Conservation Reserve Program (CRP)

Wildlife Responses to the Conservation Reserve Program in the Southeast

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Northern bobwhite (J. M. Huspeth)

Abstract

Over 2.7 million acres were enrolled in the Conservation Reserve Program (CRP) in the southeastern United States in 1999, creating early successional plant communities that might provide short-term habitat for regionally declining early successional species. Rigorous evaluations of the effects of CRP on wildlife in the Southeast are lacking. However, probable impacts may be inferred from studies of wildlife response to land management practices similar to those implemented under CRP. This review examines potential wildlife benefits of CRP as indexed by avian communities. In contrast to the Midwest where grass establishment practices dominated CRP enrollment, 62% of CRP acres in the Southeast were enrolled in tree planting practices, primarily loblolly pine. The replacement of agricultural lands with tree plantings in a forest-dominated landscape (48% of landbase) may result in a long-term net loss of habitat for early successional species. During the first one to three years following establishment, pine plantations are characterized by low-growing grasses and forbs and provide habitat for grassland and early successional bird species. As the stand matures, herbaceous plants are replaced by shrubs and trees. Avian diversity increases with stand age as shrub-successional birds colonize the stand. Avian richness is lowest during mid-rotation (15-25 years) when canopy closure eliminates herbaceous ground cover. In mid-rotation, stand thinning and prescribed fire may enhance habitat quality for grassland and shrub-successional birds. Bottomland hardwood plantings established under CRP should be expected to support high densities of grassland birds during the first five years after establishment. Peak abundance of shrub-successional species will occur 7-15 years after planting. Stands > 20 years old should support 75-85% of the avian community characteristic of mature bottomland hardwoods. Interplanting of rapidly growing tree species, such as cottonwood, sycamore, or green ash, would dramatically accelerate colonization by forest bird species. In the Southeast, the wildlife habitat value of grasslands enrolled in CRP may be limited by establishment of exotic forage grasses, mowing, and the rapid rate of grassland succession. Conversion of forage grasses to native communities and implementation of management regimes that maintain

diverse annual weed communities will enhance the wildlife habitat value for early successional species. Field border practices such as CP21 and CP22 can dramatically enhance suitability of agricultural landscapes for shrub-successional species and also may increase landscape-level suitability for wintering passerines, particularly sparrows. Overall, the potential wildlife benefits of CRP in the Southeast are substantial, but they may be unrealized because of the selection of specific practices (e.g., pine plantations). Moreover, relative to the Midwest, the actual benefits of CRP in the Southeast remain unknown because of the lack of rigorous evaluation.

Introduction

Provision of wildlife habitat is one of the intended purposes of CRP as originally conceived in the 1985 Food Security Act and amended in 1990 and 1996. Throughout the Great Plains and the Midwest, CRP has created tremendous potential wildlife habitat for grassland-dependent wildlife and at least some populations appear to have responded (e.g., Allen 1994, Ryan et al. 1998). In the Southeast, agricultural lands enrolled in CRP have the potential to provide essential early successional habitat for regionally declining grassland and shrub-successional species. However, the implementation of the program and practices established in the Southeast differ markedly from other regions and the wildlife benefits are less obvious. Consequently, evaluations of wildlife responses to CRP in the Midwest or Great Plains have little applicability to the Southeast. Regrettably, wildlife habitat value of and population responses to CRP have not been well documented in this region. However, probable impacts may be inferred from studies of wildlife response to land management practices similar to those implemented under CRP. Insofar as avian-habitat relations have been more thoroughly investigated than most vertebrate groups, and long-term population trends for birds have been indexed in a standardized fashion through the Breeding Bird Survey since 1966, this review will infer potential wildlife habitat value of CRP in the Southeast for avian communities of conservation concern. This review will provide an overview of land-use patterns and changes in the Southeast, characterize CRP in this region, and infer potential wildlife responses to the three principal conservation practices implemented in the region.

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Changes in Land-use Patterns in the Southeast

Throughout the southeastern United States, privately owned rural, agricultural, and forested lands constitute 79% of the total landbase and provide important wildlife habitats. The southeastern landscape is forest dominated, in 1997 being comprised of 48.3% forest, 14.2% rowcrops, 11.4% pasture, 1% rangeland, 1% CRP, and 3.5% other rural uses (USDA-FSA 2000). Land-use practices throughout the Southeast have changed dramatically during the previous five decades. These changes have included farm consolidation, replacement of native communities with exotic or offsite monocultures, and

conversion of agricultural lands to urban uses and forest. Based on the United States Department of Agriculture's National Resources Inventory (USDA-NRCS, NRI 1999) survey of 12 southeastern states (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV), from 1982-1997, 4.7% of the rural landbase (3.9% of total surface acres) was lost to urbanization or other uses (USDA-NRCS, NRI 1999). Twenty percent of cropland (3.6 % of total landbase), 5.8% of pasture (0.7% total landbase), and 29% of rangeland (0.4% of total landbase) in these southeastern states were converted to other uses, while forested acres remained relatively stable (0.8% loss of forested acres, 0.4% of total landbase).

