Effect of Vegetation Management on Bird Habitat in Riparian Buffer Zones

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Abstract - Riparian buffers can be valuable refuge areas for wildlife in otherwise homogeneous agricultural landscapes. Government sponsored programs like the Cropland Reserve Program generally require the planting of specific vegetative species during buffer restoration, although the effectiveness of such an approach when compared to restoration by volunteer species is unknown. We studied the effect of differences in vegetation structure on avian habitat in riparian buffer zones. A 25 m (82 ft) wide planted woodland buffer, 30 m (98 ft) wide grass, shrub, and woodland three-zone buffer, and a 9 m (30 ft) wide shrub buffer were evaluated for habitat potential using breeding-bird counts and vegetation surveys. Bird density and species richness varied with the structure of the vegetative communities present at the three sites. Avian species richness and total detections were higher in the three-zone buffer than in both the shrub and planted buffer, likely a result of the diversity of vegetation at the site. These data suggest that restoration of riparian areas by allowing fallow vegetation to recolonize is at the very least equally beneficial to avian wildlife as is restoration by planting specific grass, shrub, and tree species. Buffer restoration by natural revegetation using this method could be recommended as an alternative to implementation by planting riparian species due to its simplicity and cost effectiveness.

Introduction

Riparian buffers, or vegetated areas adjacent to streams or ditches, have been researched for nearly 30 years for their benefits to water quality**.** They reduce sediment, phosphorus, and nitrogen discharge to drainage water in agricultural areas (Osborne and Kovacic 1993). Buffers also provide habitat for wildlife species that reside in the riparian area. They offer generally undisturbed land for nest sites, den locations, and bedding areas in habitats exposed to periodic disturbance by farming machinery (Best et al. 1995). Buffers harbor a variety of foods including plant seeds, vegetative material, and arthropods. Finally, buffers can serve as travel corridors between fragmented habitats, thus facilitating gene flow among otherwise isolated wildlife communities (Dickson et al. 1995, Haas 1994, Jobin et al. 2001).

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There is a significant body of literature that suggests that the structure and composition of the vegetative community determines the composition and density of the wildlife community (Best 1983, Best et al. 2001, Blake and Karr 1987, Fahrig 1997, Finch 1989). In most instances, wildlife diversity parallels habitat diversity (Buffington et al. 1997, Finch 1989, Jobin et al. 2001). Riparian buffer zones can provide valuable refuge areas for wildlife in otherwise homogeneous agricultural landscapes (Triquet et al. 1990).

In agricultural areas, buffer zones such as these co-existed for years, allowing for higher levels of biodiversity compared with that supported only by monoculture crops. However, improvements in farming machinery, weed control, and harvest methods have led to "clean farming" techniques that limit the survivability of non-crop species during crop production. As a result, many agricultural areas have become homogeneous, supporting few species except the intended crop across the entire landscape.

Incentive programs sponsored by the US Department of Agriculture-Farm Service Agency (USDA-FSA) and the USDA-Natural Resources Conservation Service (USDA-NRCS) such as the Cropland Reserve Program (CRP), Environmental Quality Incentives Program (EQIP), and Wildlife Habitat Incentives Program (WHIP) provide cost-share assistance to private landowners for buffer implementation. The main objective of these programs is to enhance water quality and wildlife habitat without hindering agricultural production (USDA-NRCS 2004, 2006). Buffer programs like these typically require the planting of certain vegetative species within the buffer area. Establishing a healthy, uniform stand of required species may necessitate intensive non-target species management and replanting in subsequent years, which increases management costs or results in a zone of volunteer vegetation, or "weeds," if neglected (USDA-NRCS 1999). Conversely, linear borders of fallow vegetation allowed to recolonize the periphery of cropland may be a better low-cost solution. For example, fallow vegetation of this type may increase local populations of *Colinus virginianus* (Northern Bobwhite) (Bromley et al. 2002, Pucket et al. 1995) and wintering sparrows (Marcus et al. 2000). The benefits of field borders for breeding early succession songbirds, however, are less clear (Bromley et al. 2002, Marcus 1998). Furthermore, little work has been conducted on the value of buffer restoration in streamside zones by planting riparian species versus allowing natural vegetation to recolonize. Restoration by the latter method would benefit landowners due to its simplicity and might be preferred over planted buffer zones if the restoration results in a community higher in vegetative and wildlife diversity. With this method, cost-share payments need not cover higher installation costs, making restoration more profitable or allowing additional resources for buffer implementation elsewhere. The objective of this study was to determine whether planted buffers affected avian habitat differently than buffers allowed to naturally revegetate.

