Breeding Bird Abundance and Diversity in Agricultural Field Borders in the Black Belt Prairie of Mississippi

Mark D. Smith, *Department of Wildlife and Fisheries, Box 9690, Mississippi State University, Mississippi State, MS 39762*

Philip J. Barbour, *Department of Wildlife and Fisheries, Box 9690, Mississippi State University, Mississippi State, MS 39762*

L. Wes Burger Jr., *Department of Wildlife and Fisheries, Box 9690, Mississippi State University, Mississippi State, MS 39762*

Stephen J. Dinsmore, *Department of Wildlife and Fisheries, Box 9690, Mississippi State University, Mississippi State, MS 39762*

Abstract: Conservation buffer practices implemented under U.S. Department of Agriculture (USDA) Farm Bill programs offer opportunities for enhancing breeding season habitat for farmland birds. Recently, CP33 (Habitat Buffers for Upland Birds) was added as a new continuous Conservation Reserve Program (CRP) practice designed to address habitat goals for northern bobwhite (*Colinus virginianus*) under the Northern Bobwhite Conservation Initiative. However, it is presumed that this practice will also benefit other birds. To evaluate potential benefits of CP33 field borders for farmland birds, we established a total of 89.0 km of experimental field borders (6.1-m wide) along agriculture field edges on three 405-ha farms in Clay and Lowndes counties, Mississippi. We used 200-m x 20-m strip transects to measure abundance and diversity of birds inhabiting bordered and non-bordered field edges. Indigo bunting (*Passerina cyanea*) and dickcissel (*Spiza americana*) abundances were nearly twofold greater along bordered field edges. However, mourning dove (*Zenaida macroura)*, northern cardinal (*Cardinalis cardinalis*), and common grackle (*Quiscalus quiscula*) abundances did not differ between bordered and non-bordered field edges. Field borders adjacent to strip habitats (i.e., fencerows, drainage ditches) had greater total bird and red-winged blackbird (*Agelaius phoeniceus)* abundance than non-bordered edges adjacent to strip habitats. Species richness was greater along bordered than non-bordered edges. Within intensive agricultural landscapes where large-scale grassland restoration is impractical, USDA conservation buffer practices such as field borders (CP33) may be useful for enhancing local breeding bird richness and abundance.

Key words: agriculture, breeding bird, CP33, Conservation Reserve Program, field border, Mississippi, strip transect, USDA

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The Black Belt Prairie of Mississippi and Alabama has been almost completely (>98%) converted to agriculture (DeSelm and Murdock 1993, Mac et al. 1998, Peacock and Schauwecker 2003). Grassland birds inhabiting these former prairies are now restricted to prairie relics or grasslands composed predominantly of introduced grasses. As such, breeding grassland bird populations within this region have undergone a steady decline of 2.3%/year from 1966–2003 (Sauer et al. 2003). Whereas conversion of native prairies has undoubtedly affected grassland bird populations, continuing declines of most grassland birds are now ascribed mostly to agricultural intensification (Herkert 1994, Murphy 2003). Consolidation of small diversified farms to large-scale, highly specialized farming systems has resulted in the loss of edge, fence row, and idle herbaceous lands and consequently a reduction in overall landscape complexity (Rodenhouse et al. 1993, Herkert 1994, Warner 1994).

Former prairies are often the most productive farmlands in the United States, so the practicality of large-scale prairie restoration for the conservation of grassland birds is unlikely. However, enhancement of farmlands for grassland birds may be accomplished by incorporating conservation buffer practices. Available through several U.S. Department of Agriculture (USDA) Farm Bill programs, conservation buffers are practical and cost-effective conservation practices that provide multiple environmental benefits (e.g., increased herbicide and nutrient retention, reduced soil erosion) and habitat for grassland birds (Daniels and Williams 1996, Webster and Shaw 1996, Marcus et al. 2000, Puckett et al. 2000). Within intensive agricultural production systems, conservation buffers are increasingly becoming the only source of semi-permanent grasslands for nesting birds (Warner 1994).

