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Grassland Bird Population Responses to Upland Habitat Buffer Establishment

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Cover photo: Native warm-season grass CP33–Upland Habitat Buffer (photo by Dr. L. Wes Burger, Jr.)

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Grassland Bird Population Responses to Upland Habitat Buffer Establishment

Introduction

Agricultural producers can provide habitat for grassland birds by incorporating conservation practices as part of a comprehensive conservation management system. Conservation buffers are practical cost-effective practices that can be installed under several U.S. Department of Agriculture (USDA) Farm Bill conservation programs. Conservation buffers provide multiple environmental benefits (increased herbicide and nutrient retention, reduced soil erosion, enhanced water quality) while providing habitat for grassland birds. Conservation buffers are vegetative barriers (grass, shrubs, trees) strategically located within or at the edge of crop fields to protect elements of the natural environment from effects of weather and human activities. Within intensive agricultural production systems, conservation buffers may be the only source of semi-permanent grassland habitat for nesting birds.

In 2004, the USDA Farm Service Agency announced the availability of a new continuous Conservation Reserve Program (CRP) conservation buffer practice, CP33–Habitat Buffers for Upland Birds. Habitat buffers for upland birds are intentionally managed noncrop herbaceous plant communities along crop field edges to provide environmental and wildlife habitat benefits. However, unlike other buffer practices, such as riparian buffers and filter strips, CP33 habitat buffers can be deployed around the entire field margin, not just along downslope edges. Habitat buffers are often employed in addition to existing field edge habitats such as fence rows and drainage ditches and may vary in species composition or width depending upon producer objectives. CP33 habitat buffers were designed as part of a national conservation initiative for northern bobwhite. While recognizing the benefits to northern bobwhite, the presumption was that other grassland bird species, such as dickcissel, would also benefit from this practice (fig. 1).

Conservation buffers are encouraged under multiple USDA conservation programs (i.e., Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentives Program (WHIP), (CRP)) and may offer opportunities for enhancing farmlands for numerous grassland birds throughout the United States. If habitat buffers are to be broadly adopted, information regarding grassland bird use of buffer habitats is needed to validate and refine practice standards. Our objectives were to measure the effects of herbaceous habitat buffers on populations of breeding and wintering grassland birds and northern bobwhite in the Black Belt Prairie of northeastern Mississippi. The Black Belt Prairie is a subdivision of the East Gulf Coast Plain physiogeographic province.

Figure 1 Dickcissel

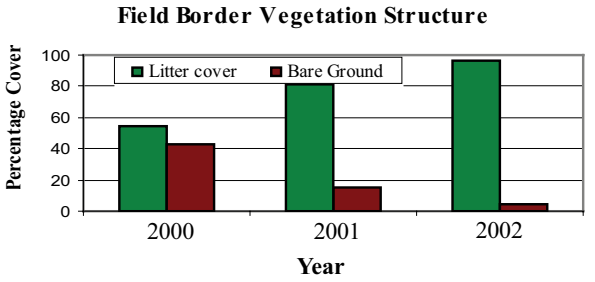
Photo credit Stephen J. Dinsmore, Iowa State University

Studies were conducted on three privately owned working farms located within the Black Belt Prairie in Clay and Lowndes Counties, Mississippi. Primary agricultural practices were row crop (approximately 60–80% row crop, soybean and corn), forage, and livestock production. During early spring 2000, experimental buffers (20 ft wide) were established along agricultural field margins (fence rows, drainage ditches, access roads, and contour filter strips) on half of each farm (fig. 2). The average percentage of the row crop field area established as habitat buffers was 6 percent, and habitat buffers comprised about 1 percent of the land base of each farm. Producers were paid a monetary incentive similar to those used in common USDA conservation buffer programs at the end of each growing season for land placed into habitat buffers. Furthermore, producers were required not to mow, herbicide, or disk habitat buffers during the duration of the study. Because the experimental buffers in this study were established prior to development of practice standards for CP33–Habitat Buffers for Upland Birds, they were similar to, but not identical to CP33 buffers. The 20-foot buffer width in the study was narrower than the minimum CP33 buffer width (30 ft). However, the legume cover crop/natural succession establishment used in this study was comparable to the natural succession option available under CP33 in many States.