Methods and Materials

Site descriptions

Three riparian buffers were evaluated: a three-zone riparian area, a shrub buffer zone, and a planted forest buffer. All three sites were located in the Middle Coastal Plain of North Carolina.

The three-zone riparian area was located on NC State Road 1942 approximately 16 km (10 mi) southwest of Warsaw in Sampson County. The adjacent 12 ha (30 ac) of land were used as either pasture (*X Triticosecale rimpaui* Wittm.) or *Zea mays* Linnaeus (corn), *Triticum* spp. (wheat), or *Glycine max* Linnaeus (soybean) farmland. Vegetation on each side of the stream consisted of an approximately 4-m (13-ft) grass and herb outer zone, a 20-m (66-ft) shrub middle zone created in 1999 by fencing out cattle, and 6-m (20-ft) inner zone closely resembling the shrub zone but also containing taller woody vegetation directly along the stream. Management was limited to spring mowing once a year in the outer zone. The linear length of buffer was approximately 250 m (820 ft).

The shrub buffer was located in the Neuse River Basin off NC State Hwy 70 approximately 6 km (4 mi) east of Kinston in Lenoir County. Land use was primarily for agricultural production with *Nicotiana tabacum* Linnaeus (tobacco), corn, and soybean as the major crops grown. Fields were artificially drained using 1.2 to 1.8 m (3.9 to 5.9 ft) deep ditches bordered by riparian buffers. These buffers developed naturally in 1993, but have been managed using a tractor-mounted weed-wipe herbicide applicator to prevent vegetative succession to large woody species, resulting in an approximately 1.8 m tall field border. The shrub buffer was 9 m (30 ft) wide and 260 m (853 ft) long and present on only one side of the drainage ditch.

The planted forest buffer was located in the Cape Fear River Basin approximately 18 km (11 mi) southeast of Mt. Olive, NC in Duplin County off NC State Road 1500. Vegetation consisting of *Platanus occidentalis* Linnaeus (American sycamore), *Fraxinus pennsylvanica* (green ash), *Taxodium distichum* (bald cypress), and *Acer rubrum* (red maple) was planted by USDA-NRCS in 1994 in an attempt to increase nutrient uptake and sediment retention by the streamside zone (Novak et al. 2002, Stone et al. 1995). The planted buffer was 160 m long and 25 m wide (524 by 82 ft) and present on one side of the stream. The adjacent 5-ha (12-ac) pasture was seeded with *Cynodon dactylon* Linnaeus (bermudagrass) and cut for hay periodically.

Comparisons among the three sites were qualitative due to the lack of replication for each buffer type.

Vegetation sampling

Sampling occurred between June 19 and July 26, 2002. At each study site, transects along which vegetation was sampled were located randomly along the length of the buffer and were oriented perpendicular to the long axis of the buffer. At each transect, one sample plot was randomly located in each buffer zone. Sample plots in the outer zone of the three-zone buffer were 1 x 3 m (3 x 10 ft) due to its small area; those in all other zones at the three sites were 3 x 3 m (10 x 10 ft). Five percent of the total buffer area at that location was sampled. Aerial cover, or the percentage of plot area beneath the canopy of a given species, was visually estimated (Barbour et al. 1987) to the nearest 10% for each species in each sample plot. The aerial cover for each species was determined as the average of its individual plot cover estimates for those plots in the zone in which it occurred. Cover estimates of zero for plots in which a species did not occur were not used in these determinations. The frequency of each species in each buffer zone was calculated as: (number of plots in the zone in which the species occurred) / (total number of plots in the zone) x 100. Plant common names were assigned using the USDA plants database (USDA-NRCS 2005).