The USDA-Farm Services Agency recently announced availability of a new conservation buffer practice, CP33 (Habitat Buffers for Upland Birds) under the continuous Conservation Reserve Program (CRP). This field border practice consists of an idle herbaceous plant community established in addition to existing row crop field edge habitats such as fencerows and drainage ditches. However, unlike other conservation buffer practices designed specifically to provide non-wildlife environmental benefits (e.g., soil erosion, herbicide retention), CP33 is not restricted to down slope field edges. This permits greater freedom for use as wildlife habitat in intensive agricultural landscapes. Whereas CP33 was designed to address habitat goals of the Northern Bobwhite Conservation Initiative (NBCI; Dimmick et al. 2002), the presumption is that other birds benefit from this practice.

Numerous studies have documented breeding bird use and reproductive success within other agricultural edge or strip habitats (e.g., Best 1983, Johnson and Beck 1988, Best et al. 1990, Bryan and Best 1991, Camp and Best 1994, Sparks et al. 1996). However, no studies have addressed potential importance of conservation field borders for breeding birds in southeastern agricultural systems. If field borders are to be implemented on a nationwide basis to enhance bird habitat within agricultural production systems, information regarding bird use of field borders is required. Our objectives were to measure relative abundance of breeding season birds along row crop field margins with and without experimental field borders. We also provide estimates of relative conservation value of field border habitats as indexed by breeding bird communities.

Study Area

Our study was conducted on three privately-owned farms (approximately 405 ha each) in Clay and Lowndes counties, Mississippi. Located in the Black Belt Prairie region of Mississippi, all farms had a history of agriculture use (i.e., actively producing crops for >50 years). Primary agricultural land use was row crop (soybean, corn) and livestock production. Grasslands on each farm consisted predominantly of perennial cool (tall fescue, *Festuca arundinacea*) and warm (Bermuda grass, *Cynodon dactylon*; Bahia grass, *Paspalum notatum*) season exotic forage grasses. Remnant stands of native grasses (big bluestem, *Andropogon gerardii*; little bluestem, *Schizachyrium scoparium*; broomsedge, *Andropogon* spp.) were scattered throughout each farm. Fencerows, drainage ditches, and contour filter strips were dominated by tall fescue and Johnson grass (*Sorghum halepense*). Wooded areas consisted mainly of fencerows and riparian corridors; however, larger blocks (>10 ha) of woods were scattered throughout each site. Oak (*Quercus* spp.), green ash (*Fraxinus pennsylvanica*), maple (*Acer* spp.), hickory (*Carya* spp.), sugarberry (*Celtis laevigata*), and eastern red cedar (*Juniperus virginiana*) were the most common species found in wooded areas.

During early spring 2000, we established experimental field borders (6.1 m wide) along row crop field margins (fencerows, drainage ditches, access roads, and contour filter strips) on one randomly-chosen half of each farm. Mean row crop field size was 26.9 ha (*N*= 37, range = 2.9–146.9 ha) and mean percentage of the row crop field area established as field borders was 6.0% (range = 0.5%–15.3%). Farm operators were required not to mow, treat with herbicide, or disk field borders during the study. Field borders were seeded with Kobe lespedeza (*Lespedeza striata*) and partridge pea (*Chamaecrista fasciculata*) at rates of 11.2 kg/ha and 3.4 kg/ha, respectively. Despite our attempt to establish a plant community, most field borders seeded naturally from seed present within the seed bank. Insofar as natural regeneration with legume supplementation is a USDA accepted cover on CP33, our field borders were representative of field borders being established under CP33. Common species occurring in field borders were morning glory (*Ipomoea* spp.), southern crabgrass (*Digitaria ciliaris*), Johnson grass, hemp sesbania (*Sesbania exaltata*), yellow nutsedge (*Cyperus esculentus*), and ragweed (*Ambrosia* spp.).