Figure 2 Experimental fallow upland habitat buffer adjacent to row crop

Photo credit Wes Burger, Mississippi State University

Figure 3 Litter characteristics of upland habitat buffers on Clay County farm from 2000 to 2002



Habitat buffer vegetation

Habitat buffers in this study were noncropped areas adjacent to row crop fields and were themselves adjacent to woods, herbaceous field contours, ditches, field roads, or pastures. Buffers were 20 feet wide and followed the original edge of the row crop field boundary. Experimental habitat buffers were planted with 10 pounds per acre kobe lespedeza and 3 pounds per acre of partridge pea, but numerous volunteer species became established.

In general, plant communities in habitat buffers had fewer species than adjacent field margin communities. This was not unexpected given that field margin communities were well established and included many perennial and woody species. During the first 3 years after establishment, 102 taxa of plants were detected in experimental habitat buffers. Of these, 54 (52.94%) were annual, 2 (1.95%) were biennial, and 46 (45.10%) were perennial. Sixteen plant species (15.69% of species detected in borders) occurred only in the experimental habitat buffer and not in the adjacent field margin.

Habitat buffer plant communities on each farm increased in species richness over the 3 years of the study. In general, over time, annual plant species were replaced by perennial species. For plants in the border, proximity to woods had a greater influence on annuals being replaced by perennials and herbaceous being replaced by woody species than for borders adjacent to herbaceous communities (e.g., pasture) or adjacent to crops (corn or soybean).

Percent litter and percent bare ground were inversely related and from 2000 to 2002, the magnitude of difference dramatically changed (fig. 3). Percent litter cover increased, while percent bare ground decreased. If management objectives are to create and maintain habitat for ground nesting birds such as northern bobwhite, disturbance (fire and/or disk harrow) will be needed by the third year to decrease litter and increase bare ground.

Grassland songbird response to upland habitat buffers

Strip transect sampling techniques were used during June and July 2002 to estimate abundance and diversity of breeding season grassland birds relative to habitat buffer management practices. Line transect distance sampling techniques were used during February through March 2002 and 2003 to estimate density and diversity of wintering grassland birds relative to habitat buffer management practices.

Breeding season songbird response

Fifty-three species (1,443 individual birds) were recorded while sampling transects during the 2002 breeding season. The six most abundant species were red-winged blackbird (20%), indigo bunting (15%), dickcissel (13%), mourning dove (8%), northern cardinal (7%), and common grackle (6%).

Dickcissel and indigo bunting were nearly twice as abundant where habitat buffers were established, regardless of adjacent plant community type or width. Dickcissels and indigo buntings have been declining at 4 percent per year and 1.5 percent per year, respectively, during the previous 24 years in the Black Belt Prairie region (based on Breeding Bird Survey trends), so habitat buffers may contribute to regional conservation efforts for these two species. Although indigo bunting is primarily a forest bird, the habitat buffers provided an herbaceous plant community along existing wooded areas, making these areas more favorable for foraging, loafing, and nesting sites. Habitat buffers provided vertical and horizontal vegetation complexity and

may enhance the suitability of existing linear habitats (ditch banks, fence rows, road edges) for dickcissels.

Species richness was greater along bordered than nonbordered transects; however, diversity did not differ. Overall bird abundance was greater along bordered linear habitats than similar nonbordered edges; however, addition of habitat buffers along larger patches of grasslands or woodlands did not alter the number of birds using these edges. The investigators speculated that in linear habitats characteristic of modern agricultural landscapes, the habitat buffers provided greater plant structure and diversity, thus supporting a greater number of individuals and species. Although the study results are based on one year of data, it is believed the magnitude of observed habitat buffer effects suggests habitat buffers may increase the abundance of selected species of grassland/shrub birds during the breeding season (fig. 4).

Wintering songbird response

Investigators recorded 71 bird species while sampling transects during the winters of 2002 and 2003. Of 17,562 individual birds, the 5 most abundant species were red-winged blackbird (45%), American pipit (11%), song sparrow (7%), Savannah sparrow (6%), and American robin (5%).