Mature Southeast pine forest (W. Hohman)

Simultaneously, more intensive management of remaining habitats has reduced the quality of these lands for wildlife. Mean farm size doubled and the number of farms declined by nearly 60% from 1950 to 1990. Specialized, high input, monocultural agriculture, increased field size, and elimination of idle areas have reduced the quality of agricultural lands for wildlife. Introduction of exotic forage grasses and increased grazing intensity have reduced the availability and quality of early successional habitats in agricultural landscapes. From 1982-1992, cattle numbers increased by more than 25% and cattle per 100 acres increased by 34%. Much of the existing range and pasture has been planted to nonnative forage grasses such as tall fescue, bermuda grass, and bahaia grass. Simultaneously, reduction in the use of fire has degraded the quality of remaining grasslands.

Although forested acreage in the Southeast has been stable . . . forest composition and quality have changed . . . .

Although forested acreage in the Southeast has been stable during the past two decades, forest composition and quality have changed, reducing habitat quality for many wildlife populations. Increasing human populations combined with increasing per capita consumption of paper products have contributed to a continuously expanding demand for pulpwood. Southern pulpwood production increased more than fourfold from 1953 to 1993 and will likely continue to increase in the foreseeable future (Johnson 1996). In a 1995 survey of seven Midsouth states (Alabama, Arkansas, Louisiana, Mississippi, Oklahoma, Texas, and Tennessee), most (67%) of 40,000,000 ha of timberland was in nonindustrial private ownership (Rosson 1995). An increasing proportion of this timberland (16%) is artificially regenerated stands (plantations), mostly loblolly pine. Most (55%) plantation acreage in the Midsouth occurs on industrial forest lands with 39% on nonindustrial private lands and 7% under public ownership (Rosson 1995). In 1995, a substantial proportion (55%) of plantation acreage was in the seedling-sapling size-class. Thus, pine plantations will likely constitute an increasing component of the southern landscape and a significant proportion of early successional habitats.

Historically, the southeastern United States contained significant acreage of hardwood bottomlands, the largest occurring in the LMAV. By 1985, more

than 80% of the original 10 million ha of forested wetlands in the LMAV had been converted to agriculture. Most of the remaining tracts of forested wetland are relatively small and highly fragmented. The quality of remaining wetlands also continues to decline due to nutrient overloading, altered hydrology, and urban development.

Although some wildlife species, such as white-tailed deer and eastern wild turkey, have thrived in modern southeastern landscapes, others have not. In particular, those species associated with grasslands, shrub-successional communities, and pine/grasslands have faired most poorly. Many of the land-use changes in agricultural and forested systems of the Southeast have resulted in the loss of early successional habitats and associated fauna. This is most clearly illustrated by population trends for the northern bobwhite (hereafter, bobwhite), ubiquitously distributed throughout the entire Southeast, but declining at a rate of 3.8%/year since 1966 (Sauer et al. 1999). Declines in bobwhite populations are not unique but representative of an entire assemblage of early successional species that are declining throughout the region. Breeding Bird Surveys in the Southeast during the period 1966-1998 indicate that two of four grassland birds and 16 of 23 shrub-successional species have exhibited significant declines (habitat associations as defined by Sauer et al. 1999). In contrast, forest breeding birds in the Southeast show no consistent declining pattern. During the period 1966-1998, 29% of 49 forest breeding birds in the Southeast have exhibited significant declines, whereas 31% of forest birds have exhibited significant increasing trends (Sauer et al. 1999). The notable exception is birds that breed in mature hardwood bottomland forests (Hunter 1993).

. . . early successional [bird] species . . . are declining throughout the region.

Factors contributing to declines in early successional species are complex and cumulative, attributable to the changing manner in which we as a society use our natural resources. Declines in bobwhite and grassland bird populations are not isolated but related and indicative of changes in an entire ecosystem. Loss of early successional communities and reduction in landscape heterogeneity associated with large scale, intensive, and monocultural production of agricultural and forest products are likely the direct causes of region-wide population declines of these species. Within the context of present land-use trends in the Southeast, both early successional game species and grassland/shrub-successional bird communities may benefit from identification of regional opportunities to create and maintain early successional habitats.