Methods

Selection of Strip Transects

We used 200-m x 20-m strip transects to estimate abundance (birds/transect) and diversity of breeding birds relative to field border management practices. We defined the population of field edges within our study sites using geo-referenced aerial photos and Geographic Information System (GIS) land cover maps and portioned all agricultural field edges into 200-m segments (sampling units) within each farm. We positioned the longitudinal centerline of each strip transect along the original (prior to field border establishment) row crop field-adjacent plant community edge. We situated the beginning of each strip transect so that vegetation on the adjacent plant community side of the transect was consistent (e.g., continuous herbaceous cover) for the length of the transect. All strip transects contained 10 m of row crop on one side of the transect centerline and 10 m of the adjacent plant community on the other side. For bordered transects (see below), experimental field borders constituted the first 6.1 m of the row crop side of the strip transect. Strip transects located adjacent to roadways or which contained field borders that were inadvertently disturbed (i.e., disked, mowed, or treated with herbicide) by farm operators were not included.

Because bird assemblages differ as a function of plant community structure and composition along edges of row crop fields (Best 1983, Shalaway 1985, Best et al. 1990, Sparks et al. 1996), we classified each strip transect based upon combinations of 1) bordered (T) and non-bordered (C) treatments on the row crop side and by 2) vegetation type (woody [W], herbaceous [G]) and 3) width (strip [S], ≤30 m of continuous vegetation type; block [B], >30 m of continuous vegetation type) on the adjacent plant community side. This classification scheme produced eight treatment combinations (TGB, CGB, TGS, CGS, TWB, CWB, TWS, CWS). Because the amount and structure of grasslands and woodlands differed dramatically among farms, we were not able to sample all eight treatment combinations within all of the farms. Therefore, we randomly selected 10 strip transects for each treatment combination from the population of transects (110 bordered, 82 non-bordered) available across all three farms except for the CGB treatment combination. As only seven strip transects were available for the CGB treatment combination, we sampled all of these. We did not randomly assign the field border treatment to individual transects. Instead, we randomly selected bordered and non-bordered transects from the population of potential transects across farms. Therefore, we conducted an observational study with replication (Eberhardt and Thomas 1991).

Survey Protocol

We marked strip transects with flagging (20 cm x 2.54 cm) at the beginning, end, and at 20-m intervals along the centerline to allow observers to monitor their speed and location during surveys. We sampled all transects twice, once during 27 June–2 July 2002 and again during 3–9 July 2002. Within each sampling period, we randomly assigned transects among observers. However, within each farm, we sampled transects in non-random order to reduce travel time between transects. Each observer sampled 3–8 transects/morning/farm. We sampled transects in reverse order during the second sampling period. We walked approximately 20 m/min along the transect centerline and made intermittent stops to record number of individuals and species of birds seen or heard within 10 m of the transect centerline. We recorded observations from 0530–1000 (CST) when wind velocities were <16 km/h. We noted the locations of birds which flushed and landed farther down the transect to avoid double-counting. To minimize observer bias, we used only observers ($N = 6$) who were familiar with birds occurring in this region and who were conducting similar, concurrent studies of breeding birds in agricultural landscapes in Mississippi.

Diefenbach et al. (2003) reported 0.93–1.00 detection probability for grassland birds when transect half-widths were <25 m. Therefore, given that our transect half-width was only 10 m, we believe that detection probability was near 1.0 for bordered and non-bordered transects adjacent to herbaceous cover. However, we acknowledge that this assumption may not be valid for the adjacent plant community side of wooded transects; therefore, we assumed species-specific detection probabilities were constant between bordered and non-bordered transects within each adjacent plant community type in order to make valid inferences regarding border effects along wooded edges.

Statistical Analyses

We estimated species-specific abundances (birds/transect) for the six most abundant species (mourning dove, *Zenaida macroura;* northern cardinal, *Cardinalis cardinalis;* indigo bunting, *Passerina cyanea;* dickcissel, *Spiza americana*; red-winged blackbird, *Agelaius phoeniceus;* common grackle, *Quiscalus quiscula*) observed. We calculated Total Avian Conservation Value scores (TACV; Nuttle et al. 2003) to index relative conservation value of bird communities inhabiting field borders. We computed TACV by multiplying abundance of each species within a strip transect by their respective Partners in Flight (PIF) breeding season priority scores for the East Gulf Coastal Plain (Carter et al. 2000). We then summed species-specific TACVs across all species within the strip transect to produce a TACV score for each strip transect within each treatment combination. When estimating species richness, diversity (Shannon and Weaver 1949), overall abundance (birds/transect), and conservation value, we used all species and individuals observed.