Vertical structure was analyzed using estimates of frequency for different vegetative classes (grass, forb, woody), vegetation density, and vegetation height. Structure measurements were collected using a 2-m (6.56-ft) rod located at the center of each 3- x 3-m sampling plot used previously for percent-cover analysis following procedures of Moorman and Guynn (2001). Vegetation contacting the rod at each 1-dm (3.9-in) interval was recorded as grass/sedge, forb, or woody. If the vegetation at a sampling point was higher than 2 m, the maximum height above the rod was estimated. The frequency of each vegetative class was calculated by dividing the number of rod samples where vegetation was contacted by the total number of rod samples taken at the site. Estimates of vertical structure for each site were calculated by averaging the total number of hits from any type of vegetation at each sampling plot (TOTHIT) and by averaging the maximum height at each sampling plot (MAXHT). In the three-zone buffer, percent cover and vertical structure were determined for the middle and inner zones combined due to the similarity of vegetation in the two areas.

To further classify the taller woody vegetation at the planted buffer site, three randomly selected 15- x 30-m plots were used. In each plot, the species identification, diameter at breast height (dbh), and height was determined for each individual with a dbh greater than 5 cm (1.9 in). At the three-zone buffer, trees with dbh greater than 5 cm were sparse and restricted to a narrow area along the stream bank. As a result, all woody individuals of the appropriate size, rather than those in sampling plots, were recorded.

The value of vegetation for Northern Bobwhite was examined because of the bird's high conservation priority (Brennan 1991, Droege and Sauer 1990) and its popularity as a game species (Davidson 1942). Quail use of seeds for each plant species was ranked using the 16-point importance scale of Landers and Johnson (1976.) The presence of bare ground was also examined because it is an essential component of Northern Bobwhite habitat vital to foraging success (Jones and Chamberlain 2004).

Bird sampling

Breeding birds were surveyed between May 1 and June 30 in both 2002 and 2003 using a modified spot-map technique (International Bird Census Committee 1970). Eight early morning surveys were conducted between

7:00 and 9:30 am at each site. All singing males seen or heard were recorded on site maps. If two or more birds of the same species were heard simultaneously, this was noted to prevent recording the same individual more than once. Buffer sites were too small to allow computation of territory density. Thus, the sum of all detections per sampling day averaged across the eight visits was used as the response for each species in each buffer. To allow for comparison of results among the three sites, average detections/census day was converted to detections/census day/1000-m buffer length since the three buffer sites differed in size. Results were standardized using length rather than area to illustrate differences in management techniques related to the type of buffer maintained. Displaying as detections per area often results in inflation of detections in upland agricultural areas with narrow field borders such as these. The tendency of birds to concentrate in such areas, however, is a reality (Best et al. 1995).

Results

Vegetation

High variability in percent cover of dominant vegetation among study sites was observed. Species such as *Arundinaria gigantea* Walt. (giant cane), *Solidago* spp. (goldenrod), *Conyza canadensis* Linnaeus (Canadian horseweed), *Rubus* spp. (brambles) and *Eupatorium capillifolium* Lam. (dogfennel) were observed in all three buffers. Species richness values for the planted buffer and the shrub buffer were 19 and 20 species, respectively. Combined species richness for the three-zone buffer was 23 species.

Compared with the shrub and planted buffers, the three-zone buffer supported relatively high frequency for all three vegetation classes while woody frequency in the shrub buffer and grass frequency in the planted buffer were low (Table 1). Also, TOTHIT and MAXHT indicate that vegetation density and stature were relatively high in the three-zone buffer.