CRP in the Southeast

Although midwestern and Great Plains states account for a significant majority of the 34 million acres enrolled in CRP, the program has had a significant effect on land-use changes in the Southeast as well. Following the 22nd CRP signup, almost 2.8 million acres were enrolled in CRP in 12 southeastern states (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North

Carolina, South Carolina, Tennessee, Virginia, and West Virginia) (Table 1). Conservation practices: CP1 (cool-season grasses), CP2 (native warm-season grasses), CP3 (trees), CP4 (wildlife habitat), CP10 (existing grasses), CP11 (existing trees), CP21 (filter strips), and CP22 (riparian buffers), collectively accounted for 97.6% of all enrolled acres. In contrast to the Midwest where grass establishment was the predominant conservation practice, tree planting (CP3 and CP11) was the most commonly selected conservation practice in the Southeast, accounting for 61.9% of total enrolled acres. Current enrollment in tree planting practices is approximately equitably distributed between newly established stands (< 15 years old, 43.7%) and reenrolled stands (52.2% > 10 years old). The most commonly established tree species was loblolly pine, although a longleaf pine National Conservation Priority Area (CPA) was established beginning with 18th CRP signup. The longleaf pine CPA included parts of nine southeastern states and provided special incentives (increased Environmental Benefits Index and exemption from Highly Erodible Lands requirements) for establishment of longleaf pine on eligible cropland. Through the 22nd CRP signup, 168,541 acres of longleaf have been enrolled in this CPA. Grass cover practices currently account for 33.1% and field border practices (CP21, CP22) 2.6% of CRP acreage in the Southeast. The distribution of enrollment between grass and tree practices differed substantially among southeastern states. Georgia and Florida enrolled almost exclusively trees (92.3%), whereas Kentucky, Tennessee, and West Virginia enrolled predominantly grasses (90.9, 85.9, 80.9%, respectively). As a result of strong involvement by state wildlife agencies, native warm-season grasses were more widely adopted in Virginia (9.5% of enrolled acres) and Kentucky (7.0% of enrolled acres), but < 1% were implemented in other states (e.g., Florida 0.1%, Mississippi 0.2%). Field border practices (CP21 and CP22) were extensively used in Kentucky (5.6% of enrolled acres), North Carolina (12.3% of enrolled acres), and South Carolina (11.1% of enrolled acres), but seldom used in Florida (0.1%), Georgia (0.3%), or Louisiana (0.3%). Thus, CRP in the Southeast is quite different from that in other regions and tremendous variation exists among southeastern states as a result of differing land use and conservation goals and potentials.

Wildlife Responses

Evaluation of wildlife responses to CRP in the Southeast has not been . . . extensive . . .

Evaluation of wildlife responses to CRP in the Southeast has not been as extensive, nor as thorough as in the Midwest. In fact, few studies have directly monitored wildlife populations on CRP fields and even fewer have documented population performance. However, numerous studies throughout the region have characterized wildlife populations on nonCRP lands established with management practices similar to those implemented under CRP (e.g., pine plantations, hardwood afforestation). As such, much of the inference that follows is based on observed wildlife responses to management regimes available under CRP, but not necessarily observed on lands enrolled in the program.

Bird populations are sensitive to changes in land-use practices. Long-term population trends for birds have been indexed in a standardized fashion through the Breeding Bird Survey since 1966, thus avian assemblages of special conservation concern can be identified (Sauer et al. 1999). Moreover, avian-habitat relations have been more thoroughly investigated than most vertebrate groups. Therefore, within a given region, probable avian communities can be predicted for a given plant community. This review will infer potential wildlife habitat value of CRP in the Southeast for avian communities of conservation concern. Insofar as CRP in the Southeast, to this point, has largely created various types of grassland, shrub, or early successional forested habitats, the two avian species assemblages most likely to benefit from CRP are those associated with open-land habitats and shrub-successional habitats. In the forest/agricultural landscapes of the Southeast, early successional bird species occur as two overlapping groups occupying two distinct types of habitats. Open-land habitats created by rowcropping, pasture management, or CRP grasslands may be occupied by grassland species, but also will support successional-scrub species. The shrub-successional species may occur in agricultural ecosystems, but are more commonly associated with early seral stages of forested habitats. Both grassland and shrub-successional species have exhibited declining population trends since 1966 and are of special conservation concern. This review will focus on probable value of CRP in the Southeast for avian communities associated with grassland or shrub-successional habitats.

Wildlife and Tree Planting Practices

Pine Plantations

Avian community composition in regenerating pine stands is largely a function of stand age, site preparation methods, and competition control methods.

Avian community composition in regenerating pine stands is largely a function of stand age, site preparation methods, and competition control methods. In loblolly pine plantations, overall avian diversity and species richness tend to increase with age, although diversity may decline during the late sapling early/pole stage (Johnson and Landers 1982, Dickson et al. 1993), then increase as the stand approaches sawtimber (Darden et al. 1990). Similarly, in slash pine plantations of Florida, Repenning and Labisky (1985) reported that breeding bird abundance, species richness, and diversity were correlated with stand age. In general, avian abundance increases with age until canopy closure at 7-9 years, then declines through the early pole stage (Darden et al. 1990, Dickson et al. 1993). Although in Virginia, Childers et al. (1986) reported that total avian abundance and species richness was greater in 2- to 5-year-old pine plantations than in 7- to 24-year-old plantations.