We used a 2^3 factorial arrangement of treatments in a completely randomized mixed-model repeated measures analysis of variance (ANOVA) in PROC MIXED (SAS 2002) to test the null hypotheses of no differences in species-specific abundances, overall abundance, species richness, diversity, and TACV between bordered and non-bordered transects. Field border, adjacent plant community type, and adjacent plant community width were considered fixed effects whereas sampling periods served as the repeated time effect. We modeled within-subject (transect) variance using the first-order auto-regressive (AR1) covariance structure. Because the effects of adjacent plant community type and width on avian abundance and diversity along row crop field edges are well documented (Best 1983, Shalaway 1985, Best et al. 1990), we considered adjacent plant community type and width as controlling factors for this known source of variation and assumed their 3-way interaction with the field border effect was negligible. We included these main effects in the model to control for this anticipated source of variation. Because we were not explicitly interested in these effects, we only report results associated with the field border effect. Because of an unbalanced design, we report Type III *F*-tests and predicted marginal means (LSMEANS) for all abundance and community metrics. We rejected the null hypothesis of no treatment effect at $\alpha = 0.05$.

Results

We recorded 1443 individuals of 53 species during both sampling periods (Table 1). The six most abundant species (red-winged blackbird, 19.7%; indigo bunting, 14.7%; dickcissel, 13.1%; mourning dove, 8.3%; northern cardinal, 7.4%; common grackle, 6.0%) accounted for 69.2% of all individuals recorded (Table 1).

Species-specific Abundance

Indigo bunting ($F_{1,70} = 16.49$, $P < 0.001$) and dickcissel ($F_{1,70} = 5.38$, $P = 0.02$) abundances were greatest in bordered transects (Table 2). However, mourning dove ($F_{1,70} = 0.08$, $P = 0.78$), northern cardinal ($F_{1,70} = 0.17$, $P = 0.68$), and common grackle ($F_{1,70} = 1.51$, $P = 0.22$) abundances did not differ between bordered and non-bordered transects (Table 2). Field borders interacted with adjacent plant community width to affect red-winged blackbird abundance ($F_{1,70} = 4.23$, $P = 0.04$). Red-winged blackbirds were more abundant in bordered than non-bordered edges adjacent to strip habitats ($F_{1,70} = 11.32$, $P = 0.001$; Table 3). However, red-winged blackbird abundance was similar between bordered and non-bordered edges adjacent to block habitats ($F_{1,70} = 0.10$, $P = 0.75$; Table 3).

Community Measures

Species richness was greater in bordered than non-bordered transects ($F_{1,70} = 4.39$, $P = 0.04$; Table 2). However, diversity did not differ between bordered and non-bordered transects ($F_{1,70} = 2.81$, $P = 0.10$; Table 2). Field borders interacted with adjacent plant community width to affect overall abundance ($F_{1,70} = 6.65$, $P = 0.01$) and conservation value ($F_{1,70} = 6.83$, $P = 0.01$). Overall abundance was greater in bordered than non-bordered edges adjacent to strip habitats ($F_{1,70} = 18.87$, $P < 0.001$; Table 3). Overall abundance was similar between bordered and non-bordered edges adjacent to block habitats ($F_{1,70} = 0.27$, $P = 0.61$). Likewise, TACV was greater in bordered than non-bordered edges adjacent to strip habitats ($F_{1,70} = 20.54$, $P < 0.001$) but was similar between bordered and non-bordered edges adjacent to block habitats ($F_{1,70} = 0.42$, $P = 0.52$; Table 3).

Discussion

Dickcissel and indigo bunting abundances were nearly twofold greater where field borders were established regardless of adjacent plant community type or width. Provision of habitat for these species is particularly important given that dickcissels and indigo buntings have been declining at 4.0%/year and 1.5%/year, respectively, during the previous 24 years in the Black Prairie region (Sauer et al. 2003). Because indigo buntings are primarily associated with forest edge/scrub shrub communities, field borders may have enhanced the habitat value of wooded areas by providing an idle herbaceous plant community along these edges for foraging. Field borders created a more gradual transition from forest to row crop, likely making these edges more favorable as foraging, loafing, or nesting sites for indigo buntings. Field bor-

Table 1. List of bird species observed within bordered and non-bordered strip transects during the breeding season in Clay and Lowndes counties, Mississippi, 2002.