Forty-nine trees with dbh >5 cm were present along the entire riparian corridor of the three-zone buffer. Dominant species were *Liquidambar styraciflua* (sweetgum) and *Betula nigra* (river birch), while red maple, *Pinus taeda* (loblolly pine), *Quercus nigra* (water oak), *Quercus michauxii* (swamp chestnut oak), and *Liriodendron tulipifera* (yellow poplar)

Table 1. Frequency and vertical structure of vegetation at the three buffer sites.

	Three-zone			
Variable	Outer	Middle/inner	Shrub	Planted
FREQUENCY				
Woody	1%	47%	9%	53%
Forb	69%	91%	92%	82%
Grass	35%	24%	21%	4%
TOTHIT (#)	4.2	9.1	5.8	5.7
MAXHT (dm)	5.2	17.8	9.8	18.5

also were observed (Table 2). Tree height ranged from a 16-m sweetgum to a 6-m red maple, with an average height of 10 m for the population. Taller woody vegetation at the planted buffer was primarily bald cypress, which had a relative density of 70% (Table 2). Red maple, yellow poplar, and green ash also were observed.

The majority of the vegetation found within the buffer zones provided little in the form of plant seeds for Northern Bobwhite. Twenty-four of the 30 most common species observed had importance values of 1 to 4 on the 16-point importance scale. None of the major species had importance values higher than 12. Only *Lonicera japonica* Thunb. (Japanese honeysuckle) in the planted buffer, sweetgum in the three-zone buffer, and *Pinus* spp. (pine) in the shrub buffer had scores of 9–12. On the other hand, plants with high value as escape and nesting cover like brambles and dogfennel were common in all three buffers. Bare ground was most frequent (88%) in the outer zone of the three-zone buffer. It was also noted in 48% and 41% of the plots in the shrub and planted buffers, respectively. In addition, plant composition and structure changed relatively little between the beginning of bird sampling and the end of vegetation sampling, ensuring the vegetation measures were representative of the conditions present when birds arrived at each site.

Birds

Of all three buffers in 2002, the three-zone buffer had the highest detections of grassland (3.2), shrub/scrub (37.4), and woodland (43.8) species/census day/1000-m buffer length, as well as the highest species richness (29 species) (Table 3, Fig. 1). Similar results were obtained during 2003 (Fig. 1). Shrub species dominated the detections in the shrub buffer, while the planted buffer contained primarily woodland birds.

Cardinalis cardinalis (Northern Cardinal) and *Passerina cyanea* (Indigo Bunting) were the only two species recorded in all three buffers (Table 3).

Table 2. Woody vegetation with dbh >5 cm at the three-zone and planted buffers in the Coastal Plain of North Carolina.

	Three-zone buffer		Planted buffer	
Species	Mean height (m)	Relative density	Mean height (m)	Relative density
American holly (*Ilex opaca* Ait.)	-	-	6	1%
Bald cypress (*Taxodium distichum* L.)	-	-	7	70%
Green ash (*Fraxinus pennsylvanica* Marsh.)	-	-	9	12%
Loblolly pine (*Pinus taeda* L.)	13	7%	-	-
Red maple (*Acer rubrum* L.)	8	15%	8	12%
River birch (*Betula nigra* L.)	9	34%	-	-
Sweetgum (*Liquidambar stracifula* L.)	12	33%	-	-
Swamp chestnut oak (*Quercus michauxii* Nutt.)	10	2%	-	-
Water oak (*Quercus nigra* L.)	12	4%	-	-
Yellow poplar (*Liriodendron tulipifera* L.)	11	4%	8	2%
Sweet bay (*Persea palustris* Raf.)	-	-	5	1%

Indigo Bunting was the most frequently detected species in the three-zone buffer, while Northern Cardinal and *Agelaius phoeniceus* (Red-winged Blackbird) were the most frequently detected species in the planted buffer and shrub buffer, respectively.

Table 3. Bird detections/census day/1000 m buffer length at three buffers in North Carolina (2002–2003). 3Z = three-zone, Pl = planted, and Sh = shrub.