Effects of stand age

Recently established pine plantations are characterized by low-growing grasses and forbs. Dickson et al. (1993) reported that grassland and early successional bird species, such as eastern meadowlarks, eastern bluebird, Bachman's sparrow, bobwhite, and mourning dove, are the most abundant

species during this establishment period. As the stand ages, herbaceous plants are replaced by shrubby species and height and structural complexity increases. These vegetational changes are accompanied by corresponding changes in the avian community. Grassland and early successional bird species such as meadowlark and bobwhite decline, and shrub-successional species such as indigo bunting, yellow-breasted chat, common yellowthroat, and prairie warblers increase, peaking 3-10 years following establishment. As the stand matures, grassland birds disappear, shrub-successional species decline, and forest birds such as red-eyed vireos, white-eyed vireos, pine warblers, Carolina wrens, and hooded warblers begin to permanently occupy the site (Dickson et al. 1993). The short-term overlap between the grassland/shrub-successional bird species and the forest species produces the high species richness prior to the pole stage (occurring during mid-rotation, characterized by close canopy, low plant species diversity, little herbaceous ground cover). The early successional species decline following canopy closure leaving the early colonizing forest bird species. This pattern of colonization/extinction contributes to the reduced species richness associated with pole-aged stands. Although total avian diversity increases with age of plantations, diversity and abundance of regionally declining grassland and early successional species will decline with stand age.

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Some early successional species, such as bobwhite, mourning doves, eastern bluebirds, and meadowlarks, may occur both in very young plantations (1-2 years) and in mature open, pine/grasslands (Repenning and Labisky 1985). As an example, in South Carolina, Bachman's sparrows were relatively abundant in 1- to 3-year-old replanted clearcuts and mature (> 80 years) stands but occurred in low density in young plantings (6-12 years) and middle-aged (22-50 years) stands (Dunning and Watts 1990). The ground cover and understory composition and structure of mature, fire-maintained stands provides the herbaceous and shrub communities utilized by many grassland and shrub/successional bird species. Thus, as stands reach economic or ecological maturity, they may once again provide habitat for grassland/shrub-successional species, particularly if thinned and burned. The recolonization by early successional species may be accelerated by thinning and burning, thereby enhancing the herbaceous and shrub ground cover.

Early successional Southeast forest (J. Thompson)

Effects of site preparation and seed bank

Site preparation methods affect seed bank availability and germination of competing plant species. In studies of forest regeneration, site preparation method has been shown to influence avian communities through effects on vegetation composition and structure. In South Carolina, two-year-old plantings treated with hexazinone had greater abundance of eastern bluebirds and mourning doves than mechanically treated (e.g., push-pile-and-burn, roller-chopping, and/or disking) plantations. Conversely, yellow-breasted

chats were more abundant on mechanically treated sites (O'Connell and Miller 1994). Although total avian abundance was similar between treatments, avian diversity was greater on herbicide-treated sites. Similarly, Darden et al. (1990) reported greater avian diversity and abundance in Mississippi pine plantations treated with herbicide than those mechanically treated. Insofar as CP3 plantings represent afforestation (establishment of trees on sites with no recent history of forest cover) as opposed to reforestation (reestablishment of trees following clear-cutting), there is no below-ground root biomass or seeds of woody species to accelerate colonization by woody species. On CP3 sites, the seed bank will reflect the agricultural history (agricultural grasses and weeds) and colonization by woody forest species will likely be slower than that experienced on regeneration sites (clearcuts). This cropping history lands will influence the developing plant community and subsequently the avian community. Therefore, during the establishment phase, avian communities on CP3 plantings will likely be more similar to grassland agricultural sites than naturally or artificially regenerated forest sites.

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Effects of mid-rotation management

CRP participants that wished to re-enroll CP3 pine tree plantings (as CP11) had the opportunity to increase their Environmental Benefits Index and hence their probabilities of having their bid accepted, by agreeing to thin and prescribe burn the pine planting during the second contract period. Although avian diversity in pine plantation tends to decline during the mid-rotation period, thinning and burning may enhance habitat quality for many early successional species. For example, Bachman's sparrows typically occur in both mature pine forests with scattered shrubs and extensive herbaceous ground cover and in recently regenerated pine stands (1-5 years). Previous studies had reported Bachman's sparrows were absent from pine plantations during mid-rotation. However, in northern Florida, Bachman's sparrows extensively used mid-rotation (17- to 28-year-old) slash pine stands that had been thinned (Tucker et al. 1998). Bachman's sparrows were more abundant in thinned plantations that had been burned than in similar-aged stands that were unburned. An ongoing study in central Mississippi is examining breeding bird abundance in 24 thinned mid-rotation (19-23 years old) loblolly pine plantations under four different management regimes (thin only, thin/burn, thin/Arsenal herbicide, thin/Arsenal herbicide/burn). During the first breeding season following treatment application, 30-39 breeding bird species were observed in these stands, including 14 shrub-successional species (L. W. Burger unpublished data). Breeding bird diversity was greatest in control (thin only) plots and lowest in herbicide-only treatments. However, as the herbaceous community recovers following herbicide and fire treatments, more early successional bird species might colonize these sites. In Georgia, avian species richness and diversity in CP11 pine plantations that were thinned (30% row

thinning or 20% strip-thinning plus 33% row thinning) increased during the second growing season following thinning (Schaefbauer 2000). During the year of thinning and the second growing season following thinning, 30 species were detected in these CP11 stands. The most abundant species were northern cardinal, indigo bunting, pine warbler, Carolina wren, and Carolina chickadee. During the second season following treatments, indigo buntings were more abundant in the strip plus row-thinned stands than in unthinned control stands. During the year of thinning, shrub-nesting species were less abundant in the strip- plus row-thinned stands than other treatments (Schaefbauer 2000). Total relative abundance (indexed by point counts) in CP11 stands, under all treatments, was relatively low, ranging from 0.22 to 2.0 birds/ha and did not differ among treatments.

