74 landscapes.

Population trends for the years 2001 to 2005 were estimated using program TRIM (TRends and Indices for Monitoring data). TRIM is statistical software to analyze time-series of counts with missing observations using Poisson regression (Pannekoek and van Strien 2001). TRIM is useful for modeling bird count data because the Poisson error distribution copes well with large numbers of zero counts. The effects of CREP on population changes at the landscape scale were carried out by including the percentage of farmland enrolled in CREP as a covariate. Landscapes were categorized as high CREP (>4% of farmland enrolled), medium CREP (2-4%) low CREP (0.5-2%) and none/negligible (<0.5%). Analysis was restricted to species for which TRIM was able to calculate population indices for each of the 4 CREP covariate categories, the 56 most common and widespread bird species in the 20 county study area. The list of bird species includes grassland obligates, farmland generalists and many species that are not associated with grassland (Table 1).

RESULTS

Twenty-seven of the 56 species showed significant population changes across the study area between 2001 and 2005 (Table 1 and 2), with increases (15 species) slightly outnumbering decreases (12 species). Of the species most closely tied to grassland habitats, ring-necked pheasant and American kestrel declined significantly, while horned lark, red-winged blackbird and eastern meadowlark increased significantly (Table 1). All 5 of these species have been previously in steady decline in Pennsylvania since at least the 1960s (Sauer et al. 2005).

Significant ($p < 0.05$) positive effects of the amount of CREP in the landscape were detected for 6 species (Table 1 and 2). Of these, 1 gray catbird (Table 2) may be a spurious association, because this species nests and forages in scrub and woodland edges, and is unlikely to benefit significantly from CREP. No significant negative effects of CREP were detected for any bird species. Population trends are presented for 9 grassland-associated species that showed a positive CREP effect at a reduced level of significance ($p < 0.1$). For all of these species, populations fared better in landscapes with grassland CREP, and for most of them, fared the best in areas with at least 4% of farmland in CREP. The strongest evidence for CREP having a positive effect on population trends at the landscape scale was for American kestrel (Figure 2a) and eastern meadowlark (Figure 2b), both of which increased strongly in landscapes with the most CREP. Both song sparrow (Figure 2b) and grasshopper sparrow (Figure 2f) also show positive population trends in areas with CREP. For grasshopper sparrow, the small number of birds detected may have prevented the result from achieving statistical significance due to large standard errors. Wentworth and Brittingham (2005) found that red-winged blackbird was the most numerous

nesting species in CREP in southern Pennsylvania. Our data show that this species appears to have increased in all areas between 2001 and 2004 – with the most rapid increase in areas with the most CREP (Figure 2h). However, a large population decrease between 2004 and 2005, possibly the result of a poor breeding season during the wet spring of 2004, makes it difficult to ascertain the effects of CREP on populations of this species. Mourning dove (Figure 2b), eastern kingbird (Figure 2c), European starling (Figure 2d) and common grackle (Figure 2e) are all species that forage in grassland, and appear to have increased in landscapes with the most CREP, while showing little population change in areas with little or no CREP.

DISCUSSION AND RECOMMENDATIONS

Although many studies have shown that grassland birds utilize CRP, often at higher species diversity and abundances than in agricultural grasslands (Best et al. 1998; Ryan et al. 1998; Weber et al. 2002), few studies have been able to demonstrate that this has produced a positive effect at the population scale (Murphy et al. 2003). We believe ours is the first study to examine the effects of CREP on bird population responses at a large-scale. That we are able to show significant population increase for several species in landscapes with the most CREP is a very significant finding. The very strong positive effect for American kestrel and eastern meadowlark are especially surprising, given that the program is still in it infancy. Many of the CREP fields in the study area had been sown for only 1 or 2 years by the end of our 5-year study period, and hence the findings must be treated with some caution. It could be that we have significantly under-estimating the value of CREP for grassland birds, given that we have such a short time period with which to demonstrate population level responses. We recommend that monitoring continue such that effects over a long time period can be assessed.

This paper presents only preliminary population level results based on the monitoring data from southern Pennsylvania. Future analyses will look at other factors that may have affected the responses, such as topography, surrounding land use, size and spatial configuration of CREP fields, and the presence of source populations to colonize them. The latter could be especially important because most of the grassland species that it is hoped would benefit from CREP have become very localized in southern Pennsylvania (Brauning 1992). A lack of source populations to colonize the new grasslands created under CREP could result in a lag of several years between the creation of the habitat, and bird population responses.