	Site (detections/ census day/1000 m buffer length)					
	2002			2003		
	3Z	Pl	Sh	3Z	Pl	Sh
Grassland species (total)	3.2	1.4	2.0	0.0	0.0	1.6
Eastern Kingbird (*Tyrannus tyrannus* L.)	1.4	0.0	1.6	0.0	0.0	0.0
Eastern Bluebird (*Sialia sialis* L.)	1.4	1.4	0.0	0.0	0.0	0.0
Eastern Meadowlark (*Sturnella magna* L.)	0.5	0.0	0.4	0.0	0.0	0.8
Grasshopper Sparrow (*Ammodramus savannarum* Gmelin)	0.0	0.0	0.0	0.0	0.0	0.8
Shrub/Scrub species (total)	37.4	1.4	22.2	35.1	2.7	21.4
Blue Grosbeak (*Guiraca caerulea* L.)	8.7	0.0	3.7	4.1	0.0	2.5
Brown Thrasher (*Taxostoma rufum* L.)	0.0	0.0	0.4	0.0	0.7	1.2
Common Yellowthroat (*Geothlypis trichas* L.)	4.6	0.0	4.9	5.5	0.0	4.5
Field Sparrow (*Spizella pusilla* L.)	5.9	0.0	1.2	5.9	0.0	2.9
Gray Catbird (*Dumetella carolinensis* L.)	0.0	0.0	0.0	1.4	0.0	0.0
Indigo Bunting (*Passerina cyanea* L.)	13.2	1.4	2.1	11.4	2.0	2.5
Northern Mockingbird (*Mimus poloygottos* L.)	0.0	0.0	1.2	0.0	0.0	0.4
Northern Bobwhite (*Colinus virginianus* L.)	0.5	0.0	0.8	0.5	0.0	1.2
Red-winged Blackbird (*Agelaius phoeniceus* L.)	0.0	0.0	7.4	0.0	0.0	6.2
Rufous-sided Towhee (*Pipilo erythrophthalmus* L.)	0.5	0.0	0.4	0.0	0.0	0.0
Yellow-breasted Chat (*Icteria virens* L.)	4.1	0.0	0.0	6.4	0.0	0.0
Woodland species (total)	43.8	26.0	2.1	29.2	19.1	2.5
American Crow (*Corvus brachyrhyncos* Brehm)	0.0	1.4	0.0	0.0	0.0	0.0
Blue-gray Gnatcatcher (*Polioptila caerulea* L.)	2.7	0.7	0.0	5.0	0.0	0.0
Blue Jay (*Cyanocitta cristata* L.)	1.8	0.7	0.0	0.5	0.0	0.0
Brown-headed Cowbird (*Molothrus ater* Boddaert)	0.5	0.0	0.0	0.5	0.0	0.0
Carolina Chickadee (*Poecile carolinensis* Audubon)	3.7	1.4	0.0	1.4	1.4	0.0
Carolina Wren (*Thryothorus ludovicianus* Latham)	4.1	5.5	0.0	4.1	4.1	0.0
Chipping Sparrow (*Spizella passerina* Bechstein)	0.9	0.0	0.0	0.0	0.0	0.0
Common Grackle (*Quiscalus quiscula* L.)	4.1	0.0	0.4	0.0	3.4	0.0
Downy Woodpecker (*Picoides pubescens* L.)	1.4	0.0	0.0	0.9	0.7	0.0
European Starling (*Sturnus vulgaris* L.)	9.1	0.0	0.0	1.8	0.0	0.0
Great-crested Flycatcher (*Myiarchus crinitus* L.)	1.4	1.4	0.0	0.9	0.7	0.0
Mourning Dove (*Zenaida macroura* L.)	0.9	0.7	0.0	3.2	0.7	0.0
Northern Cardinal (*Cardinalis cardinalis* L.)	4.1	9.6	1.6	3.2	6.8	2.5
Prothonatory Warbler (*Protonotaria citrea* Boddaert)	0.5	0.0	0.0	0.0	0.0	0.0
Red-bellied Woodpecker (*Melanerpes carolinus* L.)	2.7	1.4	0.0	1.4	0.0	0.0
Red-eyed Vireo (*Vireo olivaceus* L.)	0.5	0.0	0.0	0.5	0.0	0.0
Red-shouldered Hawk (*Buteo lineatus* Gmelin)	0.5	0.0	0.0	0.0	0.0	0.0
Tufted Titmouse (*Baeolophus bicolor* L.)	1.4	2.0	0.0	1.4	0.7	0.0
White-eyed Vireo (*Vireo griseus* Boddaert)	1.8	0.0	0.0	4.1	0.0	0.0
Yellow-billed Cuckoo (*Coccyzus americanus* L.)	1.8	1.4	0.0	0.5	0.7	0.0
Total Detections/census day/1000m	84.4	28.7	26.3	64.3	21.9	25.5
Species Richness	29.0	13.0	13.0	22.0	11.0	11.0