Pine plantation summary

In summary, pine plantations created under CRP can be expected to support populations of regionally abundant and stable forest bird species such as northern cardinal, Carolina wren, pine warbler, and indigo bunting. Furthermore, these stands will provide some short-term habitat for regionally declining grassland and shrub-successional bird species. However, these habitats will be quite ephemeral, lasting just 1-2 years for grassland birds and 3-10 years for shrub-successional species. Although an understanding of bird responses to management in pine plantations is still incomplete, thinning and prescribed fire may enhance the conservation value of these stands for grassland/shrub-successional bird species.

Hardwood Plantations

Bottomland hardwoods are regionally scarce forest communities in the Southeast. Hardwood bottomlands support a particularly diverse avian community (> 70 species), including numerous Neotropical migrants of international conservation concern. Conservation of the bottomland hardwood ecosystem has been given highest priority for avian conservation in the Southeast (Hunter et al. 1993). Numerous public, private, and interagency groups have identified restoration of hardwood bottomland as a conservation priority (Myers 1994). Although hardwood plantings were a relatively small proportion of the total CP3 enrollment and are a minor component of all plantations in the South (Rosson 1995), they were an eligible CRP practice (CP3b or CP22) and were commonly established under the Wetlands Reserve Program. Through assistance programs such as CRP and WRP more than 100,000 ha of bottomland hardwood are expected to be restored within the Lower Mississippi Alluvial Valley (LMAV). Although no studies have directly assessed avian response to bottomland afforestation under CRP, several recent studies have evaluated avian use, abundance, and productivity on afforestation sites similar to CRP/WRP plantings.

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Midsuccessional Southeast forest
(J. Thompson)

. . . within 20 years after planting, hardwood plantations are supporting many species characteristic of natural sawtimber stands.

Effects of stand age

During the first four years after establishment, hardwood plantings support high densities of grassland birds such as red-winged blackbirds and dickcissels and also may be occupied by northern bobwhite, eastern meadowlark, and northern mockingbirds (Nuttle and Burger 1996). Peak abundance of shrub-successional species, such as yellow-breasted chat, indigo buntings, common yellowthroat, occur 7-15 years after planting. However, with the exception of indigo bunting, none of the previously identified species persist in plantations that are 21-27 years old (Nuttle and Burger 1996). Thus, hardwood plantings established for bottomland hardwood conservation will provide only temporary (4-15 years) habitat for some regionally declining grassland and shrub-successional species.

The long-term objective of hardwood bottomland afforestation is to produce a forest that is similar in structure and function to unaltered, mature hardwood bottomlands. When compared to mature bottomland hardwood forests, Morisita's index of similarity was 2.6-4.6% for plantations 0-4 years old, 35-42% for plantations 7-15 years old, and 74-85% for plantations 21-27 years old (Nuttle 1997). Thus, within 20 years after planting, hardwood plantations are supporting many species characteristic of natural sawtimber stands. However, much of this similarity is attributable to high abundance of many habitat generalists, including Carolina wren and northern cardinal. Older plantations still lacked certain species that are considered area-sensitive (require large tracts of forested habitat) or require late successional forest (Nuttle and Burger 1996). Twedt and Portwood (1997) suggested that the addition of fast-growing, early successional species, such as cottonwood, willow, sycamore, and green ash, to oak plantings would accelerate the development of a three-dimensional forest structure and facilitate earlier colonization by forest bird species. They reported that 5-7 years after planting cottonwood plantations supported 36 species of birds, including forest birds such as yellow-billed cuckoo, Acadian flycatcher, yellow-breasted chat, warbling vireo, indigo bunting, orchard oriole, and Baltimore oriole. Conversely, 6-year-old oak plantings only supported nine species that were mostly grassland species such as dickcissel, red-winged blackbird, and eastern meadowlark. Cottonwood stands 5-9 years old support greater species richness (16.7) and territory density (411.9/100 ha) than similar aged oak plantings (species richness 8.1, territory density 257.3/100 ha) (Twedt et al. in press *a*).

The "conservation value" of a given hardwood planting has been indexed by weighting measures of avian abundance with a measure of species-specific regional conservation value (Partners in Flight conservation scores) (Nuttle 1997). Indexed in this manner, hardwood plantings 0-4 years old provide 34% the conservation value of mature, natural hardwood bottomlands.