We conclude that early evidence suggest that some grassland bird species have already benefited from the creation of grassland fields through the CREP in southern Pennsylvania. However, longer term monitoring will be needed to see whether these responses elicit a reversal of the long-term decrease in population levels of these species at a larger scale.

ACKNOWLEDGMENTS

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Table 1. Population trends for 30 common grassland associated bird species in Southern Pennsylvania between 2001 and 2005. The CREP effect is the significance of the amount of CREP in the landscape as a covariate with population trend.

Common name *scientific name*	Population change		CREP effect
	slope	trend/significance	p-value
Canada goose *Branta Canadensis*	+0.0230	uncertain	0.1239
Mallard *anas platyrhynchos*	0.0911	uncertain	0.1972
Ring-necked pheasant *Phasianus colchicus*	-0.0341	uncertain	0.4935
American kestrel *Falco sparverius*	-0.0801	decline (p<0.01)	0.0096[a]
Killdeer *Charadrius vociferous*	-0.0601	decline (p<0.01)	0.4790
Rock pigeon *Columbia livia*	-0.0102	uncertain	0.1426
Mourning dove *Zenaida macroura*	0.0857	increase (p<0.01)	0.0153[b]
Chimney swift *Chaetura pelagica*	0.0792	uncertain	0.4915
Eastern kingbird *Tyrannus tyrannus*	-0.0190	uncertain	0.0352[b]
American crow *Corvus brachyrhychos*	-0.0934	decline (p<0.01)	0.0845
Horned lark *Eremophila alpestris*	0.0798	increase (p<0.05)	0.4525
Tree swallow *Tachycineta bicolor*	0.1455	increase (p<0.05)	0.0671
Barn swallow *Hirundo rustica*	0.0616	increase (p<0.01)	0.3382
Eastern bluebird *Sialia sialis*	-0.1045	decline (p<0.05)	0.2261
American robin *Turdus migratorius*	0.0543	decline (p<0.01)	0.1204
European starling *Sturnus vulgaris*	0.0089	uncertain	0.0218 [b]
Common yellowthroat *Geothlypis trichas*	-0.0036	stable	0.3693
Chipping sparrow *Spizella passerina*	0.0438	increase (p<0.01)	0.1075
Field sparrow *Spizella pusilla*	-0.0628	decline (p<0.01)	0.3651
Vesper sparrow *Pooecetes gramineus*	-0.0233	uncertain	0.6914
Savannah sparrow *Passerclus sandwichensis*	-0.0248	uncertain	0.7835
Grasshopper sparrow *Ammodramus savabbarum*	-0.0162	uncertain	0.1136
Song sparrow *Melospiza melodia*	0.0192	stable	0.0415 [b]
Indigo bunting *Passerina cyanea*	-0.0208	uncertain	0.9411
Bobolink *Dolichonyx oryzivorus*	-0.0271	uncertain	0.3785
Red-winged blackbird *Agelaius phoeniceus*	0.0439	increase (p<0.01)	0.0863
Eastern meadowlark *Sturnella magna*	0.0541	increase (p<0.05)	0.0168 [b]
Common grackle *Quiscalus quiscula*	0.0138	stable	0.0757
Brown-headed cowbird *Molothrus ater*	0.0479	uncertain	0.6028
American goldfinch *Carduelis tristis*	-0.1005	decline (p<0.01)	0.5745

[a] Statistically significant at 5% level of significance
[b] Statistically significant at 1% level of significance

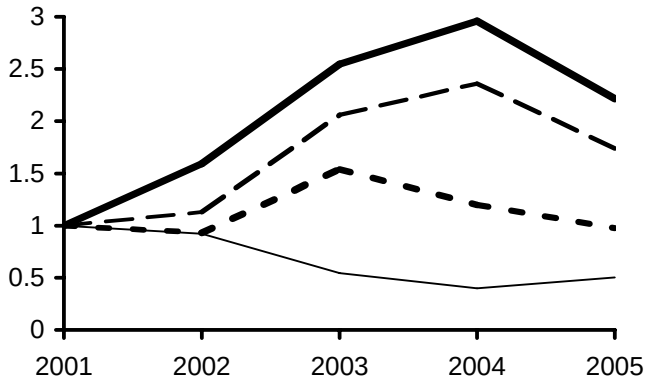
Table 2. Population trends for 26 common bird species that are not associated with grasslands in Southern Pennsylvania between 2001 and 2005. The CREP effect is the significance of the amount of CREP in the landscape as a covariate