Common name	Scientific name	*N* individuals	%
Red-winged blackbird	*Agelaius phoeniceus*	284	19.7
Indigo bunting	*Passerina cyanea*	212	14.7
Dickcissel	*Spiza americana*	189	13.1
Mourning dove	*Zenaida macroura*	120	8.3
Northern cardinal	*Cardinalis cardinalis*	107	7.4
Common grackle	*Quiscalus quiscula*	87	6.0
Brown-headed cowbird	*Molothrus ater*	39	2.7
Northern mockingbird	*Mimus polyglottos*	37	2.6
American crow	*Corvus brachyrhynchos*	32	2.2
Carolina wren	*Thryothorus ludovicianus*	27	1.9
Yellow-breasted chat	*Icteria virens*	24	1.7
Carolina chickadee	*Parus carolinensis*	18	1.3
Eastern towhee	*Pipilo erythrophthalmus*	17	1.2
Barn swallow	*Hirundo rustica*	15	1.0
Common yellowthroat	*Geothlypis trichas*	15	1.0
Horned lark	*Eremophila alpestris*	14	1.0
Yellow-billed cuckoo	*Coccyzus americanus*	13	0.9
Grasshopper sparrow	*Ammodramus savannarum*	12	0.8
Northern rough-winged swallow	*Stelgidopteryx serripennis*	11	0.8
White-eyed vireo	*Vireo griseus*	10	0.7
Blue grosbeak	*Guiraca caerulea*	9	0.6
European starling	*Sturnus vulgaris*	9	0.6
Great Blue heron	*Ardea herodias*	9	0.6
Great egret	*Casmerodius albus*	9	0.6
Downy woodpecker	*Picoides pubescens*	8	0.6
Eastern meadowlark	*Sturnella magna*	8	0.6
Ruby-throated hummingbird	*Archilochus colubris*	8	0.6
Eastern wood-pewee	*Contopus virens*	7	0.5
Blue-gray gnatcatcher	*Polioptila caerulea*	6	0.4
Eastern kingbird	*Tyrannus tyrannus*	6	0.4
Tufted titmouse	*Parus bicolor*	6	0.4
House sparrow	*Passer domesticus*	6	0.4
American goldfinch	*Carduelis tristis*	5	0.4
Blue jay	*Cyanocitta cristata*	5	0.4
Cattle egret	*Bubulcus ibis*	5	0.4
Eastern bluebird	*Sialia sialis*	5	0.4
Killdeer	*Charadrius vociferus*	5	0.4
Lark sparrow	*Chondestes grammacus*	5	0.4
Northern bobwhite	*Colinus virginianus*	5	0.4
Purple martin	*Progne subis*	5	0.4
Red-tailed hawk	*Buteo jamaicensis*	5	0.4
Red-bellied woodpecker	*Melanerpes carolinus*	4	0.3
Loggerhead shrike	*Lanius ludovicianus*	3	0.2
Orchard oriole	*Icterus spurius*	3	0.2
Summer tanager	*Piranga rubra*	3	0.2
Painted bunting	*Passerina ciris*	2	0.1
Common ground-dove	*Columbina passerina*	1	0.1
Field sparrow	*Spizella pusilla*	1	0.7
Great Crested flycatcher	*Myiarchus crinitus*	1	0.7
Hairy woodpecker	*Picoides villosus*	1	0.7
Pileated woodpecker	*Dryocopus pileatus*	1	0.7
Red-shouldered hawk	*Buteo lineatus*	1	0.7
Turkey vulture	*Cathartes aura*	1	0.7

Table 2. Breeding season species richness, diversity, and abundance (birds/transect) of mourning dove (MODO), northern cardinal (NOCA), indigo bunting (INBU), dickcissel (DICK), and common grackle (COGR) within bordered and non-bordered strip transects in Clay and Lowndes counties, Mississippi, 2002.