Plantings 7-15 years old provide 46% and plantings 21-27 years old provide 65% the conservation value of mature, natural bottomlands. Highest-priority species are most abundant in natural forest stands, thus mature natural stands have the greatest conservation value. Newly established hardwood plantings are relatively species poor, and the species present in this age class are relatively common species like red-winged blackbird and eastern meadowlark. Restoration plots 11-12 years old are populated by a few high-priority shrubland birds, such as yellow-breasted chat and painted bunting, and high-priority grassland bird species such as dickcissel and consequently will have intermediate conservation value. As restoration stands reach 22-27 years old, they will be populated by high-priority forest species such as prothonotary warbler and yellow-billed cuckoo, contributing to their increased conservation value (Nuttle 1997). Similarly, Twedt et al. (in press *a*) indexed conservation value of oak plantings 5-9 years old and cottonwood plantings 0-4 and 5-9 years old by weighting territory density (territories/100 ha) by Partners in Flight prioritization scores. They reported that the conservation value of 5- to 9-year-old cottonwood stands were generally twice as large as those of oak stands less than 10 years old. Younger cottonwood stands had conservation values intermediate between oak-dominated and older cottonwood stands.

Avian productivity in hardwood plantings has received less research focus than avian abundance and species composition. Twedt et al. (in press *b*) reported that in the Lower Mississippi Alluvial Valley, daily nest survival of blue-gray gnatcatcher, eastern towhee, indigo bunting, northern cardinal, and yellow-bellied cuckoo was similar between mature bottomland hardwood forests and cottonwood plantations. However, mean daily survival of 19 nesting birds in natural bottomland hardwoods was greater than 18 species in cottonwood plantations. Differences in daily nest survival between habitats were attributed to elevated levels of nest predation and parasitism in managed cottonwoods.

Hardwood plantation summary

In summary, hardwood bottomlands are a regionally scarce resource of the highest priority for conservation of avian diversity. Over time, hardwood plantings established under CRP will likely provide substantial benefits for conservation of high priority forest bird species. Colonization of hardwood plantings by forest birds may be accelerated by interplanting with fast-growing early successional species such as cottonwood. During the first five years after establishment, hardwood plantings will provide ephemeral habitats for regionally declining early successional grassland and shrub-successional species and thus contribute to regional avian conservation.

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Wildlife and Grassland Plantings

Native grass planting (W. Burger)

Avian communities in grasslands created under CRP have received little research attention in the Southeast. This is in part because the Southeast has relatively few breeding grassland bird species and also because grassland practices are a relatively small component of total CRP enrollment. However, grasslands created under CRP may provide regionally scarce resources for grassland and early successional bird species during both the breeding and winter seasons. Bird use of these grasslands will likely be influenced by the type of cover established, the age of the stand, and the management regime implemented over the life of the contract (Burger et al. 1990).

Effects of Grassland Cover Type

Throughout the Southeast, much of the CP1 and CP10 acreage was established in exotic forage grasses such as Kentucky tall fescue, Bermuda, or bahaia grass. Barnes et al. (1995) reported that tall fescue fields in Kentucky had dense vegetation with little bare ground and low plant species diversity. Furthermore, they observed that fescue stands provided few food resources for granivorous birds. Although tall fescue supported abundant and diverse insect communities, these food resources likely were unavailable to breeding bobwhites or their broods because of the dense vegetation structure. They concluded that tall fescue provided poor habitat for bobwhites because it lacked the proper vegetation structure, floristic composition, and sufficient quality food resources. CRP fields revegetated through natural succession or with planted native species may provide better wildlife habitat than those established in exotic forage grasses.

Program participants interested in reenrollment of grass CRP contracts could increase their Environmental Benefits Index scores by enhancing the wildlife habitat value of the existing cover. Washburn et al. (2000) evaluated efficacy of various combinations of glyphosate and imazapic herbicides in eradicating tall fescue and establishing native warm-season grasses. They assumed that reductions in fescue coverage, establishment of native warm-season grasses, increases in plant species richness, and increases in bare ground were beneficial to bobwhites. They reported that one year after treatment all herbicide treatments reduced fescue coverage and enhanced bobwhite habitat quality relative to control plots. Furthermore, the spring burn, followed by imazapic application and seeding of native warm-season grasses treatment was most efficacious in eliminating fescue and establishing native warm-season grasses.

Effects of Age of Stand

Plant communities on CRP grasslands . . . change in . . . composition and structure over the 10-year life of the contract.

Plant communities on CRP grasslands are not static, but rather change in species composition and structure over the 10-year life of the contract. McCoy et al. (in review) studied vegetation changes on 154 CRP grasslands in northern Missouri and reported that during the first two years following

establishment, fields are characterized by annual weed communities with abundant bare ground and little litter accumulation. Within 3-4 years, CRP fields became dominated by perennial grasses with substantial litter accumulation and little bare ground. They suggested that vegetation conditions 3-4 years after establishment might limit the value of enrolled lands for many wildlife species and some form of disturbance such as prescribed fire or disking might be required to maintain the wildlife habitat value of CRP grasslands.