Most sparrows are ground foragers and their use of linear habitats often depends on vegetation structure. Collectively, across most adjacent plant communities, greater densities of song, Savannah, and swamp sparrows were observed along bordered transects than nonbordered transects. Song sparrow, Savannah, and all other sparrow densities were greater where habitat buffers were established along existing grasslands (fig. 5). Whereas the addition of herbaceous habitat buffers adjacent to grasslands may seem redundant, most grasslands within the study farms were monotypic stands of cool-season, exotic forage grasses and provided little vertical structure and few quality food producing plants. Song sparrow and other sparrow densities were also greater along habitat buffers adjacent to wooded strip habitats than comparable wooded strips without a habitat buffer.

After crops were harvested, buffer habitats provide suitable cover and food resources for many sparrow species. Habitat buffers in the study were recently established (<3 years old) and consisted primarily of seed-producing grasses and forbs coupled with a relatively open understory. This combination likely facilitated ground-based foraging. Additionally, habitat buffers may provide escape cover in close proximity to foraging sites within the crop stubble. Upland habitat buffers may enhance the value of existing grasslands and crop fields by producing additional foraging habitat and providing escape cover in close proximity to waste grain food sources.

Northern bobwhite response to upland habitat buffers

Previous studies have demonstrated that habitat buffers may provide foraging habitat for bobwhite chicks and enhance breeding season survival, usable space, and local abundance. From 2000 to 2002, pen-reared, human-imprinted northern bobwhite chicks (fig. 6) were used to measure availability of insects and other arthropods within habitat buffers. Adjacent row crops and radio-marked adult wild bobwhite were used to assess habitat use and survival. Bobwhite abundance was measured during the breeding season and fall.

During the study, chicks foraging in soybean fields foraged more efficiently near the field margin than in the field interior; however, arthropod consumption did not differ between bordered and non-bordered fields. Although habitat buffers may supply abundant arthropods for chicks in some landscapes, during this study early successional (<3 years old) habitat buffers did not necessarily provide more arthropods than row crop fields at the margin.

Figure 4 Breeding season abundance of common songbird species at three Black Belt Prairie farms, 2002

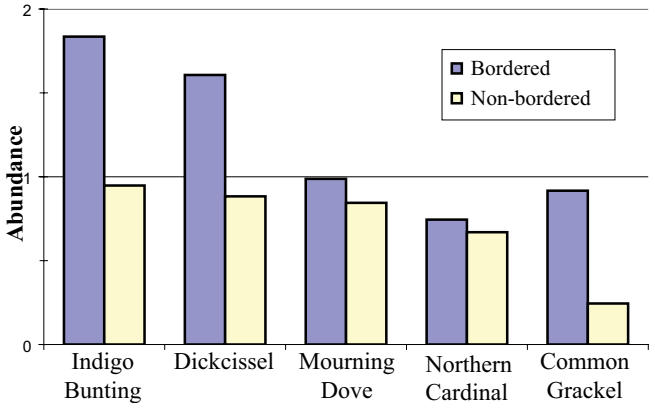


Figure 5 Winter density of sparrows on three Black Belt Prairie farms, 2002 to 2003

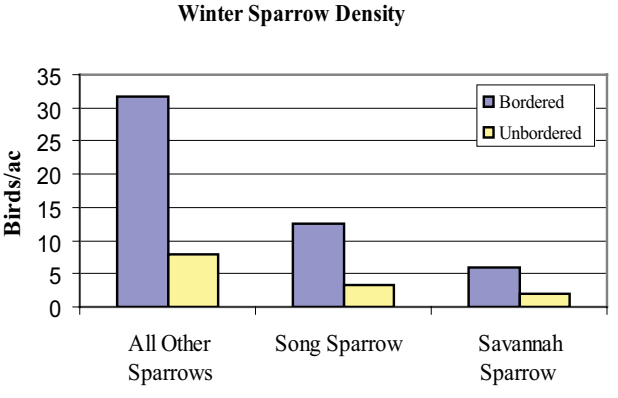


Figure 6 Bobwhite chick in agricultural field

Photo credit © Joe Mac Hudspeth, Brandon, Mississippi

Survival of radio-marked bobwhite during the breeding seasons of 2000 through 2002 was similar between bordered (37%) and nonbordered (43%) farms. Overall survival among all study sites and years was about 41 percent. Bobwhite on farms with and without borders exhibited similar habitat selection, established breeding season ranges based on the distribution of croplands and grasslands, and disproportionately used both grasslands and croplands within seasonal ranges. Although, when available, bobwhite used habitat buffers, the study did not demonstrate that habitat buffers substantively increased the use of associated row crop fields (fig. 7).