Discussion

The structure of the plant community within each buffer site dictated the composition of the avian community found there. For example, the majority of the birds detected in the shrub buffer were shrub birds (Table 3). Furthermore, the shrub buffer contained no woodland vegetation, which could account for the low detections (2.1 to 2.5 detections/census day/1000-m buffer length) of forest birds. Similarly, the planted buffer consisted primarily of woodland vegetation and was primarily occupied by woodland birds (Table 3). Few avian grassland or shrub species were detected.

Vegetation at the three-zone buffer contained relatively wide grass and shrub areas, with a few trees present along the stream bank. This more heterogeneous habitat seemed to support a greater variety of bird species. Grassland birds such as *Tyrannus tyrannus* (Eastern Kingbird) and *Sialia sialis* (Eastern Bluebird) were detected. *Guiraca caerulea* (Blue Grosbeak), Indigo Bunting, *Spizella arborea* (Field Sparrow), and *Geothlypis trichas* (Common Yellowthroat) were common shrub species observed. *Polioptila caerulea* (Blue-gray Gnatcatcher), *Poecile carolinensis* (Carolina Chickadee), and *Thryothorus ludovicianus* (Carolina Wren), which are all woodland birds, also were frequently observed at this buffer.

There are several possible explanations for the wider range of detections at the three-zone buffer. This buffer was 30 m wide on each side of the drainage feature, resulting in a 60-m total width. The shrub and planted buffers were present only on one side of the drainage feature and were 9 m and 25 m wide, respectively. Dickson et al. (1995) studied streamside zones of different widths in eastern Texas and concluded that the abundance of some bird species, such as Carolina Wren, *Baeolophus bicolor* (Tufted Titmouse), *Coccyzus americanus* (Yellow-billed Cuckoo), Northern Cardinal, and Blue-gray Gnatcatcher, increased as the width of habitat increased. Of these species in our study, all except Blue-gray Gnatcatcher and Tufted titmouse in 2003 were more abundant in the planted

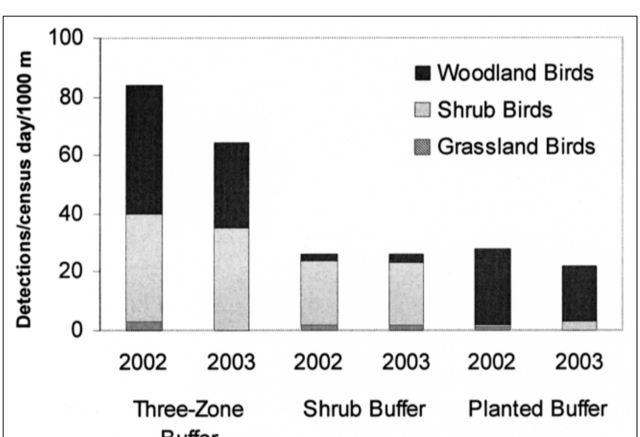

Figure 1. Detections per census day per 1000 m for May–June 2002 and 2003 bird sampling at three riparian buffer sites in the Coastal Plain of North Carolina.