Effects of Management Regime

Mowing or clipping is the most common management practice implemented on CRP grasslands. McCoy et al. (in review) reported that mowing had short-term effects on vegetation structure (reduced height within the year and increased litter accumulation) and resulted in accelerated grass succession and litter accumulation. As a result of longer growing seasons and greater rainfall, the rate of natural succession on CRP grasslands throughout the Southeast likely exceeds that observed in the Midwest, making planned disturbance even more important for maintaining habitat quality for early successional species.

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Madison et al. (1995) examined the effects of fall, spring, and summer disking and burning, and spring herbicide (Roundup) treatments on bobwhite brood habitat quality in fescue-dominated, idle grass fields in Kentucky. They reported that during the first growing season following treatment, fall disking significantly enhanced brood habitat quality by increasing insect abundance, plant species richness, forb coverage, and bare ground relative to control plots. However, the benefits of disking were relatively short-lived, with diminished response during the second growing season. During the second growing season following treatment, herbicide treatments provided the best brood habitat quality. Greenfield (1997), examining the effects of disking, burning, and herbicide on bobwhite brood habitat in fescue-dominated CRP fields in Mississippi, likewise reported that disking and burning benefited bobwhite broods during the first growing season after treatment. However, the benefits were short-lived (one growing season). Herbicide treatment in combination with prescribed fire enhanced quality of bobwhite brood habitat for the longest duration.

Winter Bird Communities

Our understanding of bird responses to CRP is mostly based on studies of grassland birds conducted in midwestern and Great Plains states during the nesting season (summarized in Allen 1994, Ryan et al. 1998). Numerous temperate nesting, migrant grassland bird species (e.g., sparrows) winter in the Southeast and grasslands created under CRP potentially provide substantial benefits for these wintering populations. Unfortunately, use of CRP by nonbreeding grassland birds has not been assessed in the Southeast.

Grassland Summary

In summary, there is little information on responses of grassland-dependent birds to CRP in the Southeast; although several studies (Barnes et al. 1995, Madison et al. 1995, Greenfield 1997, Washburn et al. 2000) have assessed the suitability of CRP grasslands or similar habitats for bobwhites. The primary conclusions of these studies were that (1) the habitat value of fields established in exotic forage grasses is low, and (2) periodic disturbance is necessary to enhance or maintain quality early successional habitats.

Wildlife and Field Border Practices

Field margin practices (filter strips and riparian corridors) constituted a relatively small (2.6%) component of CRP in the Southeast, but may provide substantial benefits for wildlife in intensive agricultural systems. Although no study has directly evaluated wildlife population response to CP21 or CP22, several studies in North Carolina have evaluated use of fallow field borders by bobwhite and passerines. Results of these studies may have application to field margin, noncrop vegetation created under CP21 or CP22. Puckett et al. (1995) examined habitat use and reproductive success of radio-marked bobwhites on four farms in Dare County, North Carolina. On two of these farms, 9.4 m wide, fallow vegetative filter strips were established along field borders and ditch banks. Spring capture rate of bobwhite and number of nests/female were greater on sites with filter strips, but nest success did not differ. Bobwhite on nonfilter strip sites exhibited greater movement from capture to first nest location. Filter strips increased use of rowcrop fields by bobwhite throughout the breeding season. In a related ongoing study of 24 farms in North Carolina, farms with filter strips (n = 12) supported higher bobwhite density in fall than farms without filter strips (Bill Palmer, Tall Timbers Research Station, personal comm.). Filter strips apparently benefited bobwhite populations by increasing usable space during the early breeding season, holding bobwhite on the landscape until cover in crop fields developed, increasing access and use of crop fields by bobwhite, and providing nesting and brood-rearing habitat.

Field borders also may produce substantial benefits for breeding and wintering passerines.

Field borders also may produce substantial benefits for breeding and wintering passerines. During 1997 and 1998, fields on farms in the coastal plain of North Carolina with field borders (n = 4) supported greater abundance of wintering sparrows than fields on farms with mowed field margins or no borders (n = 4) (Marcus et al. in press). Sparrows commonly detected in field borders were song sparrow, swamp sparrow, field sparrow, chipping sparrow, white-throated sparrow, and dark-eyed juncos. Field borders supported a mean 34.5 sparrows/ha, whereas mowed field margins averaged 12.9 sparrows/ha. Field borders also may increase use of interior portions of fields. For example, they may enhance the habitat value of agricultural fields by providing thermal and escape cover, increasing access to food resources in crop

stubble, and increasing the proportion of agricultural landscapes available for use by grassland birds.