Common name *scientific name*	Population change		CREP effect
	slope	trend/significance	p-value
Red-bellied woodpecker *Melanerpes*	0.0866	increase (p<0.01)	0.2821
Downy woodpecker *Picoides pubescens*	0.0295	uncertain	0.4344
Northern flicker *Colaptes auratus*	0.0004	uncertain	0.4919
Eastern wood peewee *Contopus virens*	-0.0580	uncertain	0.1609
Willow flycatcher *Empidonax trailii*	0.0103	Uncertain	0.8008
Eastern phoebe *Sayorrnis phoebe*	-0.0085	uncertain	0.8930
Great crested flycatcher *Myiarchus*	-0.0665	uncertain	0.0661
Red-eyed vireo *Vireo olivaceus*	0.0569	uncertain	0.7278
Blue jay *Cyanocitta cristata*	-0.0532	decline (p<0.01)	0.0791
Black-capped chickadee *Poecile*	0.1342	increase (p<0.01)	0.0567
Tufted titmouse *Baeolophus bicolor*	-0.0580	uncertain	0.6900
White-breasted nuthatch *Sitta*	-0.1269	decline (p<0.05)	0.7367
Carolina wren *Thryothorus ludovicianus*	0.0657	increase (p<0.01)	0.2490
House wren *Troglodytes aedon*]	0.0316	uncertain	0.4809
Wood thrush *Hylocichla mustelina*	0.0058	stable	0.1212
Gray catbird *Dumetalla carolinensis*	0.0336	increase (p<0.05)	0.0009[a]
Northern mockingbird *Mimus polyglottos*	-0.0129	stable	0.7726
Brown thrasher *Toxostoma rufum*	0.1748	increase (p<0.01)	0.1131
Yellow warbler *Dendroica petechia*	0.1188	increase (p<0.01)	0.3317
Ovenbird *Seiuris aurocapilla*	-0.0739	decline (p<0.01)	0.0857
Scarlet tanager *Piranga olicacea*	0.1594	increase (p<0.01)	0.8070
Eastern towhee *Pipil erythrophthalmus*	-0.0520	uncertain	0.2140
Northern cardinal *Cardinalis cardinalis*	0.0138	stable	0.9835
Baltimore oriole *Icterus galbula*	0.0688	uncertain	0.9779
House finch *Carpodacus mexicanus*	-0.1074	decline (P<0.05)	0.9715
House sparrow *Passer domesticus*	0.0096	stable	0.9562

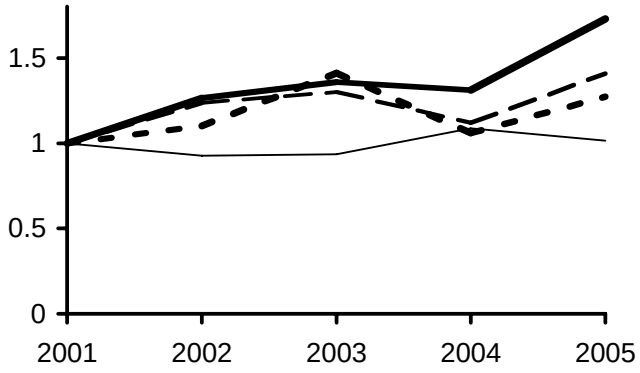
[a] Statistically significant at 5% level of significance

Figure 1. Map of the 20 county study area – shaded white, and sampling areas (landscapes) – shaded black.

2a. American kestrel



2b. Mourning dove



2c. Eastern kingbird

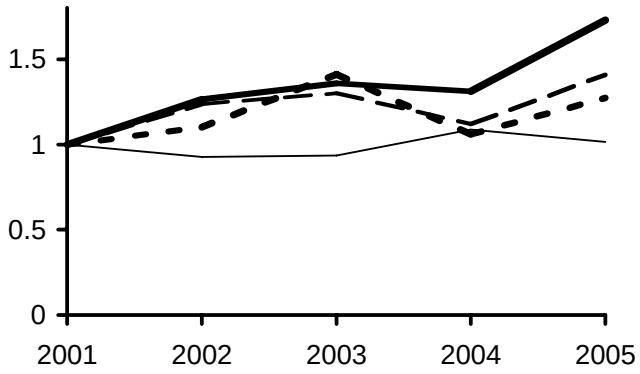
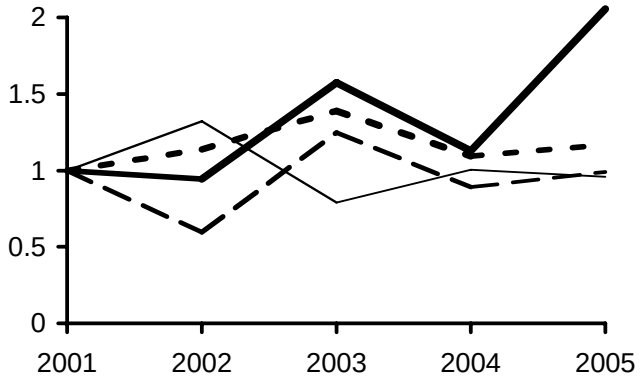
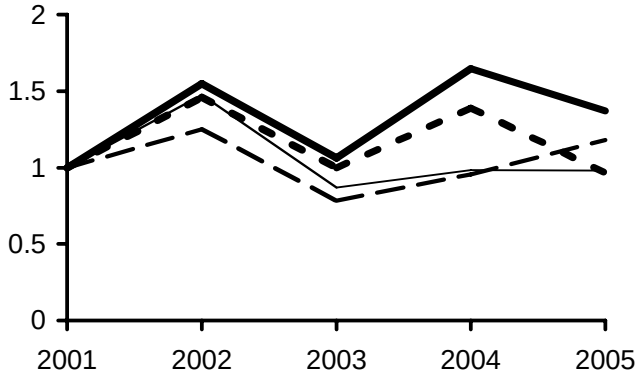