	Border		Non-border			
Metric	Mean	SE	Mean	SE	RES[a]	*P*-value
MODO	1.0	0.35	0.9	0.38	11.1	0.78
NOCA	0.7	0.13	0.7	0.13	0.0	0.68
INBU	1.8	0.15	1.0	0.16	80.0	0.001
DICK	1.6	0.21	0.9	0.23	77.7	0.02
COGR	0.9	0.37	0.2	0.40	350.0	0.22
Species Richness	4.3	0.25	3.6	0.27	19.4	0.04
Diversity	1.1	0.06	1.0	0.06	10.0	0.10

a. Relative effect size: [(border–non-border)/non-border]*100.

Table 3. Breeding season abundance (birds/transect) of red-winged blackbird (RWBL), overall bird abundance, and Total Avian Conservation Value (TACV) within bordered and non-bordered strip transects by adjacent plant community width (strip, block) in Clay and Lowndes counties, Mississippi, 2002.

	Border		Non-border			
	Mean	SE	Mean	SE	RES	*P*-value
Strip						
RWBL	4.2	0.62	1.1	0.65	281.8	0.001
Overall	15.3	1.28	7.2	1.35	112.5	<0.001
TACV	232.7	17.74	115.7	18.76	101.1	<0.001
Block						
RWBL	1.2	0.65	0.9	0.71	33.3[a]	0.75
Overall	8.7	1.35	7.7	1.48	13.0[a]	0.61
TACV	135.9	18.71	118.0	20.47	15.2[a]	0.52

a. Relative effect size: [(border–non-border)/non-border]*100.

ders provided greater vertical and horizontal vegetation complexity along existing herbaceous contour strips, drainage ditches, and field roads thereby increasing utility of these strip habitats for dickcissels. However, field borders did not affect abundance of mourning dove, northern cardinal, and common grackle, likely because these species are generalists and exhibit greater plasticity in selection of breeding and foraging habitats than indigo buntings and dickcissels.

Species richness was greater along bordered than non-bordered transects. However, diversity did not differ because most birds detected (69.2%) were of only six species. Shalaway (1985) reported that fencerow width and species richness were positively correlated and attributed this relationship to greater structural complexity of vegetation in wider fencerows. Likewise, Stauffer and Best (1980) and Yahner (1983) reported similar trends in species richness for wooded and herbaceous riparian zones and shelterbelts, respectively. However, overall bird abundance, abundance of red-winged blackbirds, and TACV were greater only along bordered strip habitats. Addition of field borders along edges of contiguous blocks of grasslands or woodlands did not increase the conservation value (TACV) or the total number of birds using these edges. Best et al. (1995) reported greater abundance of breeding birds in strip habitats (fencerows, railroad right-of-ways, and grassed waterways) in Iowa due to availability of trees and shrubs which were absent within adjacent crop lands. We speculate that field borders simultaneously increased the width of existing strip habitats while providing greater vertical and horizontal structural diversity of vegetation, facilitating greater space partitioning of birds along existing linear features (MacArthur and MacArthur 1961).

Our results are based on one year of data and do not address temporal variation in habitat value that may become evident in longer term studies (Leopold et al. 1996). However, we contend that the magnitude of field border effect sizes observed (19%–282%) warrants our conclusion that field borders can be used to enhance local breeding bird populations during the breeding season. Furthermore, we observed similar field border effects (215%–363%) on winter bird densities along these same transects during two years of study (Smith et al. 2005).