Autumn density of wild northern bobwhite was estimated using covey call-counts. Covey counts were conducted during late October to early November 1999 to 2002. Breeding season call-counts were used during mid-June 1999 through 2002 to index breeding season bobwhite density. For autumn and breeding season abundance measures, differences in abundance measures between bordered and nonbordered landscapes (1,000-acre farms) were evaluated during the three years of study. The average autumn density at bordered sites was about 66 percent greater and the average number of males during the breeding season was about 23 percent greater than nonbordered sites. These relative effect sizes were similar to those from previous habitat buffer studies (fig. 8).

The net effect of habitat buffers on the proportion of the landscape usable by bobwhite was evaluated by developing a space-use based habitat model constructed from utilization distributions of radio-marked bobwhite. The habitat suitability model was applied to each of the three experimental farm landscapes and simulated usable space before and after habitat buffer establishment (20-ft habitat buffers). An average 6 percent change in land use increased usable space for bobwhite by nearly 15 percent on average.

Figure 7 Breeding bobwhite density index at three Black Belt Prairie farms, 1999 through 2002 (years and sites pooled)

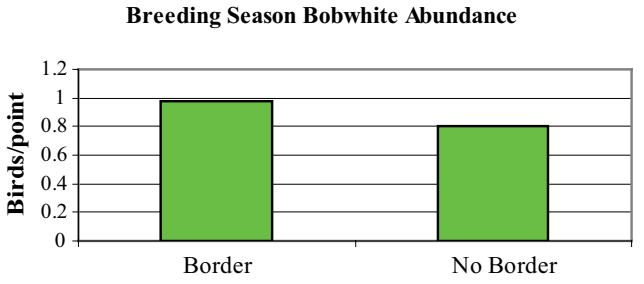
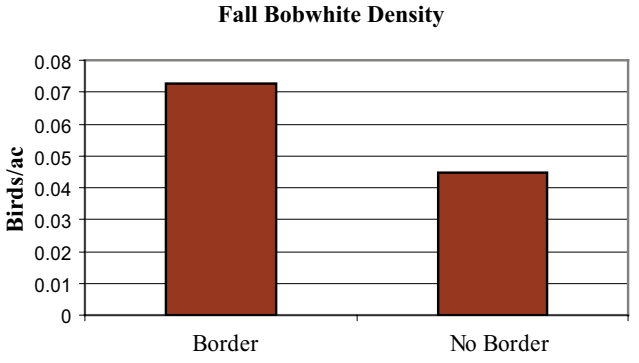


Figure 8 Autumn bobwhite density at three Black Belt Prairie farms, 1999 through 2002 (years and sites pooled)



Summary

Within intensive agricultural landscapes, habitat buffers provide important idle herbaceous cover for grassland and early successional birds. Habitat buffers may provide nesting, foraging, roosting, loafing, and escape cover. During winter, habitat buffers may provide important habitat in southern agricultural systems where most short distance migrants overwinter. The availability of habitat buffers may increase local abundance and species richness of grassland birds.

On the study sites, during the breeding season, the presence of habitat buffers increased total bird abundance, species richness, and density of dickcissel and indigo bunting, two regionally declining early successional species. Additionally, habitat buffers provided wintering habitat for resident and short-distance migrants and increased local density of wintering sparrows.

The study suggests that habitat buffers provided important habitat for many grassland birds due to their greater abundance of food (weed seeds) and more complex vegetation

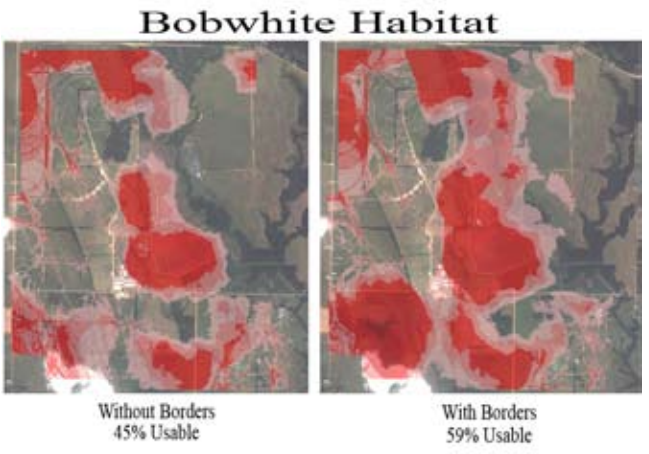
structure for nesting, roosting, loafing, thermal, and escape cover than adjacent row crop and grasslands within the study sites. Whereas agricultural intensification has led to increased simplification of farmland structure, the contention is that habitat buffers provide an additional and important structural component for breeding and wintering birds within intensive agricultural landscapes.