Figure 2. Population trends for grassland associated species that show a significant effect of CREP, in southern Pennsylvania during the period 2001 to 2005. Bold solid line=high CREP areas (>4% of farmland in CREP), dashed=medium CREP (2-4%), dotted=low CREP (0.5-2%), light solid no CREP (<0.5%). The y-axis is the population index, relative to an index value of 1 in 2001.

2d. European starling



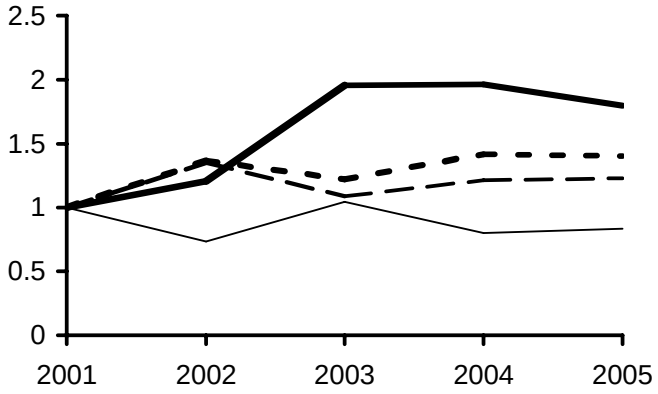
2e. Common grackle



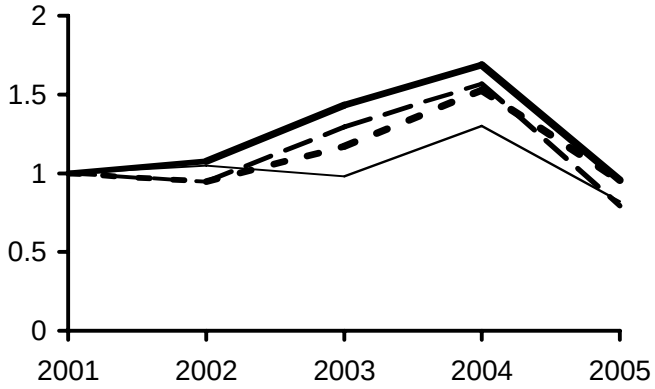
2f. Grasshopper sparrow

Figure 2 (cont). Population trends for grassland associated species that show a significant effect of CREP, in southern Pennsylvania during the period 2001 to 2005. Bold solid line=high CREP areas (>4% of farmland in CREP), dashed=medium CREP (2-4%), dotted=low CREP (0.5-2%), light solid no CREP (<0.5%). The y-axis is the population index, relative to an index value of 1 in 2001.

2g. Song sparrow



2h. Red-winged blackbird



2i. Eastern meadowlark

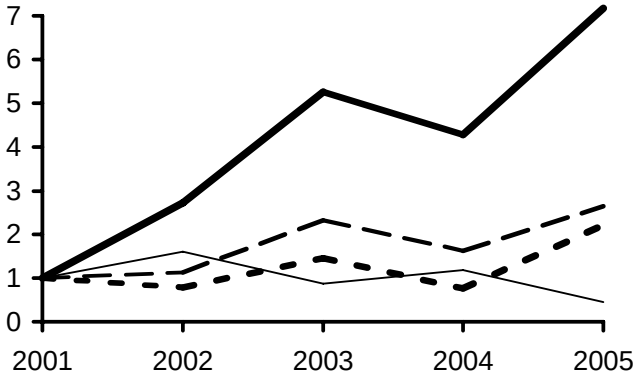


Figure 2 (cont). Population trends for grassland associated species that show a significant effect of CREP, in southern Pennsylvania during the period 2001 to 2005. Bold solid line=high CREP areas (>4% of farmland in CREP), dashed=medium CREP (2-4%), dotted=low CREP (0.5-2%), light solid no CREP (<0.5%). The y-axis is the population index, relative to an index value of 1 in 2001.