Conservation Value of Field Borders

Some avian conservationists are skeptical of strip habitats, suggesting they may constitute population sinks or "ecological traps" (Gates and Gysel 1978, Yahner 1982). However, Warner (1994) contended this supposition is too simplistic to be universally accepted given that great variation exists in nesting success in strip habitats (e.g., 8.0%, Camp and Best 1994; 65.2%, Shalaway 1985) which may be influenced greatly by the predator and landscape context in which nest success is measured (Bergin et al. 2000). For example, Conover (2005) reported greater nest density in wider field borders, but nest success did not vary in relation to field border width. Within intensive agricultural landscapes, strip habitats are increasingly becoming the only source of semi-permanent nesting cover (Warner 1994). Under this paradigm, the only alternative habitats for nesting are row crop, pasture, or hay fields. Nest density and success in row crop fields is comparatively less than in strip habitats for most grassland birds (Rodenhouse and Best 1983, Wooley et al. 1985, Basore et al. 1986). Dale et al. (1997) observed less nest success in periodically mowed fields than adjacent unmowed strips of vegetation and field edges where mowing was absent. Additionally, in agricultural landscapes, even "sink" habitats may contribute to local or regional conservation (McCoy et al. 1999). Field borders and other strip habitats may constitute "ecological traps" only if they cause birds to settle in these habitats instead of other available habitats in which greater fitness may be accrued. However, in many intensive agricultural landscapes, these greater fitness-producing habitats may not exist.

Nest parasitism by brown-headed cowbirds and nest predation by American crows are important sources of nest failure for several species of breeding birds in agricultural landscapes (Stallman and Best 1996, Winter 1999). These two species, respectively, were the seventh and ninth most abundant birds observed in our study. Although we did not measure nest success, the relative abundance of these two species raises concern over possible reduction in nest success for birds inhabiting field borders. However, Conover (2005), working in agricultural landscapes in the Mississippi Alluvial Valley, reported only 0%–6% nest parasitism in field border habitats. We suggest additional research is needed to determine fitness consequences (*sensu* Van Horne 1983) of avian habitat selection of field borders relative to other habitats commonly available in intensive production systems of the Southeast.

For some species, field borders may provide essential resources beyond nesting habitats. Field borders may be used for foraging, roosting, loafing, or as escape cover. Several studies (Thomas et al. 1991, Rodenhouse et al. 1992, Asteraki et al. 1995, Thomas and Marshall 1999) reported greater arthropod abundance and diversity in strip habitats relative to adjacent row crops. Unmowed waterways in Iowa were important habitats for birds in mid to late summer because other grass habitats were mowed frequently thereby eliminating vertical vegetation structure (Bryan and Best 1991). Although mowing was not a significant factor contributing to reduction of vegetation structure in our study, intensive livestock grazing occurred on one farm to produce an analogous effect on adjacent grasslands. Furthermore, field borders provide important wintering habitat for resident and short distance migrants (Marcus et al. 2000, Smith et al. 2005). Whereas agricultural intensification has lead to simplification of farmland structure (Rodenhouse et al. 1993), we contend that field borders provide an additional and important structural component for breeding birds within intensive agricultural landscapes.

Management Implications

Herbaceous field borders can provide habitat for farmland birds during both summer and winter (Smith et al. 2005). If increasing the abundance of breeding birds is a management goal, then our results suggest how field borders can be placed to best meet this goal. The relative benefits of field borders for breeding birds may be more pronounced adjacent to strip habitats (i.e., linear features such as fencerows and drainage ditches) than adjacent to blocks of woodland or grassland. However, Smith et al. (2005) reported that during winter, herbaceous field borders increased local bird abundance even when established adjacent to blocks of other habitats. Herbaceous field borders are one of a suite of conservation buffer practices that can be implemented as a component of a larger conservation management system.

Conservation management systems that support both birds and farm operators are important for maintenance of a diverse farmland avifauna (Peterjohn 2003, Rodenhouse et al. 1993, Murphy 2003). However, implementation of conservation practices is voluntary and depends upon adoption by farm operators. Only farmland conservation practices that economically accrue multiple environmental benefits while enhancing farmland wildlife will gain widespread acceptance and implementation (Allen and Vandever 2003). Most farm operators recognize the economic, environmental, and societal benefits of CRP conservation practices; >75% of farm operators deem wildlife as an important component (Allen and Vandever 2003). Conservation buffer practices are subsidized under numerous federal farm programs and minimally impact agricultural production systems. As such, producers may be more likely to adopt field border practices than whole field retirements. Therefore, we contend that USDA National Conservation Buffer Initiative practices, such as field borders (CP33), are compatible with the needs of farm operators while diversifying farmland structure to enhance local avifauna. However, adoption by producers will remain a function of knowledge, opportunity costs, incentives, and ease of implementation.

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