Bobwhite chick (J. M. Huspeth)

Overview

Most of the 2.7 million acres of CRP in the Southeast was enrolled in tree planting conservation practices. Although systematic evaluations of wildlife benefits of CRP in the Southeast are lacking, probable patterns of wildlife occupancy and use may be inferred from studies of similar management practices on nonCRP lands. In contrast to the Midwest where grass establishment practices dominated CRP enrollment, 62% of CRP acres were enrolled in tree planting practices, primarily loblolly pine, in the Southeast. During the first 1-3 years following establishment, pine plantations are characterized by low-growing grasses and forbs and provide habitat for grassland and early successional bird species. As the stand matures, herbaceous plants are replaced by shrubs and trees. Avian diversity typically increases with stand age as bird species associated with shrubs colonize the stand. During the pole stage (mid-rotation 15-20 years) when canopy closure eliminates herbaceous ground cover, avian richness generally declines. In mid-rotation stands (15-20 years), thinning and prescribed fire may increase herbaceous ground cover, thereby enhancing habitat quality for grassland and shrub-successional birds. Bottomland hardwood plantings established under CRP should be expected to support high densities of grassland birds during the first five years after establishment. Peak abundance of shrub-successional species will occur 7-15 years after planting. Stands over 20 years old should support 75-85% of the avian community characteristic of mature bottomland hardwoods. Interplanting of rapidly growing tree species, such as cottonwood, sycamore, or green ash, would dramatically accelerate colonization by forest bird species.

In the Southeast, the wildlife habitat value of grasslands enrolled in CRP may be limited by establishment of exotic forage grasses, mowing, and the rapid rate of plant succession. Conversion of forage grasses to native communities and implementation of management regimes that maintain diverse annual weed communities will enhance the wildlife habitat value for early successional species such as bobwhite.

Field border practices such as CP21 and CP22 can dramatically enhance suitability of agricultural landscapes for shrub-successional species such as bobwhite and also may increase landscape-level suitability for wintering passerines, particularly sparrows.

Overall, the potential wildlife benefits of CRP in the Southeast are substantial, but they may be unrealized because of the selection of specific practices (e.g. pine plantations and exotic forage grasses). Moreover, relative to the Midwest, the actual benefits of CRP in the Southeast remain largely unknown because of the lack of rigorous evaluation.

Overall, the potential wildlife benefits of CRP in the Southeast are substantial, but they may be unrealized because of the selection of specific practices . . .

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Table 1. Acres enrolled in the Conservation Reserve Program in 12 southeastern states, following CRP signup 22, March 2000, by predominant conservation practices (USDA-FSA 2000).

State	Conservation practice[a]								Grass Practices	% Grass	% NWSG[b]	Trees	% Trees	Border Practices	% Border	Total
	CP1	CP2	CP3	CP4	CP10	CP11	CP21	CP22								
Alabama	21,194	2,442	136,695	7,880	117,485	167,881	330	1,498	149,001	32.6	1.6	304,576	66.6	1,828	0.4	457,415
Arkansas	8,252	928	37,580	3,162	28,944	50,700	1,151	2,030	41,287	28.5	2.2	88,281	60.9	3,181	2.2	144,933
Florida	1,243	5	27,673	3,401	1,850	52,559	0	67	6,500	7.5	0.1	80,232	92.3	67	0.1	86,889
Georgia	3,298	341	142,847	6,951	7,875	120,990	437	354	18,466	6.5	1.8	263,838	92.3	791	0.3	285,771
Kentucky	80,685	17,208	5,157	546	146,168	1,445	13,992	972	244,608	90.9	7.0	6,602	2.5	14,964	5.6	269,165
Louisiana	2,053	1,641	94,932	2,817	19,216	37,830	230	236	25,729	14.2	6.4	132,762	73.0	466	0.3	181,819
Mississippi	21,381	272	283,746	9,521	130,441	316,412	2,435	11,333	161,615	20.4	0.2	600,159	75.8	13,768	1.7	792,041
North Carolina	6,741	1,120	14,189	2,775	17,628	38,729	3,547	8,117	28,265	29.9	4.0	52,918	55.9	11,664	12.3	94,643
South Carolina	1,388	40	48,327	11,643	12,173	103,915	3,549	19,057	25,246	12.4	0.2	152,243	74.7	22,607	11.1	203,843
Tennessee	54,877	9,974	12,175	5,116	129,467	16,090	2,710	463	199,435	85.9	5.0	28,266	12.2	3,173	1.4	232,147
Virginia	7,320	2,351	4,052	967	14,171	13,886	264	827	24,810	56.2	9.5	17,939	40.7	1,092	2.5	44,125
West Virginia	10	22	134	0	771	9	12	33	803	80.9	2.8	143	14.4	46	4.6	993
Total	208,445	36,348	807,512	54,783	626,193	920,451	28,660	44,993	925,769	33.1	3.9	1,727,963	61.9	73,653	2.6	2,793,791

[a]Conservation practices: CP1, cool-season grasses; CP2, native warm-season grasses; CP3, trees; CP4, wildlife habitat; CP10, existing grass; CP11, existing trees; CP21, filter strips; and CP22, riparian buffers.

[b]NWSG = Native warm-season grasses