Appendix 1. List of routes, number of stops, and observer.

County	Route	Number of stops	Observer
Adams	ADA1	47	Pete Robinson
	ADA2	34	Pete Robinson
	ADA3	32	Pete Robinson
Bedford	BED1	50	Bob Mulvihill
	BED2	44	Bob Mulvihill
	BED3	50	Bob Mulvihill
	BED4	50	Bob Mulvihill
Berks	BER1	24	Patti Barber
	BER2	28	Patti Barber
	BER3	28	Patti Barber
	BER4	22	Patti Barber
	BER5	28	Patti Barber
	BER6	27	Patti Barber
Chester	CHE1	22	Anne Bodling
	CHE2	22	Anne Bodling
	CHE3	23	Anne Bodling
Columbia	COL1	27	Wayne Laubscher
	COL2	22	Wayne Laubscher
	COL3	21	Wayne Laubscher
	COL4	29	Wayne Laubscher
Cumberland	CUM1	39	Don Orris
	CUM2	40	Don Orris
	CUM3	31	Don Orris
	CUM4	48	Don Orris
	CUM5	40	Don Orris
Dauphin	DAU1	40	Duane Hoffman
	DAU2	32	Duane Hoffman
	DAU3	31	Duane Hoffman
Franklin	FRA1	44	Dan Snell
	FRA2	30	Dan Snell
	FRA3	36	Dan Snell
	FRA4	36	Dan Snell

Appendix 1 (cont.). List of routes, number of stops, and observer.

County	Route	Number of stops	Observer
Franklin	FRA5	31	Dan Snell
	FRA6	42	Dan Snell
	FRA7	39	Dan Snell
	FRA8	42	Dan Snell
	FRA9	34	Dan Snell
Fulton	FUL1	25	Dan Snell
	FUL2	28	Dan Snell
	FUL3	30	Bob Mulvihill
	FUL4	27	Dan Snell
Juniata	JUN1	38	Hunter Hart
	JUN2	43	Hunter Hart
	JUN3	37	Hunter Hart
	JUN4	44	Hunter Hart
	JUN5	24	Hunter Hart
	JUN6	42	Hunter Hart
Lancaster	LAN1	43	Anne Bodling
	LAN2	38	Anne Bodling
	LAN3	35	Anne Bodling
	LAN4	50	Anne Bodling
	LAN5	34	Anne Bodling
	LAN6	28	Anne Bodling
	LAN7	36	Anne Bodling
Lebanon	LEB1	27	Anne Bodling
	LEB2	28	Anne Bodling
	LEB3	28	Duane Hoffman
	LEB4	30	Duane Hoffman
Montour	MON1	22	Wayne Laubscher
	MON2	25	Wayne Laubscher
Northumberland	NOR1	21	Duane Hoffman
	NOR2	22	Duane Hoffman
	NOR3	26	Duane Hoffman
	NOR4	23	Duane Hoffman
	NOR5	20	Wayne Laubscher
	NOR6	21	Wayne Laubscher
	NOR7	24	Duane Hoffman

Appendix 1 (cont.). List of routes, number of stops, and observer.

County	Route	Number of stops	Observer
Perry	PER1	39	Don Orris
	PER2	41	Don Orris
Schuykill	SCH1	24	Mike Ward
	SCH2	29	Mike Ward
	SCH3	46	Mike Ward
	SCH4	0	Mike Ward
Somerset	SOM1	50	Bob Mulvihill
	SOM2	50	Bob Mulvihill
	SOM3	36	Bob Mulvihill
Snynder	SNY1	35	George Boone
	SNY2	48	George Boone
	SNY3	40	George Boone
	SNY4	30	George Boone
	SNY5	37	George Boone
Union	UNI1	23	Wayne Laubscher
	UNI2	39	Wayne Laubscher
	UNI3	32	Wayne Laubscher
York	YOR1	47	Pete Robinson
	YOR2	38	Pete Robinson
	YOR3	38	Pete Robinson
	YOR4	44	Pete Robinson
	YOR5	31	Pete Robinson
	YOR6	22	Pete Robinson