buffer than in the wider three-zone buffer. These species prefer woodland habitats; however, the woodland portion of the three-zone buffer was much narrower than the predominately woodland planted buffer. In this case, the structure and composition of buffer vegetation seemed to influence the bird community more heavily than did buffer width as the narrower woodland buffer contained more woodland birds than did the wider three-zone buffer. Additionally, Dickson et al. (1995) suggested that species such as Yellow-breasted Chat, Blue-gray Gnatcatcher, Common Yellowthroat, and Blue Grosbeak favored narrow streamside zones. In our study, detections for these species were all highest in the three-zone buffer, which was the widest of the three buffers investigated. These contradictions suggest that the differences in species richness and relative abundance among the three buffers could be due to some combination of habitat characteristics including buffer width and vegetation type.

The surrounding landscape could have had an effect on the characteristics of the avian community observed at the three sites. The three-zone and planted buffers both connected larger adjacent woodland areas, while the shrub buffer was somewhat isolated from significant woodland habitat. More woodland birds may have occupied territories within the three-zone and planted buffers because of their proximity to other suitable woodland habitats. Although we did not control for variation in landscape context, changes in relative amounts of forest and agriculture at large scales can influence avian density and reproductive success (Riddle 2007).

Land management also differed among the three sites. The farmland adjacent to the three-zone and shrub buffers was used for crop production of corn, wheat, and soybeans, which most likely affected food availability to birds within these buffered areas. The planted buffer was surrounded by land farmed in pasture grass that was periodically cut for hay, but the crop was sparse and likely contributed little in the form of bird forage during both years of observation.

The differences in the bird community among the three buffer types probably resulted from some combination of these aforementioned site characteristics. The type of vegetation present at each site undoubtedly played a major role in determining the bird community found within each. Vegetation composition at the three-zone buffer incorporated characteristics of three different habitat types (grassland, shrub, and woodland) into a single streamside area. As a result, avian species ranging from grassland to shrub and woodland birds occupied the area. Although the restoration simply involved leaving the area fallow, management did have an effect on the composition of the wildlife community. Spring mowing in the outer zone once a year maintained habitat suitable for grassland birds such as Eastern Bluebird and *Sturnella. magna* Linnaeus (Eastern Meadowlark). The 4- to 5-year early successional zone created by leaving the area undisturbed after buffer widening created habitat suitable for shrub birds like Indigo Bunting and Blue Grosbeak. The large trees along the stream bank, although sparse, were effective in supporting woodland species like Carolina Wren and Blue-gray Gnatcatcher.

Although most of the riparian vegetation at the three sites produced seeds ranking from low to medium as Northern Bobwhite Quail food sources, the birds were observed at the three-zone and shrub buffer sites. Bobwhite may have chosen these zones for their cover protection and nesting habitat while foraging for food outside the buffer. On the other hand, they may have found suitable food within the buffer zone. Bobwhite forage for seeds during the winter, but their high-protein diet during the warmer months predominately consists of insects and other arthropods (Eubanks and Dimmick 1974) that are commonly present in high densities within buffer zones (Whitaker et al. 2000). Although buffer seed production was less than ideal with respect to quail forage, the vegetative structure at these two sites supplied essential cover and indirect food sources for bobwhite residents. Bare ground was also available for efficient foraging and movement throughout the buffer zones. The inability of the buffer to produce highly desirable seed for Northern Bobwhite did not prevent these birds from occupying the area.

This study suggests that restoration of riparian zones by allowing fallow vegetation to recolonize is, at the very least, equally beneficial to avian wildlife as is restoration by planting specific grass, shrub, and tree species. Restoration by this method is more affordable and less labor intensive than the alternative. Although governmental support is available to landowners for buffer implementation, rarely does the payment cover the total expense required for successful restoration using planted species. The less expensive restoration by natural vegetation could entice more landowners to become involved with programs like CRP and EQIP. Others may voluntarily create buffer zones using this method due to its simplicity and effectiveness. To skeptical landowners who are not comfortable undertaking rigorous implementation techniques required by planting riparian vegetation, these simpler and more affordable restoration practices could motivate them to establish naturally revegetated buffers on their land.

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