Although habitat buffers have elicited bobwhite population responses in other studies, statistical differences in foraging efficiency of chicks, adult survival, or habitat use when habitat buffers comprised about one percent of a study site (6% of cropland) were not observed. However, the magnitude of bobwhite population increases observed in the study was similar to that previously reported. The study demonstrated that habitat buffers may have a disproportionate effect on usable space for bobwhite (15% increase) relative to required changes in land use (6%) (fig. 9). Furthermore, habitat buffers provide connectivity to previously isolated habitat thereby reducing fragmentation.

Habitat buffer management practices encouraged by USDA conservation programs can be used specifically to enhance northern bobwhite populations. However, the amount of habitat buffer habitats established will likely influence the magnitude of population response. Given the results in the context of those reported elsewhere, it is recommend that at least 5 to 10 percent of an area (10–15% of cropland) be placed in habitat buffer habitats to elicit measurable responses of northern bobwhite populations. The study suggests that habitat buffers be maintained as early successional communities through periodic disturbance (e.g., winter disking) to maintain seed producing plants, vegetation structure, and arthropods for grassland birds.

Resource management systems that support both birds and farm operators are important for maintenance of a diverse farmland bird population. However, implementation of conservation practices is dependent on voluntary participation by producers. Only farmland conservation practices that cost effectively accrue multiple environmental benefits while enhancing farmland wildlife will gain widespread acceptance and implementation. Environmental benefits (increased herbicide and nutrient retention, reduced soil erosion and sedimentation, etc.) of buffer conservation practices are well documented, and most farm operators recognize the economic, environmental, and societal benefits of CRP conservation practices; with more than 75 percent of farm operators deeming wildlife as an important component. Therefore, the study suggests that USDA National Conservation Buffer Initiative practices, such as habitat buffers (CP33–Habitat Buffers for Upland Birds), filter strips, and riparian buffers, are compatible with the needs of farm operators while diversifying farmland structure to enhance wildlife.

Figure 9 Predicted percentage of an agricultural landscape usable by bobwhite with and without installation of 20-foot herbaceous habitat buffers



Technical references

Barbour, P.J. 2006. Ecological and economic effects of field borders in row crop agriculture production systems in Mississippi. Ph.D. Dissertation, Mississippi State University, Mississippi State, MS. 422 pp.

Smith, M.D. 2004. Wildlife habitat benefits of field border management practices in Mississippi. Ph.D. Dissertation, Mississippi State University, Mississippi State, MS. 183 pp.

Smith, M.D., and L.W. Burger, Jr. 2006. Population response of northern bobwhite to field border management practices in Mississippi. Proceedings of the National Quail Symposium. In Press.

Smith, M.D., P.J. Barbour, L.W. Burger, Jr., S.J. Dinsmore. 2005. Density and diversity of overwintering birds in managed field borders in Mississippi. Wilson Bulletin 117:258–269.

Smith, M.D., P.J. Barbour, L.W. Burger, Jr., S.J. Dinsmore. 2005. Breeding bird abundance and diversity in agricultural field borders in the Black Belt Prairie of Mississippi. Proceedings of the Southeastern Association of Fish and Wildlife Agencies 59:43–56.

Smith, M.D., and L.W. Burger, Jr. 2005. Use of imprinted northern bobwhite chicks to assess habitat-specific arthropod availability. Wildlife Society Bulletin 33:596–605.

Smith, M.D., and L.W. Burger, Jr. 2003. Multi-resolution approach to wildlife habitat modeling using remotely sensed imagery. Proceedings of the Society of Photo-Optical Instrumentation Engineers (SPIE) 48th Annual Meeting 5131:31–43.